The development of a tool for assessing the quality of Internet-based medical information sources

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DECLARATION

This work has not been previously accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

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STATEMENT 1

This thesis is the result of my own investigations, except where otherwise stated.

Other sources are acknowledged giving explicit references. A bibliography is appended.

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SUMMARY

The research aimed to determine whether a tool or technique could be developed to assist librarians and other information professionals in the selection and evaluation of information sources available via the Internet.

A literature review was conducted to examine techniques in use for assessing information quality, to determine their applicability to information available via the Internet, and for use by information professionals. A qualitative, user-centred investigation was conducted to explore the information seeking behaviour of health and medical users of the Internet based in an academic environment and to develop a theory of information quality assessment. The investigation was particularly concerned with how assessments of information quality were made, whether criteria could be identified from users describing their own information seeking experiences, and whether criteria applied across a range of different source types available via the Internet. A draft evaluation tool was developed and distributed to library and information professionals in order to elicit feedback on its potential value and usefulness in assessing the quality of Internet-based information sources.

The study concludes that an assessment of information quality is dependent upon the needs of the user and the source used. Furthermore, quality assessment is a complex process involving consideration of a wide range of inter-related factors which affect perceptions of source quality. However, it is possible to develop a grounded theory regarding source assessment, and both a range of generally applicable criteria and source specific criteria were identifiable from different interviewees' comments. An evaluation tool was developed based upon these findings which was well received by the librarians and information professionals who were asked to review it. Further research is required to evaluate the effectiveness of the tool through its implementation and testing, and to broaden the scope of the criteria by examining the information seeking behaviour of a wider range of Internet users.
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Chapter 1

Introduction
1.1 Background

In 1969, the beginnings of 'the Internet' consisted of four networked computers located in three universities and a research institute in America. By the early 1980s, that number had grown to over 1,000, and by October 1994, 3,864,000 host computers distributed throughout almost every continent and country across the globe were connected to the Internet (Zakon, 1997).

The Internet is frequently described by its users as a "realm of pure mind". Anything which is thinkable can be expressed to an audience of hundreds of thousands (Holderness 1994, p.17).

On the Net, anyone with a computer can be his own reporter, editor and publisher - spreading news and views to millions of readers around the world (Elmer-Dewitt 1994, p.55).

The development of world-wide networking has offered an ideal mechanism for accessing and disseminating information in ways that have not hitherto been possible, and the explosion in the volume and variety of resources which followed its inception could never have been predicted. The number of Usenet Newsgroups has multiplied from three in 1979, to 10,696 in 1994, and the number of World-Wide Web (WWW) sites from 133 in June 1993, to 10,022 at the end of 1994. By July 1997, an estimated 19,540,000 host computers were connected to the Internet and there were some 1,203,000 WWW sites (Zakon, 1997).

However, the ease of accessing and disseminating information quickly resulted in numerous problems. Internet users were becoming increasingly frustrated with the difficulties of locating relevant materials from the volume that was available. Both commentators in the tabloid and the quality press focused upon the ease of accessing pornographic and other potentially offensive material. Authors from the library profession were not only concerned with censorship issues, but many were also sceptical of the value and efficiency of using the Internet to access information. In addition, the usefulness and quality of the available information was questioned. For example, Miller (1994) noted the volume of junk and the ephemeral nature of much material, and Crawford (1994) highlighted problems associated with deliberate misinformation.
For generations, the challenges of information overload and the need to identify quality information have recurred. Librarians and other information professionals have continuously met such challenges by developing methods and techniques for filtering information in order to sift high quality sources from the inevitable dross. The library community was quick to realise the potential of the Internet, as illustrated in the statement issued by the UK Office for Library Networking in 1993 (p.1), which opens: 'Networking is one of the most important issues currently facing the library and information community'. The library community also quickly recognised the need to organise the available resources and assist users in searching the Internet. Commentators advocated that, based upon their training and experience, librarians were 'the most appropriate intermediaries to assist in connecting to and understanding these network resources' (Kovacs, Schloman and McDaniel, 1994). Rosenfeld (1994) called for library and information professionals to apply their traditional skills to improve access to information available via the Internet and argued that 'librarians are trained to evaluate the quality of information' and 'can apply many of these same skills' to the Internet (Rosenfeld 1994, p.13).

However, the Internet posed new evaluation problems in terms of the volume and variety of material, as well as the lack of contextual clues associated with the origins of the information:

With the vast increase in quantity of data available and ease of manipulation electronically, how can the source and the quality of the information be validated? How can librarians guarantee the accuracy of the information they use? How can deliberate misinformation be detected? (Ladner and Tillman 1993b, p.73).

This research arose from a recognition of the benefits of using the Internet for accessing and disseminating information, but also the difficulties associated with locating high quality sources. The potential for library and information professionals to play a central role in filtering information on behalf of end-users was also recognised. Furthermore, an initial review of the literature revealed little material which referred to information quality or evaluation and the Internet, and the available literature on information source evaluation dealt primarily with paper-based or traditional electronic reference materials. The research was driven by the need, firstly to develop guidelines to assist library and information professionals in selecting and evaluating sources on behalf of end-users of
the Internet, and secondly, to develop guidelines which would accommodate the volume and variety of materials being made available.

1.2 Aims of the research

The overall aim of the research was to determine whether a tool or technique could be developed to assist librarians and other information professionals in the selection and evaluation of Internet-based information sources. However, numerous questions and problems were identified at the outset:

- what is ‘information quality’? what is meant by a ‘quality’ source of information?
  what factors affect the ‘quality’ of a source of information?
- what is the most appropriate method or technique for assessing the quality of Internet-based information sources for use by library and information professionals?
- is information quality an issue to users of the Internet? how do users of the Internet assess the quality of the information sources they access and use? is it possible to determine the factors affecting end-users’ perceptions of the quality of information sources available via the Internet? is it possible to identify quality issues which apply across a range of different types of information sources available via the Internet?
- can user assessments be interpreted in order to develop a tool or technique for use by library and information professionals in assessing the quality of Internet-based information sources?
- if a tool or technique were developed, would it provide an effective filter for the retrieval of sources available via the Internet?

In order to achieve the overall aim and address the questions listed above, the following objectives were identified:

1. to conduct a literature review in order to consider:
   (a) definitions of ‘information quality’, and
   (b) the range of tools and techniques used for assessing information quality, and to consider the applicability of the different tools and techniques to LIS professionals involved in the selection and evaluation of information available via the Internet;
2. to examine the information seeking and information use behaviour of users of the Internet in order to determine:
   (a) whether information quality is an issue for Internet users,
   (b) how users of the Internet assess the quality of the sources they access and use,
   (c) whether it is possible to identify the factors affecting source quality from users' assessments of the sources they access and use, and
   (d) whether it is possible to identify factors affecting source quality from users' assessments which apply across a range of different source types available via the Internet;

3. to interpret end-user assessments in order to develop a tool or technique for use by library and information professionals in assessing the quality of information available via the Internet; and

4. to implement and test the tool or technique in order to determine its value and usefulness to the LIS community when selecting and evaluating information available via the Internet.

1.3 Context

The research commenced in October 1994 soon after the introduction of Mosaic, the first graphical and user-friendly browser for accessing information available via the WWW. The Internet was still very much in its infancy, and during the course of the PhD, the technologies for accessing and using Internet-based information developed at a rapid pace. Likewise, the nature of the information available via the Internet and public attitudes towards it were continuously changing.

The origins of the Internet are generally traced back to the invention of packet-switching in the 1960s and its existence is attributed to the US Department of Defense (see for example Kantor and Nuebarth, 1994; Rosen, 1994; Zakon, 1997; Leiner, et al., 1997). ARPA\textit{net}, the Advanced Research Projects Agency Network, was commissioned in 1969 and initially four computers were connected. During the 1970s, other computers
began using networking technologies to communicate and the first international connections were made to ARPAnet in 1973. In 1982, the Transmission Control Protocol/Internet Protocol (TCP/IP) suite was established as the ARPAnet protocol suite, enabling different computers on different networks to communicate. Networking continued to spread as many more individuals and organisations had access to computing facilities through local and wide-area networks and TCP/IP was adopted as a common networking standard. The various networks converged to create what increasingly became known as 'the Internet'.

As computing technology continued to improve and become increasingly prevalent, a number of tools for accessing and disseminating information via networks were developed. Initially Internet users had access to e-mail, Telnet and File Transfer Protocol (FTP), enabling communication, the interrogation of remote computers, and the downloading of files of data or information, respectively. However, early versions of FTP and Telnet required prior knowledge of the location and availability of information sources, as well as knowledge of how to use them, and their use was therefore limited to those with some basic knowledge of computing.

In the late 1980s and early 1990s, a number of information retrieval tools were developed which both improved and facilitated access to Internet-based information resources. In particular, the development of distributed client-server computing fundamentally altered the way in which information could be accessed as the user could access materials using the interface located on their machine. Gopher was an early example of a distributed client-server tool which offered a menu-based interface to Internet sources. The software was friendlier and more helpful than command-line interfaces and users could browse through the menus of resources without having to know filenames and locations. Furthermore, access to one Gopher server generally provided access to all Gopher servers world-wide. The WWW was also an early example of a distributed client-server tool which was built around a hypertext language, enabling users to link between different parts of the same document, different documents on the same server or different documents on remote servers.

It was not until the development and free distribution of multi-media browsers, such as Mosaic and Netscape Navigator, that the potential of the WWW and the Internet for information access and dissemination were realised. Such browsers achieved 'a degree
of user-friendliness' that was 'more reminiscent of a computer game than of a conventional software package' (Furner-Hines and Willett, 1995). Using Mosaic or Netscape, files could be located, retrieved and displayed easily with the full integration of text, graphics and sound. In addition, WWW browsers provided access, not only to WWW information in hypertext format, but also to existing information sources, such as Gopher and FTP archives. Hypertext links were supplemented by subject-based catalogues and search tools, improving the ease with which users could search for and retrieve information.

During the mid-1990s, the WWW rapidly became the most heavily used tool for disseminating information due to its ease of access and use and there was an exponential growth in the volume and variety of information being made available. During this period, one of the major changes to the Internet was a cultural shift from a research-based network towards increased commercialisation. In May 1995, the US government ceased to fund the Internet backbone and a number of major commercial network providers adopted the role. In addition, commercial network providers such as Compuserve,America Online and Prodigy began to provide Internet access through their services. Increasing commercialisation of the Internet resulted in a much more varied audience and a much greater range of information sources designed to meet their needs. Moreover, the ever-increasing popularity of the Internet led US academics to begin considering the development of an 'Internet 2', intended to accommodate the particular needs of academic and research users of the Internet (see for example, Saunders-McMaster, 1997).

During the course of the PhD, a significant volume of research was conducted elsewhere to investigate the impact of the Internet upon libraries and information services, and the ways in which libraries could improve access to the available information. In particular, the 'Electronic Libraries Programme' (eLib) funded by the Higher Education Funding Bodies in the UK has been concerned with shaping the development and implementation of the electronic library. The main remit of the programme was:

... to provide a body of tangible, electronic resources and services for UK Higher Education, and to affect a cultural shift towards the acceptance and use of said resources and services in place of more traditional information storage and access methods (eLib, 1997).
The first phase of *eLib* projects began in 1995 and included research into training in the use of new technologies and the creation of subject-based gateway services to selected and evaluated networked resources. A recent article investigating the effect of *eLib* on higher education in the UK implied that the programme had little impact and that any changes would have taken place regardless (Davies, Scammell and Hall, 1997). However, *eLib* has undoubtedly acted as a catalyst in increasing awareness of the availability of Internet-based information through its training projects, as well as in enhancing access to quality materials through the development of the subject-based gateway services.

As mentioned, the initial literature search conducted in October 1994 revealed few articles which mentioned information quality in relation to the Internet. During the course of the study, this became an area of increasing concern. A number of both formal and informal sites, including the *eLib* subject-based gateway services mentioned above, were developed to provide more effective access to information through the identification and collection of high quality sources. Numerous information professionals produced criteria for use in the selection and evaluation of Internet-based information sources. In addition, researchers at the University of Georgia amalgamated such criteria (Wilkinson, Oliver and Bennett, 1997), as did researchers for *DESIRE*, a project funded in part under *eLib* (Hofman and Worsfold, 1997).

Commentators began to question the accuracy and reliability of the health and medical information being disseminated via the Internet. An editorial in the *Journal of the American Medical Association* questioned the credibility and usefulness of the available information (Silberg, Lundberg and Musacchio, 1997), and others have highlighted the unverified claims made by producers of medical products (Bower, 1996), as well as the inaccurate medical advice being disseminated (Uretsky, 1996; Seaboldt and Kuiper, 1997; Impicciatore, *et al.*, 1997). Criteria have been developed specifically for evaluating health and medical information (see for example, Ambre, *et al.*, 1997), and various organisations have developed guidelines for the provision of high quality medical information, including the *Medical Matrix Code of Conduct* (1997), the *Health on the Net (HON) Foundation Code of Conduct for Medical Web Sites* (1997) and the British Healthcare Internet Association (BHIA), *Standards for Medical Publishing on the Web* (1996).
Thus, the research was conducted in an exciting but also a daunting period. The Internet increasingly became an integral part of western society, and its availability spread throughout the rest of the world. However, individual users were becoming frustrated with the volume of material, and much of the public’s attitude was biased by the mass media image of an environment dominated by pornography. Librarians and information scientists were constantly at the forefront in developing methods and techniques to ensure maximum exploitation of the vast quantity of valuable and high quality materials which were available, and information quality assessment was an issue of particular interest and concern.

1.4 Overview of the study

This chapter has attempted to provide a background and context to the study. Chapter 2 is a review of the literature which examines definitions of ‘information quality’ and a wide range of tools and techniques used for assessing information quality. The applicability of the various tools and techniques are considered in relation to information available via the Internet and assessment by library and information science (LIS) professionals. The chapter concludes firstly, that information quality is a subjective issue which is dependent upon the needs of the user and the source concerned, and that there is no definitive statement of information quality, but it is possible to identify factors affecting the extent to which a source meets the needs of a user. Secondly, the development of evaluation criteria is considered the most appropriate approach to the assessment by LIS professionals of the quality of Internet-based sources. However, the criteria which were available when the review was conducted had been developed on an ad-hoc basis without consideration of users’ behaviour and were not necessarily applicable to the range of source types available via the Internet.

The third chapter provides a detailed justification for the methodological approach taken. A qualitative and user-centred approach was adopted to explore the information seeking and information use behaviour of Internet users and to develop a grounded theory of information quality assessment. Interviews were conducted with users of health and medical information based in an academic environment regarding an example where the Internet had been used to look for work-related information. The interviews
examined whether information quality was an issue and how assessments of information quality were made. The interview transcripts were analysed to identify the issues mentioned by users affecting their perceptions of the quality of the sources they accessed and used. In addition, the evaluation criteria were tabulated (Appendix B), and a draft evaluation tool was developed for use by LIS professionals based upon the results.

It was initially intended that the criteria arising from the first interviews would be implemented and tested in order to determine their effectiveness in filtering information retrieved via the Internet. However, the analysis conducted thus far indicated that the criteria mentioned by users were dependent upon the reason for information seeking and the source type used, and the initial interviews had not fully explored all of the source types available via the Internet. Further research was required to validate the criteria and develop the theory of information quality assessment. A second study was conducted using a standardised interview technique to examine the information seeking behaviour of a comparable group of Internet users. The first draft of the evaluation tool was simultaneously distributed to LIS professionals in order to elicit their feedback on its potential value and usefulness. The various tools used for data collection and analysis are provided in Appendix A.

Chapter 4 presents the results of data collection. The three main major stages of data collection were the information seeking and information use interviews, the criteria development and validation interviews, and the review of a draft of the evaluation tool by LIS professionals. In addition, questionnaires were distributed prior to each stage of interviewing. The main body of the chapter is a discussion of the information seeking behaviour of the interviewees and their comments on source assessment. In addition, the criteria identified from the interview transcripts are tabulated in Appendix B. The reviewers' comments on the first draft of the evaluation tool are also discussed.

Chapter 5 draws the results of the study together to develop a grounded theory of information quality assessment. In Chapter 4, each source type is examined independently. A final stage of analysis enabled the identification of a range of issues which affected users' perceptions of the quality of a number of different types of information sources. These issues are central to the theory of quality assessment and are discussed in addition to the source specific issues which were mentioned. The
development of the final draft of the evaluation tool (Appendix C) is described, and its role and format are considered. The results of the research are compared to the criteria available in the literature and reasons for any variations are considered. The validity of the results are then assessed by appraising the methods used to develop them. The generalisability of the results and possible approaches to testing the evaluation tool are also discussed.

The conclusions and recommendations of the thesis are summarised in the sixth chapter. The study concludes that information quality assessment is dependent upon the needs of the user and the nature of the source used. Furthermore, information quality assessment is a complex process involving consideration of a wide range of inter-related factors which affect users' perceptions. It was possible to develop a grounded theory regarding source assessment, and both a range of generally applicable criteria and source specific criteria were identifiable from the users' assessments of the sources they accessed and used. It was possible to develop an evaluation tool based upon the results, the Evaluation Criteria Document (Appendix C), the first draft of which was well received by the LIS professionals who were asked to review it. However, the tool was not implemented and tested and therefore, no conclusions are drawn regarding its effectiveness in assessing the quality of information sources which are available via the Internet.

The recommendations relate to the use of the evaluation tool and the need for further research. It is recommended that the tool is used as a guide in the selection and evaluation of information sources. Readers of the Evaluation Criteria Document should select the appropriate criteria from those that are available according to the needs of the user or user group concerned, the nature of the source being evaluated, the knowledge and experience of the evaluator, and the time and resources available to conduct the evaluation. Further research is necessary in a number of areas, but in particular:

1. to evaluate the effectiveness of the Evaluation Criteria Document through its implementation and testing by library and information professionals in conjunction with Internet users, and

2. to broaden the scope of the evaluation tool by examining the information seeking behaviour of other Internet users.
Chapter 2

Literature review
2.1 Purpose of chapter

The first objective of the study was to conduct a literature review to examine definitions of information quality and to examine the range of tools and techniques used for assessing information quality. This chapter provides an overview of different definitions of information quality in order to provide a framework and point of reference for the remainder of the study. A range of existing techniques and procedures for assessing information are considered. Criteria and techniques traditionally used by LIS professionals are initially discussed, followed by consideration of a wider range of procedures and techniques which might be relevant to the evaluation of information available via the Internet. The final section discusses the applicability of the various techniques in assisting librarians and other information professionals in the selection and evaluation of information sources available via the Internet.

2.2 Definitions

Throughout the study a number of terms are used continuously: 'information', 'information source', 'quality' and 'information quality'. These terms are encountered within a range of varying contexts and their meanings are often ambiguous and dependent upon the situations in which they are used. This study is concerned with 'information quality' in relation to the Internet, and definitions of the terms are considered in order to provide a framework and point of reference.

2.2.1 Information

Every living creature, social groups of living creatures, distinct but interdependent species of living organisms, and indeed the entire biosphere can be recognised as systems organised for survival ... no survival imperative can be observed that ... does not require the use of information (Scarrott 1994, pp. 88-89).

Information is available to people in many forms and may be absorbed through all the senses. When walking down the street, a vast amount of information is available to every individual, from a billboard poster to a smell from a shop to an overheard
conversation. Simply seeing a bus approaching will provide information to a passer-by. As a consequence, the term is used in a range of situations and its meaning in everyday use is often assumed rather than clearly defined.

Certain disciplines require a working definition of the term which serves as a point of reference. Each discipline has a different perspective on the nature of information and how it should be defined which is dependent upon its use and importance to that discipline. For example, in physics, information is defined as a physical entity in its own right, as much a part of the physical universe as matter or energy (for example, see Stonier, 1986). Communication theory is concerned with 'the procedures by which one mind may affect another' and the concept of information 'applies not to the individual messages ... but rather to the situation as a whole' (Shannon and Weaver 1949, p.9). Due to the requirements of these disciplines, information is seen in terms of its structure and properties and the ability to make certain assumptions based upon these.

Information science, informatics and librarianship are concerned with the representation, storage and retrieval of information in the context of human communication. In a discipline which is centred around information, the concept has proved particularly difficult to define. Commentators have drawn distinctions between data, information, knowledge and intelligence. For example, Teskey (1989, p.8) defines data as 'a result of direct observations of events i.e. values of attributes of objects', information as 'structured collections of data' and knowledge as a model of the world, 'which can be created or modified by new information'. Fatmi and Young (1970, p.97) define intelligence as the ability of an individual to use information in order to extend their knowledge: 'Intelligence is that faculty, of mind, by which order is perceived in a situation previously considered disordered'.

While it may be possible to draw a useful distinction between data, information, knowledge and intelligence, it is difficult to derive cut and dried definitions of each term. However, the role of data and information have been defined in relation to the decision making process. Information is 'data of value in decision-making' (Yovits 1969, p.369); data is input into the decision-making process, and if used, it becomes information. Saracevic and Wood (1981, pp.12-13) suggest 'information by itself has no inherent value. It has value only when used in some decision process'. Furthermore, common to many definitions of information is its capability of effecting some
transformation. For example, Belkin and Robertson (1976, p.201) define information as 'that which is capable of transforming structure'. Information for informatics is 'structured data which act to transform a state of knowledge or knowledge structure' (Belkin 1975, p.53). These concepts are applicable to this study: information refers to any structured data sent over networks which has the potential to transform a state of knowledge or knowledge structure.

2.2.2 Information source

The dissemination of information refers to the process by which information is dispersed or communicated among a population or to another individual. In order for an individual to communicate or disseminate information to others, the information must have some form or structure which is recognisable by both the sender and the receiver. In spoken communication, a common language and structure will be used to convey information, and in written communication, that language is represented by symbols which have meaning for both the sender and the recipient.

The term ‘information source’ is often used to refer to information which has been represented by symbols for dissemination and recorded in some form for future use. For example, the Oxford English Dictionary (1990) defines a document as ‘a piece of written or printed matter that provides a permanent record or evidence of events’, and a record is ‘the state of being set down or preserved in writing or some other permanent form’. Scarrott (1994, p.89) refers to the process as hoarding which ‘provide[s] a means by which the present generation can take advantage of the observations and analytical efforts of preceding generations’.

This study is concerned with information sources available via the Internet. However, defining an information source in an electronic environment is problematic because of the potential to continuously change or delete information once it has been disseminated. For example, a database or an active discussion group might be referred to as an ‘information source’ but information contained in the database or available through the discussion group may change or may be available for consultation for a short period of time only. Furthermore, electronic information sources are problematic because different levels of access may be available. For example, a whole database may
be referred to as a ‘source’, as might an individual record in the database. A Usenet Newsgroup is in itself a source of information, as is an individual message to the group.

Information has been defined as any structured data which has the potential to transform a state of knowledge or knowledge structure, and therefore, a source of information is any such recorded information. Within this study, ‘information source’ is used to refer to any information which has been recorded and is available for consultation at the time of use. Thus, a database or a Usenet Newsgroup is referred to as an information source because it enables access to information at the time of use. Furthermore, a source is referred to as such whether it is a two-line Usenet Newsgroup posting or a complete database, where the entity in question provides access to information.

2.2.3 Quality

Quality, like information, is used in a wide range of contexts and its meaning differs according to the situation in which it is used. Pfeffer and Coote (1991) have attempted to classify these situations as follows:

The traditional approach: to convey prestige or positional advantage, e.g. a 5-star hotel has more quality than a 1-star hotel.

The scientific or expert approach: fitness for purpose. Conformity to standards as set by experts. This is the sense used in industry to define a quality product.

Managerial or excellence approach: to measure customer satisfaction and meeting the needs of your customer.

Consumerism approach: to empower the customer, giving the customer what they want.

Democratic approach: to achieve common goals in the interest of the community as a whole. Developed as a reaction against some of the above definitions.

The drive towards consumerism during the 1980s and 1990s resulted in an increased interest in and usage of the term quality in relation to the management of products and services. In particular, Total Quality Management (TQM) refers to a whole organisation approach to quality management which attempts to embrace all the activities of an organisation in order to satisfy customer needs in the most efficient and cost-effective way. Quality Assurance (QA) refers to the systems and structures used to achieve a
A QA programme is designed to establish a set of procedures in order to focus attention on systems and structures, and therefore provide the best possible product or service. A trend towards accountability in libraries has also resulted in an increased interest in quality, particularly in ensuring the quality of services to users.

However, despite increased interest in and use of the term quality, there remains no universally accepted definition. The term is generally used as an abbreviation to denote 'good quality' or 'high quality'. Thus, the *Oxford English Dictionary* (1990) defines quality as 'an attribute, property, special feature or characteristic', and refers to:

> The nature, kind or character (of something) ... in which there is comparison (expressed or implied) with other things of the same kind; hence the degree or grade of excellence, etc. possessed by a thing.

However, the interpretation of quality as an abstract concept of excellence lacks meaning for a study which requires a working reference.

The British Standards Institution (1995) defines quality as 'the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs'. The Library Association (1996, p.2) emphasises the importance of meeting the needs of users and refers to quality as a 'statement of what it is [libraries] want to achieve'. Quality is described as 'a philosophy and a vision' rather than a definable entity. In the light of these statements, it is possible to interpret quality, not as an abstract concept of excellence, but as an understanding between a customer and a supplier of a product, or between a user and provider of a service, of the ability of the product or service to meet the needs of the user. Therefore, there is no expectation of an absolute measure of quality because any understanding of a quality product or service will depend upon the attitudes, perceptions and needs of those concerned. However, as the British Standards Institution (BSI) definition suggests, there are characteristics of a product or service which will affect its 'quality', such as whether a service is efficient or whether a product is hard-wearing or valuable. It is these factors which can be examined in a particular situation or context to make an overall assessment of the product or service.
2.2.4 Information quality

The increased speed and ease of publishing generally, and in particular, the ease of disseminating information via the Internet, has resulted in an exponential growth in the volume of information sources available. Consequently, the need to assess 'information quality' and to identify 'quality sources' has taken on heightened importance. However, if both 'information' and 'quality' are ambiguous terms, the combination of the two has resulted in a concept which authors have only just begun to define.

The issue has been debated on the info-quality-l discussion list and some of the results developed into a file of definitions (Ciolek, 1996). Factors discussed include the usefulness of a source, the ability of a source to 'get the message across' and the 'level of noise' in a source. In relation to information available via the Internet, quality is often used to refer to sources which contain original content, as well as sources which are accurate and reliable. Other attempts include that by the Information Market Observatory (1995) which discusses the quality of electronic sources and refers to factors such as typographical and indexing errors. Likewise, Saracevic and Wood (1981, p.112) offer the following explanation:

There is often a consensus as to what is information of higher quality, what is of lesser quality, what is redundant, outdated or superseded information and what is junk, or even worse, what is wrong, or false information.

Thus, authors have generally avoided an explicit definition of information quality and the explanations mentioned above are somewhat vague. However, some members of the info-quality-l list attempted a clearer explanation, although their comments were not added to the file of definitions. For example, Huppert (1996, September 26th) suggested, 'a Web site's quality is directly proportional to its effectiveness in fulfilling the purposes for which it was intended', and added in a later posting: 'The definition must lie somewhere in the interaction between what the Web site designers intended and how users respond' (1996, September 27th).

Huppert's definition is analogous to the BSI (1995) definition of quality, which provides a framework for understanding the concept of 'information quality', as well as 'quality' generally. As suggested, there can be no absolute measure of quality because it refers to the fitness for purpose of a product or service within a particular setting. Likewise, there
can be no definitive statement of a quality source of information because there are so many variables involved, particularly in an electronic environment where the providers and users of information may be numerous. However, if quality is understood to refer to fitness for purpose, and factors can be examined to assess that fitness for purpose, then there are also identifiable factors which affect an information source and make it of more or less quality within a particular context or situation.

2.3 Selection and evaluation in libraries

This section provides an overview of commonly employed methods and techniques for assessing the quality of information sources in libraries. The role of the librarian has long included the need to select and evaluate materials for inclusion in library collections. Early libraries were simply a collection of everything available within a topic or discipline, but with the invention of printing, the role of the librarian changed as the number of books increased from a few hundred to tens and hundreds of thousands of volumes. In 1780, the librarian was required to 'not admit indiscriminately every book in his collection, but select such only as are of genuine merit and well-approved utility' (Cotton des Houssayes 1967, p.44). By the mid-19th century, librarianship was recognised as a profession and the new role of the professional included ensuring 'that his library contains the best books on the best subjects, regarding carefully the wants of his special community' (Dewey 1876, pp.5-6). Since the nineteenth century, methods and techniques have been developed by LIS professionals for assessing information source quality, and these methods and techniques have been adapted and modified to suit the delivery of information in new formats.

2.3.1 Paper-based and audio-visual information sources

Kroeger's Guide to the Study and Use of Reference Books of 1904 outlined a methodology and criteria to be used in the evaluation of a reference work:

The student should first read the title-page and preface or introduction of each reference book, where the purpose of the book is usually stated. Then examine the book for special features, including indexes, cross-references, bibliographies, etc.
Several articles should be examined and compared with those on the same subjects in another reference book.

Additional points to be noted are: the authority for the article, its arrangement, the date, the treatment of the subject, whether technical or popular, whether concise or extended.

It is not sufficient that titles of reference books should be known to the student, but systematic study should be followed by constant reference to the books by means of set questions which must be looked up thoroughly. As the student progresses, he must not confine himself to the reference books, but consult the best books on any subject for fuller, and sometimes, more authoritative information (Kroeger 1904, p.5).

The methodology and criteria first introduced by Kroeger were later expanded by Mudge in 1923 in the New Guide to Reference Books and the relevant pages from the introduction to Mudge were reprinted in subsequent editions by Sheehy and Winchell, until the ninth edition of 1976. Current commentators on reference work, notably Higgens (1984) in the UK and Katz (1992) in the USA, still suggest similar criteria and methods for evaluation to those first outlined by Kroeger and later expanded by Mudge.

Both Higgens (1984) and Katz (1992) stress the need to determine the authority of a work. Authority relates to an assessment of the credentials of those responsible for the production of a work, including authors, publishers and editors, and is determined by identifying the qualifications, position, experience and reputation of the individual or individuals concerned to determine their 'overall suitability for the task' (Higgens 1984, p.12). Katz feels this will be straightforward where the person concerned is a known scholar but may be problematic and librarians will need to rely upon evidence of the author's qualifications, 'the librarian's own understanding and knowledge of the subject', and 'a check of the author in standard biographical works such as Who's Who or American men and women of science' (Katz 1992, p. 24). The imprint of the publisher 'may indicate the relative worth of a book' as some publishers 'have excellent reputations' while 'others are known for their fair-to-untrustworthy titles' (Katz 1992, p.24).

Higgens (1984, p.13) relates the accuracy of a work to its authority, and emphasises the need for librarians not familiar with the subject matter to undertake some research:

Information should not be verified simply by making comparisons with other works, but by returning to the primary source; reference volumes may
well copy from one another, so that agreement by them on some particular
fact, statement or statistic is not necessarily a guarantee of accuracy.

Katz emphasises the need to determine the intended purpose and whether the work has
fulfilled the stated purpose. He suggests clues will be found in the table of contents, the
introduction or preface and the index, as well as in publisher's catalogues, advance
notices or on the cover of the work: 'Such descriptions may help to indicate purpose and
even relative usefulness, but are understandably less than objective' (Katz 1992, p.24).
Furthermore, he discusses the scope of a work and proposes establishing whether the
author has contributed anything new that cannot be found in other works, whether the
work is comprehensive, and the currency of the material. Currency is considered 'one of
the most important features of any reference work', although material might be outdated
at publication (Katz 1992, p.25). Both authors emphasise the need for close
consideration of reprints and new editions to determine whether a work has been
updated and the extent of updating. Higgens (1984, p.13) focuses upon the
comprehensiveness of coverage:

The editor should give a clear and unequivocal statement of the objectives
of the book, and of its inclusions, omissions (due to length or agreed
policy), coverage, ... etc.

Objectivity and bias in reference works is mentioned by both authors:

Objectivity and fairness of a work are important considerations, particularly
in reference works which rely on prose rather than simple statistics or
collections of facts. Does the author have a bias about politics, religion,
race, sex, or the proper type of colour to paint a study? No one is totally
objective, but those who write reference books must indicate the worth of
both sides when there is a matter of controversy (Katz 1992, p.25).

Higgens proposes determining the number of entries on countries to disclose national
bias, investigating the author's background to determine political or religious bias, as
well as an analysis of the vocabulary used.

The audience of the work, and whether the material is aimed at scholars or the lay
person, is mentioned. Katz suggests the librarian should rely upon their own subject
knowledge by looking for material with which they are familiar, although in some
circumstances it may be necessary to consult a subject expert. Factors for consideration include the use of jargon, technical terms and the style of writing.

The format and organisation of material are mentioned by both commentators as ‘a reference work should be an item from which information may quickly and easily be obtained’ (Higgins 1984, p.14). Katz is concerned with the ease of using reference works and suggests examining the arrangement of information, such as the indexes used, the use of cross-references and the logic and consistency of other methods of arrangement. Other issues are a clear distinction between headings, the clarity of the layout and arrangement of information on the page, and the clarity and relevance of illustrations and their location in relation to the text. Katz mentions the cost of the reference work, and Higgens (1984, p.15) mentions the worth of a work in terms of whether it ‘fills a gap’ or approaches a subject ‘from a different and useful point of view’.

In addition to the comments on reference works generally, Higgens also offers specific advice on evaluating encyclopaedias, dictionaries, periodicals, abstracting journals, directories, newspapers, maps, theses and conference presentations. Katz offers detailed criteria for the evaluation of bibliographies, indexing and abstracting services, encyclopaedias, almanacs, yearbooks, handbooks and directories, biographical sources, dictionaries and geographical sources. Many of the criteria are similar to those already described and are arranged under the same headings of purpose, scope, authority, currency, accuracy and organisation of information. However, other criteria include the methodology used to compile bibliographic sources, the clarity of annotations and abstracts, the depth of indexing and the timeliness of the publication of indexing and abstracting services.

There are a large number of other works which propose criteria for evaluating reference works. Examples include criteria for bibliographies (American Library Association, 1972) and for encyclopaedias (Whiteley, 1992), both from the American Library Association (ALA). Lea (1990) covers criteria for dictionaries (Whittaker, 1990), both general (Walford, 1990) and subject encyclopaedias (Grogan, 1990), subject bibliographies (Lee, 1990) and biographical reference works (McDonald, 1990). The criteria described in these works, and many others, are similar to those already discussed.
However, there are slight differences. For example, the American Library Association (ALA, 1972) refers to citation accuracy, typographical errors, spelling mistakes and grammatical errors, as well as factual accuracy. Lee (1990) feels the availability of bibliographical references is in itself an indication of a concern for accuracy, as is the identification of any unseen items in a bibliography. The ALA (1972) emphasises the methodology used to compile a bibliography, including whether all pertinent sources have been consulted or whether important materials have been omitted. Further issues are associated with bias and objectivity, such as the interpretation of important events (Walford, 1990), the treatment of controversial issues and sexual bias (Whitely, 1992). McDonald (1990) recommends examining any selection criteria used in the development of biographical reference works, such as whether inclusion is by merit and a publisher or editor is responsible for selection, or whether selection is by application or payment.

There is a focus on the layout and arrangement of information, such as whether the overall organisation is appropriate to the subject area concerned, and whether the arrangement facilitates use of the work (Grogan, 1990). Whittaker (1990) feels every page should be self-explanatory, and the ALA (1972) suggest it 'should be possible to use the bibliography from at least one approach without using the index'. Whiteley (1992) recommends selecting a topic and testing the effectiveness of any cross-references and indexes to lead to related information. The ALA (1972) also comments that the format of a work should be designed to keep it within the price range of the intended user group without sacrificing legibility.

Numerous other authors offer further details on the process of evaluating reference works. For example, Stevens (1986) draws a distinction between the theoretical criteria and the practice of evaluation. Stevens (1986, p.13) feels an initial consideration of the theoretical questions, such as those offered by Higgens and Katz, 'should' make 'an evaluative judgement [possible] about a particular reference work'. However, 'all of those elements of evaluating reference books must be placed eventually in a perspective that relates to a particular situation' and therefore:

The moderately complex task of evaluating reference works on a theoretical basis is simpler, largely because there is a specific list of elements to be considered, than the actual practice of evaluating reference works where
professional judgement is involved and where other elements that cannot be easily categorised somehow always come into play (Stevens 1986, p.16).

Stevens (1986, p.16) recommends an initial decision regarding which criteria are appropriate to the work in question, followed by the application of the criteria in 'a casual and non-specific manner', and a close and careful examination of the work bearing in mind the needs of the users concerned.

Rettig (1987) proposes a method for evaluating reference works involving an examination and description of the work, and comparison of the work to similar titles. He recommends examining the title page, preface or introduction to determine the scope and purpose of a reference book, and verification of any claims by attempting to answer a range of questions using the work. Rettig (1987, p.468) emphasises the need to compare a work to others available, which involves:

Differentiating the coverage, identifying the overlap between works, comparing the depth of treatment, judging the quality, identifying the respective audiences, noting the differences in organisation and special features.

Rettig also emphasises the need for the librarian to test the claims of a reference book by daily use in dealing with the information needs of library users.

In addition to criteria relating to the evaluation of reference books, LIS professionals have developed criteria for the selection and evaluation of a vast range of other types of sources. For example, Whittaker (1982) offers detailed criteria for both fiction and non-fiction materials, including criteria relating to the author, editor, and publisher of a book, the subject area or theme, the aims and intended audience, the layout and arrangement of information, the price, and comparison of a book to others available. Whittaker proposes a systematic evaluation involving an identification of the objectives of the evaluation process, determining an evaluation strategy, identifying the criteria to be used, examining the work, comparing it to others and obtaining a second opinion. Spiller (1991) offers a similar guide, but also includes details on the location and availability of reviews, such as the popular press and specialist reviewing journals.

Other authors propose criteria for evaluating information within particular disciplines. For example, Johnson, McKinin and Sievert (1992) offer criteria for assessing clinical
information, including whether it is based upon a randomised controlled trial, blind trial or cohort study, and advise using journals with a high impact factor. Shirley, et al. (1981, p.208) recommend the selection of scientific literature according to whether material contains statistical data based upon the assumption 'that observation, to be scientific, must be numeric'. The authors investigated the relationship between articles containing statistical data and other indicators, such as the impact factor of the journal concerned, and established that 'articles containing numeric displays will occur with more frequency in journal titles defined as "quality"' Shirley, et al. (1981, p.209).

Berkman (1990, p.43) comments on problems in evaluating the quality and reliability of business information sources and identifies four areas of increasing concern:

- accuracy of data found in company directories,
- reliability of market studies and forecasts,
- determination of bias in sources, and
- pitfalls in the use of polls and surveys.

Berkman therefore advises examining who has supplied the data in market forecasts, how the data was collected, and the motivations and experiences of those concerned with providing the information. In addition, he suggests considering selection bias, the use of loaded questions, involvement of partisan sponsors and misleading conclusions in polls and surveys. He also emphasises the need to use original sources of information, rather than secondary sources, and the need to verify the accuracy of any information.

Waddell and Plummer (1984) offer a guide to assessing the accuracy of films and videos about Asia. Evaluative questions relate to the author’s qualifications, the programme’s original production date, the factual accuracy of the material, whether a balanced viewpoint is provided, whether the topic has been placed in context and whether any political or ideological messages are clear. The authors suggest:

The selectors should preview the programme and make sure that it does not exhibit distortions such as ethnocentrism, ... confusion of “modern” with “western”, ... exoticism ... [or] treat Asian culture as exotic and Asian people as inscrutable (Waddell and Plummer 1984, pp.96-97)

The evaluation criteria described above result in a qualitative description of an information source. Various commentators have attempted to develop schemes for
rating or numerically ranking sources. For example, Miranda and Mongeau (1991) consulted academics and librarians to identify the major journals within sport. Participants were asked to rate journals on a scale of one to five according to overall importance, timeliness, relevance to student and faculty needs, and reputation. The aim was to establish 'the collective wisdom of a diverse group of faculty, which in its entirety, represents a significant sample of informed opinion' with a view to providing 'a reasonable basis for comparison of journals' (Miranda and Mongeau 1991, pp.90-91). The results enabled the authors to numerically compare journals and determine which journals were 'statistically "better" than the other journals rated' (Miranda and Mongeau 1991, p.92).

DiFelice, Miller and Rhodes (1985) also developed a form for the evaluation of multi-media resources. Criteria relate to, firstly the content of sources, including accuracy, currency, objectivity and scope; secondly, educational value; and thirdly, technical and physical aspects, such as whether images are clear, and whether editing and production is smooth, logical and effective. Respondents were requested to rate sources on a scale of one to five, equating with a scale from 'strongly disagree', through 'neutral' to 'agree strongly'. Respondents were offered a zero option for 'not applicable'. The objectives of the form were:

- to encompass all media,
- to be easily used by media specialists, subject specialists and potential users,
- to provide some means to compare different media formats on the same subject,
- to provide the means to recommend selection in terms of priorities, and
- to provide an overall rating for an item by an individual or group of evaluators (DiFelice et al., 1985).

Thus, the authors suggest the form enables an overall rating of a source, allowing comparison between two sources, comparison between different features of the same resource, or comparison between the same features of two different sources.

Braga and Oberhofer (1981) propose a model for the evaluation of scientific and technical journals from developing countries. Criteria are:
- standardisation (the availability of an ISSN, table of contents, abstracts, etc.),
- length of availability,
- frequency of appearance,
- coverage by indexing and abstracting services,
- dissemination,
- coverage of material from a range of organisations, and
- the authority of the editorial board.

For each criterion, a set of variables is suggested and for each variable, conditions are specified which a journal would need to fulfil in order to obtain points. For example, circulation is a variable of the criterion dissemination. A journal with a circulation figure between 1,000 and 2,999 is awarded one point, between 3,000 and 4,999 two points and above 5,000 three points. Likewise, journals appearing twice a year receive one point, three times per year, two points, and twelve times a year, five points. The total number of points for each journal can be calculated and the journal rated. A journal achieving below a certain number of points is considered 'very bad', and between other values, 'bad', 'good' or 'very good'. Thus, 'the included criteria try to reflect conditions of quality and aim to evaluate objectively measurable parameters' (Braga and Oberhofer 1981, p.51).

Chafetz (1976) describes a system incorporating assessment by subject experts with a document rating form. The form offers a slightly different approach to those described because the criteria are weighted according to their perceived importance. The criteria relate to the scientific and technical approach of the material, the uniqueness of the sources, credibility, impact and the clarity of presentation. Each criterion is assigned an assessment of 'poor', 'median' or 'excellent', with a weighted score according to its perceived importance. For example, the methodology is assigned a score of zero for poor, five for median and ten for excellent, while the sample adequacy is assigned zero, 3.5, and seven respectively. Thus, 'the significance of [the] criteria is reflected in the numerical range established for them', because:

A document of average technical merit which initiates new and promising paths in prevention of alcoholism may be of greater value than the descriptions of alcoholism treatment programmes where little or no new information is presented (Chafetz 1976, p.165).
2.3.2 Online and CD-ROM sources

While LIS professionals were quick to recognise the immense opportunities offered by information in an electronic format, they were also quick to discern problems associated with it. Research into the effectiveness of information retrieval systems began in the late 1960s. In the 1970s and 1980s, information professionals began to recognise quality problems such as spelling errors and a lack of standardisation. For example, Norton (1981) describes a number of frequently encountered problems in online databases, including different records with the same ‘unique’ accession number and the advertising of database updating, despite evidence to the contrary. Likewise, Pemberton (1983) discusses the problem of ‘dirty data’, such as misplaced decimal points, incorrect digits and missing words. Consequently, new techniques and procedures were required to enable the assessment of information in an electronic format.

Herther (1988) and Large (1989) were among the first authors to suggest criteria for evaluating reference materials available via online services and on CD-ROM. Many of the proposed criteria are similar to those suggested for the evaluation of reference works. For example, Herther suggests consideration of the authority and credibility of a source by examining the qualifications of the contributors and publishers, as well as an examination of the original source material. Moreover, she recommends similar techniques to those proposed for the evaluation of reference works, such as examining any reviews, conducting sample searches and comparing the results to those available from other sources.

Alternatively, Large examines the criteria proposed for evaluating paper-based reference sources and discusses the difficulties of applying such criteria to information available in an electronic format. For example, ‘electronic sources normally provide little or no indication of individual authorship or editorship, and even the support documentation may not prove very helpful’ (Large 1989, p.89). Large emphasises difficulties inherent in evaluating electronic materials due to the lack of a contents page, introduction or preface where evaluative ‘clues’ are located in printed works, as well as difficulties of browsing electronic materials (Large 1989, p.89). However, while it ‘may prove more difficult’ to evaluate electronic sources, ‘many of the criteria applied to the evaluation of printed reference sources ... can properly be applied to online and CD-ROM sources’,
but 'it is necessary to consider criteria which are especially significant when considering these machine-readable sources' (Large 1989, p.91).

Large proposes three categories of criteria specific to machine-readable resources:

- scope, authority, currency, accuracy, uniqueness, comprehensiveness of coverage, retrieval approaches and support services offered by databases,
- search software, charging policy, general availability and support services available from different hosts, and
- the different telecommunications networks available.

Large recommends consulting any available documentation, conducting searches and comparing the results with those available from different databases. Similarly, Herther (1988) emphasises the need for new criteria and refers to the arrangement of information, whether the use of colour is appropriate and valuable, whether screen layouts are logical, and whether help information and documentation is available and clear. In addition, she recommends criteria relating to the revision and updating of electronic sources as they offer the potential to be more current than paper-based equivalents.

A wide range of other materials are available which offer guidelines to assist librarians and information professionals in the selection and evaluation of information in an electronic format. Other notable examples include Harry and Oppenheim (1993a) who propose criteria specifically for the evaluation of CD-ROM products. The authors discuss technical requirements, the availability of documentation and user support, coverage, user interface (input and output options, whether help information is available, ease of navigation, clarity and consistency of screen layouts, etc.), search facilities and reliability. In addition, they describe the evaluation of a range of CD-ROMs using the proposed criteria (Harry and Oppenheim, 1993b). Speight (1996) discusses acquisition, content, software and hardware considerations, and company and supplier information for CD-ROMs. Dickenson (1990) and Van Brakel (1992) both discuss criteria relating to encyclopaedias available on CD-ROM. General criteria include the scope, authority, intended audience, accuracy and currency of the material. Criteria relating specifically to the format include the user interface, search facilities, output and display facilities and the technical reliability of the product.
During the early 1990s, commentators focused upon issues relating to the quality of electronic databases. In 1989, the Finnish Society for Information Services formed a working group to consider the quality of Finnish databases in response to 'the frustration of information retrieval professionals' with problems encountered while searching (Juntunen, et al. 1991, p.352). Factors identified were insufficient information about the scope and coverage of databases, a lack of user guidance, limitations in search programmes, spelling mistakes and factual errors. For example:

One database abounded in typing mistakes ..., in another database the panellists found a lot of incorrect or obsolete information which was mainly due to ineffective updating (Juntunen, et al. 1991, p.355).

The working group therefore identified a range of criteria designed to assist library and information professionals in the selection and evaluation of databases. The criteria relate to coverage, including how often databases are updated, the subjects and document types covered, comparison with other databases, whether the producers explicitly state the scope and coverage of the database, and whether the material is accurate. The authors propose criteria relating to the availability and effectiveness of search facilities, the availability and usefulness of any documentation, training courses, telephone help-lines, newsletters, and whether feedback mechanisms are available for users to make suggestions and recommendations. Other issues include cost, particularly the pricing strategies available and how the charging structure is arranged, connecting to online databases, including the number of steps involved in accessing a database, and whether it is possible for users to change their password.

The 1990 Southern California Online User Group (SCOUG) Retreat discussed quality problems which users wished to see addressed in the future development of online databases (Basch, 1990a). Basch lists six categories of system enhancements identified at the Retreat:

- search language,
- databases,
- document retrieval and display,
- user interface,
- customer support, and
Factors discussed include natural language retrieval, graphical user interfaces, cross-file searching, online thesaurus, detailed online database documentation, improved response times, cost schedules based upon the information retrieved rather than connect times, and context sensitive online help. In a later article, Basch (1990b) translates the 'user wish-list' into criteria for evaluating the quality of online databases. The criteria are listed under ten headings:

- consistency,
- coverage and scope,
- error rate and accuracy,
- output,
- customer support and training,
- accessibility and ease of use,
- timeliness,
- integration,
- documentation, and
- value to cost ratio.

The criteria which were developed from the 1990 SCOUG retreat have been widely implemented and used for database evaluation, and remain heavily used by those working in the field. May (1994) investigated the development of a tool kit for database evaluation, and as part of the project, the SCOUG criteria were distributed to 1,000 database users who were asked to rate them in order of importance. The results 'showed a remarkable degree of consistency'. The top five criteria were 'coverage, followed by accessibility, timeliness, consistency and accuracy'. Questionnaires were developed based upon the SCOUG criteria and distributed among database users in order to elicit a user evaluation. Based on the results of the evaluation study, May concludes that 'the information community is comfortable with the vocabulary of performance criteria'. However, more 'work needs to be done in refining that vocabulary', in 'gaining a better understanding' of the relationships between different criteria and to investigate the weighting of the criteria.
Commentators also became increasingly concerned during the early 1990s with the accuracy and reliability of electronic data and called for increased quality controls in database production (see for example, Mintz, 1990; Granick, 1991). In response, a number of tests have been proposed for use by LIS professionals to evaluate database quality. Jacobs (1993a and 1993b) recommends techniques to identify 'errors of omission' and 'errors of commission' in electronic databases. Errors of omission are the absence of frequently used data elements, such as the publication year, document type, language code or classification code, which may result in the non-retrieval of potentially relevant records. Errors of commission relate to inaccuracies and inconsistencies in databases, such as inaccurate spelling of author or company names, and different versions of the same name in one database. Suggested techniques include browsing the database and using truncation and cross-referencing facilities. Similarly, Cahn (1994) proposes searching for commonly misspelled words in order to assess the accuracy of a database.

The proposed criteria and techniques described above offer a limited solution for library and information professionals when attempting to assess the quality of online and CD-ROM databases. Cahn (1994, p.29) comments that information professionals 'have no benchmarks to compare, no consistent tests repeated over time to consider when choosing a database'. Likewise, Armstrong (1994, p.45) notes that there are 'many thousands of users who regularly still find problems with the services, either in the data or locating the data', and highlights the lack of an 'agreed acceptable level of quality for databases'. In 1993, Jacobs proposed a method for labelling the quality of databases, synonymous with food labelling. Jacobs (1993c) proposed such a label would include, for example, the number of records, last update date for the database, the percentage of records with different access points, and the average length of each record. The proposed label would provide librarians and other database users with 'objective and quantitative information about the database by the file producers' which would assist in identifying the quality of the product (Jacobs 1993c, p.9).

In 1993, The Library Association, in conjunction with the UK Online User Group (UKOLUG), established the Centre for Information Quality Management (CIQM), initially to act as a clearing-house for database quality issues. Database users could report any problems encountered with databases to CIQM, who then reported the problems to the database producers. Armstrong (1994, p.48), director of CIQM, noted
that many of the quality problems described by database users were due to 'differences between expectations ... and reality as experienced at the workstation'. He therefore recognised the benefits of a database labelling approach, as proposed by Jacsó. At the time of writing (April 1998), CIQM was involved in the development of labels for a range of online databases, two of which were made available via the WWW for examination (Armstrong, 1997). The labels are intended to describe explicitly database capabilities and therefore provide users with a specification of the scope and quality of the database. The labels are designed to prevent any misunderstandings over the intended purpose of a database, as well as indicate the extent to which databases fulfil the intended aims. The label includes details of coverage, a set of quality assurance statements, statistics on file formats and contact information.

2.3.3 Internet sources

In much the same way that library and information professionals were expeditious in modifying traditional criteria for assessing printed reference works, they were also swift to recognise the need for criteria appropriate to sources available via the Internet. Numerous authors have examined the applicability of the various criteria discussed above to information available via the Internet. Among the earliest is a paper by Stoker and Cooke (1995) which examines the applicability of the criteria proposed by Kroeger (1904), Large (1989) and Harry and Oppenheim (1993) to a networked environment. In July 1995, the SCOUG Retreat focused upon quality issues relating to information available via the Internet (Ebbinghouse, 1995), and participants examined the relevance of the SCOUG database criteria to Internet-based resources (Basch, 1990b). Rettig (1995) discusses criteria for assessing reference works and considers their modification for Internet-based information, and other authors have also attempted to do the same (see for example, SantaVicca, 1994; Starr, 1994; Cassel, 1995; Pratt, Flannery and Perkins, 1996).

The SCOUG retreat established that some traditional criteria were relevant to sources available via the Internet, such as timeliness and accuracy (Ebbinghouse, 1995). However, other criteria were considered less applicable, such as consistency and customer support. Coverage and scope were deemed harder to evaluate due to a lack of introductory information. Rettig (1996) suggests accuracy, appropriateness, authority,
completeness, documentation, illustrations, revisions and ease of use are applicable to both Web sites and reference books. Furthermore, he believes 'arrangement of a Web resource is a critical element', and content, reliability and uniqueness are increasingly important due to 'the ease of self-publishing in the Web'. Stoker and Cooke (1995) recommend the following based upon traditional criteria: authority, genealogy, scope and treatment (including purpose, coverage, currency, methods of revision, accuracy, objectivity and audience), format, arrangement, technical considerations, price, availability and user support.

Numerous other authors have proposed criteria for the selection and evaluation of information available via the Internet. Hinchliffe (1995) proposes criteria relating to format, scope, comparison to other sources, authority, treatment, arrangement and cost. Grassian (1997) lists the audience, purpose, accuracy, comprehensiveness, the value of the information provided, the authority or expertise of the individual or group concerned, and whether the site follows good graphic design principles. Smith (1997b) identifies scope, content (including accuracy, authority, currency, uniqueness, links made to other resources, quality of writing), graphic and multi-media design, purpose, audience, workability (including user-friendliness, required computing environment, search facilities, browsability, organisation, interactivity and connectivity), and cost.

Brandt (1996) distinguishes between determining the validity, reliability and authenticity of information, and whether a source is pertinent to the users' needs. Tillman (1997) focuses upon the ease of determining scope, authority, currency, the last update and what was updated, as well as the stability of information, and ease of use in terms of both convenience, organisation and speed of connection. Harris (1997) emphasises the need to determine the credibility of a source and recommends an examination of the author's credentials, any evidence of quality control, whether the work is timely, whether discussion is 'reasonable', whether the author's world-view influences the writing, and any evidence of supporting documentation. Harris feels users are 'safest with a named source', that 'the more that is being claimed by a source, the more credibility and evidence' is required and that 'corroboration or confirmability is an important test of truth'.

Scholz-Crane (1997) offers guidance on where to look for evaluative information. She suggests examining the header, body and footer of a WWW document to determine the
author, sponsoring institution, institution, date of creation or revision, intended audience and purpose of the information. Scholz-Crane recommends criteria relating to the experience of the author, the potential for bias, when information was last updated and the intended purpose of the information.

McLachlan (1996) developed a rating form for use by teachers and students in evaluating the quality of WWW sites. Criteria are speed, first impressions, ease of navigation, use of graphics, sound and video, content and information, currency and availability of further information. Under each criterion, a series of statements is listed with a rating scale from one to five, where one equates with 'poor', and five, 'excellent'. The use of graphics, sound and videos, for example, is assessed by allocating a score from one to five for the following statements:

- the graphics/sounds/videos are clearly labelled, clearly identified;
- the graphics/sounds/videos serve a clear purpose, appropriate for my intended audience; and
- the graphics/sounds/videos will aid my students in reaching the desired objectives for this site.

A total number of points is calculated for each site to determine the overall site rating:

100-91 This site is so well-designed, and so effectively meets my instructional goals, that I can provide my students with general instructions and allow free exploration.

90-76 This site contains good material but a site map with specific directions will assist my students in reaching the stated objectives.

75-61 This site contains information that will make stops at designated points worthwhile, but students will need more structured guidance to reach my instructional goals. A list of bookmarks to specific pages and/or links is advisable, as is frequent discussion of student progress.

60-46 Although useful information exists at this site, its most effective contribution to my objectives will be in whole-class instruction where I can guide exploration and keep students on task.

45-31 This site contains a few pieces of information that make it a possible alternative when other sources are not readily available. Supervised student use is advised.
The criteria described above may be used by LIS professionals in the selection and evaluation of materials for inclusion in library collections or when evaluating sources in response to an individual enquiry. Other uses include in the development of library WWW pages or when reviewing material for journals, such as the *Library Journal*. Library and information professionals have also been involved in teaching 'critical thinking', which involves educating users to evaluate the information by considering issues such as accuracy, authority, objectivity, currency and coverage (see for example, Tate and Alexander, 1996; Jones, 1996).

Furthermore, LIS professionals have been involved in the development of databases of the descriptions of high quality sources. Examples include the *Social Sciences Information Gateway* (SOSIG), a gateway to selected and evaluated sources within the social sciences, and *Organising Medical Networked Information* (OMNI), a similar service within biomedicine. Librarians voluntarily select, evaluate and catalogue materials, and a description is added to a searchable database with a pointer to the respective site. OMNI has developed detailed *Guidelines for resource evaluation* (OMNI, 1997), designed to assist in formalising the evaluation process. The guidelines specify an initial consideration of whether material contains 'substantive information of relevance to the OMNI user community', thus excluding personal home pages, collections of links, material which is strictly local in context and adverts. Criteria are divided into contextual issues, content evaluation and access evaluation. Contextual issues relate to the scope, intended audience, authority and provenance of a source. Content relates to coverage, accuracy, currency, frequency and regularity of updating, uniqueness and comparison with other sources. Access issues include restrictions to access, usability, design, layout and user interface, and user support and documentation.

Comparable sites include *CyberStacks*, a database of selected and evaluated WWW resources, which are described and catalogued according to the Library of Congress Classification Scheme. *CyberStacks* relies upon traditional criteria for the selection and evaluation of reference sources proposed by the ALA. In addition, the now defunct *InfoFilter* project was initially developed as a guide to sites available via the Internet. The project aimed 'to leverage the same well-developed and tested principles of reference reviewing to the sources available on the Web' (Collins 1996, p.124). Librarians and information professionals were involved in the identification and
reviewing of resources and a discussion list was used to enable the collaborative reviewing of sites.

In 1997, Hofman and Worsfold examined the methods and criteria used by the various subject gateways in order to develop:

- A generalised graphical model of a functioning subject gateway that would enable a systematic approach to quality issues in the provision, development, control, monitoring and analysis of a subject gateway.
- A structured list of selection criteria that could be used as a reference tool by subject gateways and enable new and evolving subject gateways to produce their own tailored selection schemes without having to reinvent wheels (Hofman and Worsfold, 1997).

A list of 250 generic evaluation criteria were initially collected by examining the criteria used by the various subject based gateway services, those criteria used by other Internet services, as well as the criteria described in the literature. Following removal of duplicates, standardisation of the language and a qualitative analysis to group the criteria thematically, a second list of criteria was developed and evaluated. The criteria are divided into five groups:

- Scope criteria: considering the users,
- Content criteria: evaluating the content,
- Form criteria: evaluating the medium,
- Process criteria: evaluating the system, and
- Collection management criteria: considering the service.

The scope criteria are intended as the 'first filter', and content, form and process are only considered if a source is considered appropriate to the users. Collection management considers the total collection and how a source relates to it. Three services implemented the criteria by rating their importance on a scale of one, 'not at all useful', to five 'very useful'. All of the criteria were allocated a rating of either four or five by all the evaluators, and the results indicated 'the relative importance of the different categories of criteria' and their usefulness for subject-based gateway services.

The above discussion has provided an overview of the range of techniques and procedures currently used by LIS professionals to assess the quality of information
sources available in different formats. The remainder of the chapter will examine a wider range of procedures, some of which have already been adopted for assessing the quality of material available via the Internet.

2.4 Peer review

Peer review is generally used to refer to the evaluation of a piece of work conducted by contemporaries or colleagues of an equivalent or higher professional standing to those producing the work. Peer review can occur at a number of stages, either before, during or after a piece of research has been published, and can influence the direction of future research as well as whether work is published. Examples include the invisible college phenomenon whereby experts in a field influence the work of others, the review of funding applications by panels of experts, the refereeing process in academic journals or the reviewing of books and other published materials for publication in journals, magazines or newspapers. This section considers traditional applications of peer review, and the ways in which peer review has been applied to information available via the Internet.

2.4.1 Traditional applications of peer review

Price (1963) first coined the phrase, the ‘invisible college’, referring to collaboration and communication among groups of scholars within particular disciplines. The author suggests that ideas, reprints, pre-prints and progress reports are exchanged at meetings and conferences, status and prestige are awarded to certain group members, and those group members affect the direction of future research. According to Jewitt:

It would seem intuitively clear that “senior” members of a discipline would exercise influence on the research or project choices of those more “junior” than themselves (Jewitt 1986, p.214).

Cronin (1982) reviewed the effect of the invisible college on information transfer. He describes the invisible college as ‘the lifeblood of scientific progress’ and advocates that such informal communication acts as a ‘filter’ and a ‘screen’, but recognises that the system might be elitist and ‘can encourage the dissemination of large amounts of useless
and unwanted information' (Cronin 1982, pp.224-225). Furthermore, he suggests the invisible college is not something 'to which one can point', nor is it something which could be formalised (p.225).

Refereeing is a peculiar form of peer review. It is the process by which subject experts are consulted to elicit their opinions regarding the quality or appropriateness of a piece of work prior to its publication, generally in academic journals. Refereeing has been described as 'the institutionalisation of evaluative judgements into a system of roles and procedures' (Zuckerman and Merton 1971, p.67). The aim of refereeing is that following the process, a journal editor will feel confident in the assurance of one or more experts that:

- the ideas of the report are important, original and appropriate for publication in his journal,
- the technical aspects of the reported study, its design and methods, are satisfactory, and that the interpretations are justified by the results obtained, and
- the presentation is logical, lucid, not immoderate in length, grammatical, and in words and acronyms that are at a minimum recognisable (Ingelfinger 1974, p.688).

Ziman (1969, p.319), among others, has extolled the benefits of refereeing and describes the process as 'as an essential element' of 'scientific publication' which filters out inaccurate research. Without refereeing, 'the communication problem would be ten times worse' as scientists would have to 'wade through tomes of irresponsible nonsense in a search for a few reputable papers' (Ziman 1969, pp.319).

However, the refereeing system has also been the subject of much debate and controversy. Suggested disadvantages include exploitation of the position and 'bias in refereeing which is to be expected as a natural consequence of the peer evaluation process' (Gordon 1977, p.343). Ingelfinger (1974, p.688) also comments, 'since author and reviewer usually are by selection engaged in similar endeavours, they are almost unavoidably either competitors or team mates'. Commentators have also criticised refereeing for the costs involved, the delays to publication imposed by the refereeing process, and the suppression of novel ideas due to assessment by an established authority, 'so easily impregnated with dogma and elitism' (Ingelfinger 1974, p.691). Furthermore, Gordon (1977) suggests authors will attempt to publish their work
elsewhere following rejection from a journal, and therefore refereeing does not prevent publication, but only affects where material is published.

Studies highlight inadequacies in the refereeing process. For example, Gordon (1977, p.343) reports results which indicate ‘no significant correlation between referees’ evaluations and the number of citations a paper receives after publication’. The author therefore suggests refereeing acts ‘as a conservative filter’, preventing publication of papers ‘which have the potential to make the largest contributions’. Critics have quoted examples of famous scientists whose works have been rejected by referees and later recognised as a breakthrough in science, or later re-invented by different scholars and accepted.

Research by Ingelfinger (1974) indicates a lack of consensus among referees for the *New England Journal of Medicine*. Overall, agreement between pairs of referees was better than that to be expected by chance ‘but not strikingly so’ (p.690). There was a high level of agreement regarding outstandingly poor papers but referees disagreed to the maximum extent possible (where one referee strongly recommended the publication of a paper and the other strongly recommended the rejection of a paper) for over ten percent of the articles. Gordon (1977) suggests reasons for disagreement among referees include differing amounts of guidance, time and attention spent on the task, and varying degrees of competency among referees.

Ingelfinger (1974, p.692) concludes that the refereeing system provides an ‘effective educational function’ through the suggestions and criticisms of reviewers, and that ‘the reviewing system, in brief, brings “law and order” to biomedical investigation, analysis and communication’. However:

> The sparse information available is thus only moderately assuring that the biomedical reviewing system, as presently constituted or used, is a dependable screen of uniform mesh size that sieves out the inferior or saves the superior (Ingelfinger 1974, p.690).

Ingelfinger (1974) therefore proposes a number of improvements to the refereeing system, including better indoctrination of reviewers, a reduction in the workload of individual referees and an attempt to enhance the rewards of the system.
The above are examples of the implementation of peer review prior to the publication of research. There are a number of examples of peer review following publication, including the reviewing of books by subject experts for inclusion in academic and other journals, as well as in newspapers. Moore (1989) describes plans for the implementation of a quality filtered database of materials selected and evaluated by subject experts within health and medicine. Similarly, Bernstein (1980, p.72) describes the development of a 'prototype information transfer system for medical practitioners', the 'Hepatitis Knowledge Base'. Recent review articles within the subject were examined because they provided 'a high quality, analytic, organised and compacted synthesis of information in a given area' (Bernstein 1980, p.87). The contents of the review articles were added to a database and ten subject experts consulted to review the material in order to achieve a consensus of opinion on the subject area.

Chafetz (1976) describes the 'Quality Evaluation Literature System', a system which incorporates assessment by subject experts using a document rating form. Each document, together with a document rating form, was sent to subject experts considered peers of the authors for evaluation. The rating was recorded and forwarded to users with a user-rating form designed to elicit feedback on the evaluation made and any further comments. User feedback of the system indicates a 'favourable reception' (Chafetz 1976, p.169). However, the results recorded by Chafetz indicate a lack of agreement between different experts upon the relative quality of documents. For example, ratings ranged between 65 and 97 for one document.

A further example of peer review following publication is seen through increasing moves towards the development of an evidence based health care service. Through organisations such as the Cochrane Collaboration and the NHS Centre for Reviews and Dissemination, as well as various health authorities in the UK, teams of subject experts have been involved in the systematic evaluation of the medical and health care literature in order to identify the best available evidence and develop protocols. The Cochrane Collaboration facilitates the creation, review, maintenance and dissemination of systematic overviews of the effects of health care and the NHS Centre for Reviews and Dissemination produces and disseminates reviews concerning the effectiveness of health care interventions. The resulting information is made available through various channels, including databases accessible via the Internet and various journals, such as
2.4.2 Peer review and the Internet

There are a range of examples of the implementation of peer review via the Internet, including the refereeing of electronic journals, the moderation of Usenet Newsgroups and discussion groups, and the selection and evaluation of Internet sites for inclusion in databases of quality resources. Other examples might be the internal peer review of material before its dissemination via an organisational WWW site, or peer pressure which might control discussion within Usenet Newsgroups and discussion groups. Few of these have been discussed in the literature, but an overview of the material that was available at the time of writing (April 1998) is discussed.

Various refereed journals are currently available via the Internet, including some which were previously available in a paper-based format, such as the *British Medical Journal*, as well as those which are only available via the Internet, such as the *Interpersonal Computing and Technology Journal, IPCT-J* (described in Collins and Berge, 1994). In addition, a number of refereed and non-refereed journals are available which allow post-publication peer review of articles. For example, *Ariadne* is a non-refereed electronic journal in the field of librarianship and information science which offers the facility for readers to e-mail authors with their comments on articles.

Authors have discussed the advantages and disadvantages of electronic journals. For example, Götze (1995, p.19) advocates the use of networks in order to 'overcome the increasingly dreadful situation that paper can no longer carry all the scientific information being generated'. Other advantages include the speed of peer review and of the publication process generally compared to paper-based journals, as well as the capability for a timely interaction between authors and critics because of the nature of the medium (Collins and Berge, 1994). Disadvantages include a lack of credibility associated with electronic publications, difficulties of gaining access due to a lack of facilities, the need for training, and problems associated with the archiving of electronic material (Collins and Berge, 1994). Commentators have also debated the future of electronic journals. For example, Harnad (1995) advocates a new form of electronic
journal which eliminates publishers and other external parties, enabling scholar-to-
 scholar communication without incurring the costs of the paper-based publication
 process. However, other authors have defended the role of editors and referees,
 emphasising the need for quality control in journal publication (Rowland, 1997).

Peer review has also been implemented via the Internet through the establishment of
 public archives of unpublished work. The most well-known is Paul Ginsparg’s archive
 of physics information, xxx.lanl.gov e-print archive established in 1994 by the American
 Physical Society at Los Alamos. The archive contains the pre-prints of papers ultimately
 intended for traditional refereed journals. Pre-prints are submitted to the archive by
 authors, and users of the service can examine the work and offer comments. Authors
 also submit papers in parallel to conventional journal submission, while others only
 submit material following the traditional refereeing process. In September 1996, the
 archive served over 35,000 users world-wide and processed more than 70,000 electronic
 transactions per day (Ginsparg, 1996).

According to Ginsparg (1996), the archive has ‘already supplanted traditional research
 journals as conveyers of both topical and archival research information’. Harnad (1997)
 describes the archive as ‘revolutionary’, and suggests the only barrier to complete
 transformation from the traditional refereed academic journal to such a model is the lack
 of resources to meet the costs of the peer review process. Despite this, Harnad feels a
 publisher-free future for physics is inevitable. However, Ginsparg (1996) questions
 whether ‘the enthusiastic use of the instant communication provided by free access to
 unreviewed electronic archives’ will be ‘preferred only in isolated subsets of the
 scientific community’.

Usenet Newsgroups and discussion groups were among the earliest means of accessing
 and disseminating information via international networks and a number of models for
 group ‘moderation’ have been developed in order to address the problems of
 information overload. Examples include current awareness groups and digests of high
 volume groups which cover a limited number of relevant postings. In a moderated
 Newsgroup or discussion group, postings are mailed to an individual who acts as an
 editor and decides whether a message is relevant to the group concerned. The aims
 include:
To prevent inappropriate postings ... to facilitate discussions, to create a forum for announcements, to prevent repeated posts ... or to cut off endless uninformative arguments (Landfield, 1995).

McKeon (1997) suggests a parallel for group moderation is the refereeing of a journal: 'While the moderator controls the day to day content ... the moderator does not control the entire topic area'. Moderators serve to accept the relevance of a posting to a group, but acceptance does not imply agreement with the content of a message (McKeon, 1997). Moderators do not censor unpopular viewpoints, although they may attempt to quell overheated arguments or end repetitive discussions (Landfield, 1995). Furthermore, while groups provide 'some measure of editorial screening', there is no expectation of the moderator 'to investigate the truth or the source of any posting' (Lally 1995, p.149).

Taylor (1994, p.28) advocates the benefits of group moderation:

Many moderated Newsgroups are reserved for very specific types of postings and consequently have a very low volume of high quality information ... they are the source of some of the most valuable information ... on the network.

Furthermore, research results indicate that users are more satisfied with the information retrieved via moderated Usenet Newsgroups. In particular, users' satisfaction with the information gathered, given the costs to gather the information, was higher for moderated Newsgroups than unmoderated Newsgroups for both personal and professional information seeking among new users (Lally, 1995). However anecdotal evidence 'indicated a great deal of frustration with posting delays and rejected queries from the moderated Newsgroups' (Lally 1995, p.152).

A final example of the implementation of peer review via the Internet is the selection and evaluation of sources by subject experts for inclusion in databases of quality materials. Medical Matrix is 'a large, peer reviewed, annotated database of Internet clinical resources' (Medical Matrix, 1997). Sites are evaluated by practising clinicians and periodically reviewed by an editorial board drawn from members of the American Medical Informatics Association using the following criteria and rating scheme:
1-20 points Peer review: Previously evaluated, verifiable, endorsed, dated, current, referenced;
1-10 points Application: Ability to enhance the knowledge database of the primary care clinician or specialist at the point of care;
1-5 points Media: Text, hypertext, or use of multi-media: images, video, sound in the context of the resource (e.g. image database);
1-5 points Feel: Search features, navigation tools, composition, advanced HTML tools, and integration within a larger database;
1-5 points Ease of access: Clinical content highlighted, reliability and speed of the link, bytes to the page; and
1-5 points Dimension: Size, effort, and importance to the discipline.

Sites are awarded a star rating, ranging from one to six stars, according to whether they offer:

- specialised knowledge with suitable clinical content,
- suitable clinical content, well authored and maintained,
- a valuable resource for improving general knowledge in the discipline, or other outstanding features, such as multi-media,
- one of the best of speciality category/subcategory and a valuable place to go,
- outstanding site across all categories and a premier web page for the discipline, or
- an award winning site for Medical Internet.

Likewise, sites are reviewed by health care and medical professionals for *Six Senses* according to content, aesthetics, interactivity, innovation, freshness and character. Sites are awarded a score from one to six in each category, resulting in an overall rating of one to 36 for each site. A 'Six Senses Seal of Approval' is awarded to sites achieving a total score above 24 points which can be displayed as a badge on the reviewed site. The *Six Senses* criteria are:

Content: The depth, quality, and medical accuracy of information offered by a site.

Aesthetics: The "eye pleasing" nature of a site, which reflects knowledge of the specific medical audiences to be addressed. This is most typically determined by layout, incorporation of graphical elements (i.e., buttons, toolbars, image maps), and use of colour.
Interactivity: The extent to which a site allows a user, professional or lay person, physician or patient, to intuitively navigate and explore a site, and effectively engages the user in an interactive experience.

Innovation: The effective use of new technologies, or the innovative use of older technologies. Examples include online respiratory sounds and “fly-through” circulatory paths.

Freshness: The incorporation and promotion of new health care and medical content. Sites that publish new content regularly (at least bi-weekly), but do not indicate this freshness, may score low in this category.

Character: The measure of how successfully a site creates a strong, unique, and consistent “personality.” Sites that dramatically change look & feel or shift editorial voice from technical medical language to lay person’s terms generally score low in this category.

The use of peer reviewers to select and evaluate materials for services such as Medical Matrix and Six Senses is based upon the assumption that experts in the field are the most appropriate people to select and evaluate the quality of information sources. However, there is a disappointing lack of research investigating the effectiveness of peer review, other than the research conducted into the effectiveness of the refereeing of paper-based journals. Moreover, there is a dearth of research into the value and usefulness of sites such as Medical Matrix and Six Senses.

2.5 Quantitative analysis

This section examines the use of quantitative analysis techniques to assess information quality, and considers how the techniques have been applied to information available via the Internet.

2.5.1 Traditional applications of quantitative analysis

For many decades, an estimation of quantity was considered an adequate measure of quality. For example, early measures of scientific performance included a count of publications and early library collections were evaluated on the basis of the number of books they contained. Library collections are still evaluated by analysing borrowing records, inter-library loan statistics and journal usage levels, and academic performance is often related to the number of publications produced by an individual.
During the 1960s and 1970s, increasingly sophisticated quantitative techniques were developed in order to indicate the quality of a source of information. This was in part due to the development and later automation of the *Science Citation Index (SCI)* at the Institute for Scientific Information (ISI). Initially covering 600 journals in 1964, the size and coverage of the SCI has continuously expanded, and three indexes are now available electronically, the SCI, the *Arts and Humanities Index* and the *Social Sciences Index*. The potential of the SCI for journal evaluation was quickly recognised. In 1971, the ISI conducted an analysis of journal citation patterns in science and technology by examining the number of times individual journals had been cited, the citation history of cited journals, and the citation history of the citing journals (Garfield, 1972). Garfield (1972, p.474) found:

...only 25 journals (little more than 1 percent of SCI coverage) are cited in 24 percent of all references; that only 152 journals are cited in 50 percent of all references; that only 767 journals are cited in 75 percent of all references; and that only 2000 or so journals are cited in 85 percent of all references.

Thus, Garfield (1972, p.474) concluded, 'it is immediately apparent that the majority of all references cite relatively few journals' and 'a good multi-disciplinary journal collection need contain no more than a few hundred titles'. Garfield (1972) proposed using the 'impact factor' of journals, a measure of the number of times journals had been cited over a given period divided by the number of articles published, to assist librarians and individual scientists in journal selection. In a later article, Garfield (1978, p.68) referred to the SCI as 'a quality information filter' and described 'increasing use of citation analysis as an aid in identifying those individuals and organisations who are producing high impact work'. Garfield (1978, p.71) proposed the 'act of citing' was 'an expression of the "importance" of the material cited' and 'that the number of times a given journal has been cited is an objective indicator of the quality of the journal'.

Numerous authors have investigated the use of citation analysis to filter information and studies justify the validity and reliability of the technique. For example, Lawani and Bayer (1983) report the results of a study which revealed that papers rated highly by subject experts were consistently more frequently cited during the five years following their publication. Other authors have modified citation analysis techniques in order to filter information. Pao (1975) analysed the cited references from review articles on cardiac arrhythmias to identify the most frequently cited references in the reviews. A
'judgement of relevance was inferred' from the references selected by the review authors, and 'a consensus derived from the frequency with which items were cited' (Pao 1975, p.354). The procedure provided:

A quality information filtering system which reduces the quantity of journal literature on a specific subject to a few highly relevant, influential and easily accessible items (Pao 1975, pp.353-354).

Boyce and Primov (1977, p.1002) evaluated Pao's selection method and established that 'the articles selected by the quality filtering method are, on the average, cited far more times than other articles'.

In 1977, Broadus reviewed the evidence with regard to the application of citation analysis in developing library collections. He concluded that advantages of the technique were that it is an unobtrusive measure, that there is evidence of a strong relationship between citation analysis and other methods of evaluating information quality, that research indicates the validity of citation analysis in highlighting important papers and that there is evidence of parallels between the use of materials in libraries and citation patterns. However, citation analysis has also been heavily criticised. Broadus highlighted a number of drawbacks to citation analysis, including that the author of a paper may not cite everything used, an author may cite publications which have been used to a minimal extent or perhaps not at all, work may be cited to refute it, references may be made to 'dress up the paper, to curry favour with the mighty, or to give comfort to the lowly' (Broadus 1977, p.308). Broadus emphasises the difficulties of using citation analysis to deal effectively with recent materials and that authors may overlook important material and use only the material which is most readily accessible to them.

Garfield (1972) recognised a number of problems with evaluating journals using the SCI, including the lack of comprehensiveness of the index, the lack of coverage of foreign language materials, inaccurate and inconsistent citations by authors, and possible distortion of results due to random events in journal publishing (one article may be cited an exceptional number of times). In addition, Garfield (1972) felt some journals may be not be frequently cited for reasons other than their quality, such as the New Scientist, a valuable journal but with a relatively low citation level due to its news orientation. Furthermore, 'citation frequency is, of course, a function of many variables...
besides scientific merit', including the reputation of the author, subject controversy, availability of the journal and coverage of articles and journals by secondary services (Garfield 1972, p.476). In addition, Garfield (1978) later recognised that it may take a number of years before newer journals are cited.

Philosophical debate has focused upon the objectivity of citation analysis compared to the subjectivity of review by subject experts. For example, Weisheit and Regoli (1984, pp.318-319), while recognising the limitations of citation analysis, describe the technique as 'a more objective approach' than 'the reputation approach' involving the ranking of journals by subject experts. The authors comment on bias, low response rates and the potential for disagreement between reviewers over the meaning of the ranks assigned to journals. Alternatively, Lindsey (1989) recognises the advantages of citation analysis to assess quality but criticises the technique because it measures what is measurable, rather than providing a true assessment of quality. Problems include the assumption that all citations are equal, a lack of subjective analysis and the lack of concern for ethical or political questions.

The citation analysis first conducted by Garfield (1972) indicated that only a minority of the literature is frequently cited. Further research indicates that it is possible to use citation counts to identify a core set of materials which contain the majority of relevant information for a discipline, and that it is possible to examine other measures of information use in order to establish that core. Bradford (1948) first proposed a 'law of dispersion', whereby the journals of interest within a given subject could be arranged according to the number of articles they contained of interest to the subject, with an increasing number of journals containing only a few articles of interest. Journals could be divided into successive zones containing similar numbers of articles on the subject area concerned, with a nucleus of journals containing the majority of articles.

In the 1950s, Urquhart (1959) carried out an extensive investigation into journal use patterns at the Science Museum Library in order to plan the journal collection for the proposed National Lending Library. Of the total journal records examined, only 60 titles were used 100 times or more, 193 were used between 50 and 99 times, and 2,190 titles were only used once. Urquhart (1959, p.293) therefore concludes:
Extensive use of scientific literature is confined to a small fraction of total output ... less than 10% of those [journals] available ... are sufficient to meet 80% of the demand for serial literature.

Such techniques have been used as the basis for source selection. For example, Goffman and Morris (1970) tested Bradford’s ‘Law of Dispersion’ by examining the distribution of transplantation-immunology articles among journals in the Index Medicus and determined a minimum nucleus of journals for the area. Goffman and Morris (1970, p.923) concluded that ‘a smallest core of journals which must belong to the library’s collection can be defined’. In a later study, Goffman and Warren (1980) examined the literature for schistosomiasis between 1852 and 1962. The literature was analysed, firstly by a panel of experts who identified a core subset of the literature, and secondly, using quantitative techniques. A Bradford ‘distribution’ of authors, journals and papers was established, indicating that one percent of the authors wrote 27% of the papers, and nineteen journals contained over 30% of the total papers. Goffman and Warren (1980, p.148) therefore felt, ‘there exist qualitative characteristics of a scientific literature that can be expressed in quantitative terms’, and:

It is more than possible for individuals to decide upon a small nucleus or core of journals of quality in their field in which it is highly likely they will find the vast majority of articles of quality (Goffman and Warren 1980, p.178).

Furthermore, Wallace and Bonzi (1985) explored the relationship between Bradford’s ‘Law of Dispersion’ and citation analysis by testing the hypothesis that articles appearing in the nucleus of a Bradford distribution would be more highly cited than other articles. The results indicated ‘a substantially greater rate’ of citation among articles in the nucleus of journals and the authors therefore concluded:

If the assumption that a high citation rate is an indicator of quality, utility or importance is true, it would appear to be the case that the journals in the nucleus of [a discipline] are of superior quality (Wallace and Bonzi 1985, p.195).
2.5.2 Quantitative analysis and the Internet

Despite the volume of research described above, and the obvious potential for quantitatively analysing information available via the WWW in particular, the number of examples of its application is very limited. Some sites and services include counters to indicate the number of visits during a specified period, generally with a view to indicating popularity. For example, the *Lycos* search service initially provided a 'most-linked to' list of sites available via the WWW to indicate quality, although the facility was no longer available at the time of writing.

Some research has explored the use of quantitative techniques to examine the subject coverage of WWW sites. Larson (1996) undertook a bibliometric analysis of the WWW by analysing the output from a search tool and conducting a co-citation analysis of the documents retrieved in order to determine the relationship between subject disciplines. Co-citation analysis is used 'to map the topical relatedness of clusters of authors, journals or articles' (Larson 1996, p.74). A different tool was then used to search for documents containing links to a core list of WWW sites within the selected subject discipline and a matrix was produced indicating topic clusters. The author concludes, 'the method produced quite reasonable and comprehensible clustering of WWW sites that had topical similarities' and:

... would seem to indicate that a "new" tool for mapping the intellectual terrain of the WWW is now available for scholars seeking to define and map this terrain (Larson 1996, pp.76-78).

Almind and Ingwersen (1997) describe a similar analysis of information from Denmark and other Nordic countries available via the WWW. The study demonstrated the comparative lack of visibility material from Nordic countries in comparison to their coverage by the ISI databases. Almind and Ingwersen (1997, p.404) propose that the WWW could be regarded as a citation network 'where the traditional information entities, and the citations from them, are replaced by Web pages ... with hyperlinks ... acting as citations'.

Pedersen (1996) describes a study to develop a technique for determining whether mailing lists are likely to meet subscribers' needs. Pedersen calculated the average number of messages per day posted to a range of discussion groups, and categorised the
messages according to whether they were administrative, announcements, discussion, pointers to further information, noise, etc. Pedersen summarised the characteristics of the groups according to the volume of postings and the nature of the messages. For example, one group was described as having 'very light traffic consisting entirely of announcements', while another was 'a more active forum ... dominated by relevant discussion' and 'a good source of job announcements' (Pedersen 1996, pp.45-46). The author therefore concludes that:

The method described is both a valid and useful way of describing Internet mailing lists in such a way that potential subscribers can make intelligent decisions about the value of the lists to them (Pedersen 1996, p.47).

Hernández-Borges, Pereras and Jiminz (1997) used quantitative techniques to develop a methodology for analysing the potential quality of a range of paediatric mailing lists. Medline was searched for the names of mailing list subscribers and an impact factor was calculated for each of the subscribers' papers according to the SCI. An average impact factor was calculated for each list, as well as an average impact factor per participant and per message to the group. An average number of postings per author was also calculated. The results were compared to the same results for six paediatric journals and indicated, for example, the most popular and active list, and the list with the highest quality per posting. The authors propose that the methodology offers a technique for assessing the quality of mailing lists because it is:

... based on the accumulation of defined impact factors generated by published articles of the various members of the discussion groups, a way for any scientific group to gain prestige in a given field of science (Hernández-Borges, et al. 1997, p.7).

The article gave rise to some discussion on the lis-medical discussion list. Stephens (1997, August 4th) highlighted two assumptions in the proposed methodology. Firstly, 'that the “quality” of an author can be judged from the impact factor of the journal they publish papers in', and secondly, 'that the same qualities are desirable in an author of a published paper as those in a poster to an e-mail list'. Stephens questioned the value of impact factors as a measure of quality generally, and questioned the function of discussion groups in comparison to journals. Furthermore, he suggests the results may be skewed by a high impact factor of one participant from the list.
2.6 Internet-based facilities

The various methods and techniques described above have arisen from a tradition of quality assessment within a paper-based environment. Due to the volume of material disseminated via the Internet, and the WWW in particular, new methods and techniques have been developed which are peculiar to the Internet. While there are some similarities to the assessment of information available in other formats, the methods discussed below have been developed primarily within the context of information available via the Internet.

2.6.1 Automated methods

One area of research during recent years has been the automatic filtering of material from Usenet Newsgroups. Gant (1995) provides an overview of a range of automatic filtering systems, and draws a distinction between retrieving and filtering information. Retrieval relates to a specific question or problem and requires the user to actively seek information, whereas filtering refers to an on-going information need and information is delivered to the user according to a profile of that need. Examples described include the Stanford Information Filtering Tool (SIFT) which filters Usenet postings according to a profile specified by the user. Other tools enable the automatic filtering of incoming e-mail messages by author or by words in the subject or text of a message.

During 1991 and 1992, the University of Michigan investigated using artificial intelligence techniques to filter Usenet postings according to individual user needs (Rosenfeld and Holland, 1994). The researchers assumed an automated filtering system would be valuable in reducing the volume of irrelevant and low quality postings. Users’ interests were profiled and users were asked to evaluate the materials they received over a two month period. The participants were negative about the results and about the system generally. In particular, ‘the quality of the retrieval is proportional to the labour invested by the user in developing quality filters’ (Rosenfeld and Holland 1994, p.30). The authors therefore felt, ‘automated filtering of dynamic resources to reduce information overload is unlikely to succeed’ and is ‘impractical’ in the Internet environment, particularly where users ‘are usually casual consumers of news’ and
therefore ‘not likely to be willing to devote time to creating quality filters’ (Rosenfeld and Holland 1994, pp.28-30). The authors conclude:

Automatic filtering is not acceptable as a single selection method. Human mediation, or human filtering, must be part of the process too, since automatic systems can only suggest to the user documents that are relevant (Rosenfeld and Holland 1994, p.29).

Similar results were deduced from a project based at Dublin City University (Cullen, 1997). The project aimed:

To develop a filtering information service which would automatically filter information from the Internet and distribute it to selected users on a daily basis according to individually defined profiles of user information needs (Cullen 1997, p.45).

While users felt the system was a ‘good idea’, the information retrieved was not relevant to them and usage of the system declined rapidly during the course of the project. In conclusion, ‘user dissatisfaction with the (ir)relevance of retrieved items was so significant that the Library could not consider supporting the service in its present form’ (Cullen 1997, p.49).

The development of tools for accessing and retrieving information available via the Internet was an area of particular interest and concern during the course of the study. One notable area of research is the use of metadata to enhance information retrieval. Metadata is data about data, comparable to a bibliographical record, which is written into the document itself. For example, at the time of writing, the eLib project, Resource for Urban Design Information (RUDI), was testing a search facility using metadata to label documents with subject keywords, author names and place names. The metadata fields can be used to narrow searches, ensuring more relevant search results (Worthington, 1997).

In 1996, the US Communications Decency Act was introduced which sought to regulate the information available via the Internet (DesAutels, 1997). The Platform for Internet Content Selection (PICS) was developed in response to the proposed Act as a means of enabling users to circumvent indecent or other potentially offensive materials. PICS is a metadata framework which enables information providers or independent services to
add additional descriptive information to materials for selection purposes. Thus, data can be added to material on the level of indecency or violence, and users can search for sources according to specified criteria.

As already discussed, CIQM has been involved in work investigating the quality of traditional online databases for a number of years and the work has culminated in the development of database labels, a method for providing users with a specification of database quality. Armstrong (1997b) has proposed the use of PICS metadata labels for storing data about the quality of Internet sources using a method similar to database labelling. He proposes using scales to indicate the quality of a source, enabling users to filter material according to particular criteria, such as the number of references or the currency of material. Armstrong also advocates the use of PICS labels to enhance records in subject-based gateway services, allowing users to compare the sources which are retrieved.

Automated methods have been used for many years to address quality issues in the dissemination of information. For example, software is used to ensure monographs and journals do not contain spelling errors, and techniques have been devised to enable the quality control of information in online and CD-ROM sources. For example, Mintz (1990) describes the use of software to identify wrongly used words in online databases, to verify post codes, telephone numbers and journal titles, and to ensure consistency within controlled vocabulary fields. Granick (1991) also refers to the use of authority files for names, abbreviations, commonly used terms and index terms, and for the validation of numerical data.

With the widespread availability of user-friendly browsers and software for developing material in a format suitable for dissemination via the WWW, individuals are able to create and disseminate documents easily. Similarly, it is a fairly straightforward process for the author of a WWW site or e-mail message to check the spelling of material prior to its dissemination. However, many of those publishing via the WWW have little knowledge or understanding of the computer programming required to ensure the compatibility of documents between different machines or browsers. Users can examine the pages they create to determine whether they look acceptable on their own machine, but unless the pages conform to certain standards, the user cannot ensure that the documents will appear as intended elsewhere.
Documents produced for dissemination via the WWW are written in a standard language, the Hypertext Mark-up Language (HTML). A free online HTML conformance checker has been developed, initially called HALSoft and later renamed WebTechs HTML Validation Service, which enables users to check the validity of their HTML (Bigham, 1997). The software compares the HTML in a document to the defined syntax for HTML in order to ensure it conforms to current standards. The software therefore ensures documents display correctly on all compliant browsers and that documents are legible in any version of a browser, including later implementations.

2.6.2 Popular reviewing services

During 1995 and 1996, there was a trend towards providing more effective access to Internet resources through the provision of various forms of site reviews. Services included those which provided a numerical rating or award which could be displayed on the site concerned, databases of selected and evaluated resources, and more detailed and descriptive evaluations of sites. Examples already mentioned include Medical Matrix, a database of peer reviewed medical resources selected by health care professionals, and Six Senses, a service awarding badges to indicate site quality. Likewise, OMNI and SOSIG are concerned with the development of databases of high quality materials which have been selected and evaluated by LIS professionals within particular subject areas.

A number of popular and commercial rating sites and services were also developed during the mid-1990s with a view to providing more effective access to Internet-based information. In particular, many of the popular search services such as Excite, Magellan, Lycos and Yahoo! developed reviewing services in parallel to their general search facilities. Some of these services provide little or no information on how resources are selected or evaluated, while others, such as Excite and Magellan, initially provided information on the selection and evaluation process but this information was no longer available at the time of writing. Smith (1997b) has compared the available criteria used by a number of reviewing sites. The results indicate a bias towards the graphic and multi-media design of sites, which is mentioned by all services, the organisation of information and the ease of browsing sites, information currency and general content.
Less emphasis is placed upon aspects such as authority, uniqueness and audience, indicating 'that appearance is widely regarded as important'.

The Lycos Top 5% service still provides some detail on its selection and evaluation policies. Lycos Top 5% provides access to 'only the best sites' which have been evaluated and reviewed by Lycos editors. Sites are evaluated according to three rating categories using the following criteria:

- **Content**: Does it cover its topic in a broad, deep and thorough manner? Is the information useful, accurate and up-to-date?
- **Design**: Does it lead visitors through the information nicely? Are the pages beautiful, colourful and easy to use? Does the site use video, audio and original graphics?
- **Overall**: Is the site fun, inviting and captivating? Would you like to meet the people behind the site?

Sites are awarded a score of up to 100. No further detail is provided on score allocation, although the meaning of the final score is defined:

- **If scores were classic rock bands, this is what they’d sound like.**
  - **100-90**: The Beatles, Rolling Stones, Bob Dylan ... not only good but important and influential. Sites that signal a leading trend on the Internet.
  - **89-80**: The Who, Joni Mitchell, Beach Boys ... strong but occasionally uneven work. Niche sites with strong potential and areas of importance.
  - **79-70**: Led Zeppelin, Elton John, The Doors ... broad appeal but sometimes lacking ideas. Sites that may be useful but not necessarily inspired or compelling.
  - **69-60**: James Taylor, John Denver, Billy Joel ... relatively ordinary. Standard-issue sites that lack originality.
  - **59-50**: Garth Brooks, Celine Dion, Sheryl Crow ... a typical Grammy evening. Sites that barely make the Lycos TOP 5% cut.
  - **49-01**: Unusually low quality, for sites that have zero content and a dramatic lack of visual appeal. Obviously, scoring more than once in this range excludes membership in the TOP 5% directory.
Despite a lack of research into the effectiveness of the various popular reviewing sites discussed above, commentators have suggested that they enable Internet users to spend ‘less time searching and more time reaping the benefits of … Web browsing’ (Venditto 1997, p.84). Internet World voted Lycos Top 5% ‘best’ of a range of reviewing services and argues that readers, ‘may not agree that Lycos Top 5% Sites reviews offer the most stunningly insightful opinions’, but the service will save the user time in ‘pursuit of quality information’ (Venditto 1997, p.92).

However, various LIS professionals have examined the differences between such sites and services. Rettig (1996), Tillman (1997) and Cooke, McNab and Anagnostelis (1996) have compared services in terms of how materials are selected, the level of description offered, the classification and organisation of materials, and the criteria used. In addition, McNab, Anagnostelis and Cooke (1997) examined the use of badges and star rating schemes by comparing the ratings awarded to a medical site. The authors generally conclude that popular reviewing services offer little indication of site quality. For example, Rettig (1996), discussing one such site suggests, ‘criteria for inclusion and the rating scale are highly impressionistic and descriptive notes on each site are minimalist’. Furthermore, ‘the impressionistic “cool” counts for a great deal’. Rettig suggests popular and commercial reviewing services have:

Ventured into reviewing … in ignorance of the traditions and criteria of reviewing in the print world. Had they based their criteria on those long used in the print world, the reviews available to Internet users would probably be more evaluative.

Collins (1996, p.124) argues that popular reviewing services:

Trivialise the valuable aspects of the new medium by failing to define what their ratings really mean or by defining them in such an arbitrary and subjective manner that their ratings are useless except to those who hold the same subjective preconceptions.

Furthermore Engstrom (1996, p.2) compares the popular reviewing services to those provided by medical professionals, describing the popular sites as ‘a slurry of amateur opinion and sales plugs’ made by ‘faceless, nameless, non-medical “experts”’. Furthermore, he suggests popular sites, ‘place a premium on such things as a Web site’s
graphics and numbers of visitors at the expense of original ideas and valuable information' (Engstrom 1996, p.3).

2.6.3 Internet-based evaluation criteria

Many of the criteria mentioned earlier are peculiar to the evaluation of sources available via the Internet. Examples include those used in the peer review of materials by Medical Matrix or Six Senses, and the criteria developed for popular reviewing sites such as Lycos Top 5%. In addition to these, during the course of the research a range of other organisations and institutions have been involved in the development of assessment criteria. As with the other Internet-based facilities discussed, there is a disappointing lack of research associated with the development or implementation of such methods, but they are briefly discussed below.

A project based at the University of Georgia has attempted to identify and rate the importance of various criteria to develop a generic evaluation tool (Wilkinson, Oliver and Bennett, 1997). A range of sources were consulted to identify possible evaluation criteria, including periodicals, journals, online rating services and authorities on library reference materials. A total of 509 possible criteria or 'indicators of quality' were identified. Content analysis was conducted to eliminate duplicate items, to clarify those with ambiguous meaning, and to eliminate meaningless items, such as 'I pick the good stuff'. The original list was reduced to 125 indicators which were categorised under eleven headings:

- site access and usability,
- resource identification and documentation,
- author identification,
- authority of author,
- information structure and design,
- relevance and scope of content,
- validity of content,
- accuracy and balance of content,
- navigation within document,
- quality of the links, and
- aesthetic and affective aspects.
A review panel was identified of 64 individuals involved in the maintenance of collections of Internet materials. A questionnaire was developed and the review panel was asked to identify the focus and importance of each indicator: 71 items were classified as 'information quality indicators', while 67 were 'site quality indicators'. The relative importance of the indicators was determined by rating them on a six-point scale ranging from one for irrelevant to six for essential. The ten highest ranking indicators were:

- is there a good organisational scheme?
- is the design so complex that it detracts from the content?
- is the information sufficiently current to meet the user's needs?
- are there any obvious errors or misleading omissions in the document?
- are the links relevant and appropriate to the document?
- what is the author's name?
- what is the author's professional or institutional affiliation?
- does the author or the sponsor of the site have a vested or a commercial interest in the topic?
- are the links evaluated in any way prior to inclusion?
- are the links clearly visible and understandable? (Oliver, Wilkinson and Bennet, 1997).

The availability via the Internet of inaccurate or unreliable information within health care and medicine has been an area of particular concern and various organisations have developed criteria. For example, during the course of the research, the Health Information Technology Institute at Mitretek Systems devised criteria for assessing the quality of health information available via the Internet (Ambre, et al., 1997). The document, produced by a range of health care professionals including consultants and IT specialists, provides an extensive guide to source evaluation intended for consumers of health information. The criteria relate to areas such as subject relevance, currency, accuracy, evidence basis, links to further information, design and interactivity. Extensive notes, as well as some examples, are provided to explain the criteria and to offer hints on evaluation. For example, currency is defined as 'being up to date with the state of medical/clinical knowledge', and the following example is provided to illustrate its assessment:
A position paper from the American College of Physicians on a blood platelet disorder was published ... One of the members of the expert committee that drafted the position paper also has a personal Web site where there is a discussion of the same condition. Interestingly, the Web site had not been updated in the past year, and thus made no mention of the published consensus paper.

In addition, three organisations have sought to develop codes or standards for the provision of quality health and medical information available via the Internet: the

- the provision of a clear statement of authority, including the credentials of the authors,
- that sources should be kept current and the last date of amendment should be indicated,
- the provision of references and citations to other sources of information, particularly esteemed journals and institutions,
- appropriate evidence for any claims made on the site, including 'a clear distinction between advertisements for products and balanced scientific studies' (Medical Matrix Code of Conduct, 1997),
- information on any support or sources of funding,
- to undergo a process of expert review or editorial examination of materials,
- the identification of the intended audience, and
- the provision of contact information to enable feedback.

2.7 User needs research

While a proliferation of user needs studies are available in the LIS literature generally, few have considered how users select and evaluate information sources. Available studies focus upon use of the library, types of information need, types of information source used, the effectiveness of library catalogues and other information retrieval systems, and the extent to which information services satisfy particular requirements (see for example, Faibisoff and Ely, 1976; Haug, 1997). The factors affecting the relevance of a source of information have also been widely discussed. However, users' perceptions of source quality and the impact of quality upon selection have largely been
ignored. Where quality is addressed, research examines the information service provided and not the information itself.

There are some notable exceptions. In the late 1960s, Gerstberger and Allen (1968) examined the criteria used by research and development engineers in the selection of different types of information sources. The information seeking behaviour of engineers was examined by asking respondents about the channels of information they used and to rank those channels according to four criteria: accessibility, ease of use, technical quality of the information, and the degree of experience they had with each channel. The results indicate 'accessibility is the single most important determinant of the overall extent to which an information channel is used'. Engineers use the most accessible channel first and information quality only affects their selection 'to a minor extent.' However, the study was specifically concerned with reasons for using types of sources and therefore information quality assessment 'is delayed until after the channel has been selected.' In addition, there was no scope for users to suggest their own criteria as they were dictated by the researchers.

More recently, Bichteler and Ward (1989) examined the methods used and problems encountered by geologists in retrieving and processing information. The respondents commented upon the quality of the information and how they judged quality. The 'most significant characteristics' affecting source quality were:

- reputation of the author,
- whether the conclusions and interpretations follow from the data,
- quality, quantity and validity of the data,
- instrumentation and analytical techniques,
- journal title and reputation of the publisher,
- organisation, rationale, clarity and style,
- well-written abstract, and
- up-to-date, appropriate references (Bichteler and Ward 1989, p.143).

Schamber (1991a and b) examined the criteria used in the evaluation of weather-related information in a multi-media environment. Schamber attempted to elicit criteria using an open-ended interview technique in order to ask respondents to, 'evaluate ways in which specific sources and presentations “made a difference” to them in answering their
questions or resolving their situations' (Schamber 1991b, p.127). The respondents' answers were analysed to identify criteria and to examine how the criteria differed according to the type of information source used.

Ten summary categories of criteria were identified:

- **Presentation quality**: ... permanence, choice of format or output, availability of preferred format, inclusion of non-weather information, entertainment value or characteristics of human sources,
- **Currency**: the information was up-to-date or timely,
- **Reliability**: the source could be trusted, believed or relied upon; often based on reputation, expertise or consistency,
- **Verifiability**: other source(s) of weather information were also consulted or available, usually for the purposes of comparison,
- **Geographic proximity**: the information covered certain geographic areas, locations or altitudes, usually near the respondent's location or destination,
- **Specificity**: the information was specific to the respondent's need; it had sufficient detail, depth or interpretation,
- **Dynamism**: presentation of information was dynamic, active or interactive,
- **Accessibility**: the source was accessible; available when and where needed, easy to use, or affordable,
- **Accuracy**: the information was accurate, usually in the sense of agreement between forecast and actual conditions, and
- **Clarity**: information was presented in a way that was clear, not confusing; that took little effort to read or understand. (Schamber 1991b, p.129).

The criteria were not mentioned by all of the users, and not all of the criteria were mentioned in relation to the different sources. Schamber suggests variations may be due to the importance attributed to individual criteria by different respondents, criteria may have been taken for granted, or respondents may have assumed the existence of criteria in particular information sources. Furthermore:

In view of the open-ended interview structure, it is likely that the criteria mentioned less often were simply those that were not uppermost in the respondent's consciousness (Schamber 1991b, p.131).

However:

The fact that nine criteria were mentioned by two-thirds or more respondents and even the tenth-criterion, clarity, by more than half the
respondents tended to support the validity of the categories in actual information seeking and use situations (Schamber 1991b, p.131).

Sievert, *et al.* (1996) attempted to determine what factors beyond relevance influenced clinicians' decisions to choose to read one journal article over another when looking for information. Health care providers were interviewed and the factors which influenced their use of journal articles beyond subject relevance were: methodological rigour, authors and their institutional affiliations, document types and the populations studied. Furthermore, some factors were considered more or less important according to the expected use of the information, such as whether the information was to be used for teaching or research.

Kuller, *et al.* (1993) examined the similarities between selections of references from a database made by librarians and physicians, the decision making processes used by librarians and physicians, and the utility of librarian selections versus those made by physicians. Librarians and physicians selected an equal number of articles from an online search, their reasons for selection of the articles was noted, and the relevance of the references was assessed by physicians. There was no significant difference between the articles selected by both groups. Selection decisions were based upon the article title, abstract and journal title, although librarians paid more attention to the medical subject headings, while physicians focused upon clinical applicability. The articles were given almost equal scores in terms of their relevance by the physicians, suggesting that librarians are as effective in selecting useful articles as physicians in a clinical setting. The authors conclude that 'librarians can effectively serve a quality filtering function in the clinical environment' (Kuller, *et al.* 1993, p.38).

### 2.8 Discussion

The aim of the literature review was not only to examine definitions of information quality and the range of tools and techniques used for assessing information quality, but also to determine the applicability of the various techniques to information available via the Internet and for use by LIS professionals. The above discussion has examined a range of methods currently used to assess information quality and some existing Internet-based applications have been considered. This section discusses the
applicability of the various techniques in assisting librarians and other information professionals in the selection and evaluation of information available via the Internet.

Quantitative analysis techniques are widely recognised and used to assess the quality of sources of information, particularly through the use of citation analysis. Advocates would argue that quantitative techniques offer an objective means of assessing quality and research evidence indicates that such techniques can be effective. Furthermore, there are a limited number of examples of the application of quantitative analysis techniques to information available via the Internet. The studies indicate that it is possible to conduct a bibliometric analysis of WWW information in order to analyse content, and the study conducted by Hernández-Borges, et al. (1997) provides an example of how citation analysis can be used to investigate the potential quality of mailing lists.

However, numerous problems have also been highlighted in relation to the use of quantitative techniques to assess information quality. In particular, different sources of information are used or cited for different reasons and quality might not always be a factor in source use. This may be problematic with respect to information available via the Internet where a wide variety of sources are available which are accessed and used for a range of reasons, and the most heavily used sites are often of a pornographic nature. Furthermore, Garfield (1978) felt that the use of citation analysis to measure the quality of new journals was particularly problematic because it may be some time before a journal is recognised and used in a field. The Internet is often used to disseminate current information which may be continuously updated and amended. Consequently, while quantitative techniques potentially offer an objective means of assessing quality which could be implemented by anyone, including LIS professionals, it is questionable whether such techniques are appropriate to the information available via the Internet. Larson (1996, p.74) comments on ‘the meaning and significance of citation’, which might be ‘quite different in these two environments, scholarly publishing and the WWW’ and Stephens (1997, August 4th) questions the different function of discussion groups in comparison to journals, by implication indicating that the measures of quality should be different for the two source types.

Authors have further argued that quantitative techniques measure what is measurable rather than providing an assessment of quality (see for example, Lindsey, 1989).
Broadus (1977, p. 324), in his review of the application of citation analysis techniques to library collections, concludes that the technique may be valid in assessing quality but argues 'ideally selection should be done by a person expert in the subject or subjects covered by his or her library'. As discussed, quality is a subjective issue dependent upon the attitudes and perceptions of those involved in supplying and using information. There are a wide range of factors which may affect perceptions of information quality but quantitative measures ignore the wider context of information seeking and use. This author therefore concurs with Lindsey (1989, p. 201):

Citation counts cannot substitute for the human judgement of quality, with its ethical, aesthetic, moral and political dimensions, that is at the core of our definitions of quality. The precise measure of true quality is beyond reach. Citation counts provide a useful approximation of this measure. However, our best valid measure remains human judgement.

Computers are used to check spelling accuracy or validate the HTML used to create WWW pages. Such procedures improve isolated aspects of a source of information but the available research suggests computers cannot currently be used to make an overall assessment of quality. Some research has been conducted into the use of software to filter information according to user profiles but users are generally dissatisfied with the results. The problems encountered relate to the complexity of information seeking and further underline the need for human judgement in selecting and evaluating sources of information. As with the use of quantitative techniques, Rosenfeld (1994, pp. 12-13) advocates the need for human intervention in the selection process:

No automated tool can assess the quality of an information resource on the Internet; intrinsic issues of format, content, context, source, location, and authority generally cannot be judged by software. Instead, quality assessment continues to be almost wholly the product of intellectual labour.

The use of PICS metadata to enhance resource descriptions might enable the more effective retrieval of sources. However, the use of a metadata format to provide descriptive detail about the quality of a source will still require someone to evaluate the source and provide the necessary critical information about it. Therefore, there is a need for the selection and evaluation of sources of information which involves human judgement.
Peer review refers to the evaluation of information by experts in the field concerned. A process of peer review would appear to be the most obvious means of assessing quality as a subject expert would be the best equipped person to make an assessment of a work within their field:

Knowledgeable experts and authorities are the individuals who are most able to identify the important facts and concepts in a field and to perceptively select and cite from the massive amount of literature those parts that are of relevance, importance and high quality (Bernstein 1980, p.94).

Various forms of peer review have been implemented to filter information available via the Internet, including through the establishment of archives of unpublished work, the refereeing of journal articles, moderation of Usenet Newsgroups and discussion groups, and the selection and evaluation of materials for inclusion in databases of high quality materials. Indeed, commentators have suggested that networking technology, and the use of e-mail in particular, encourages informal peer review. In 1982, Cronin considered the implications of information technology for the invisible college and predicted that e-mail would enable the easier and faster exchange of information. He concludes:

Invisible colleges have a functional (and psychological) reality which transcends the medium or mechanism by which they coalesce ... what remains uncertain, however, is the extent to which technological innovation will encourage a broadening of the participative base and reduce the unequal distribution of benefits which is a feature of the prevailing situation (Cronin 1982, p.232).

Rowland (1997) argues that e-mail has indeed 'transformed' the invisible college:

The invisible college has been democratised and reinvigorated, and academic life radically changed, by the almost cost-free discussion across time and space that e-mail offers (Rowland, 1997).

However, many of the implementations of peer review are unique to a particular environment and serve a peculiar function within that environment. Formalised peer review in the form of refereeing is designed to act as a quality filter but is unique to the publication of academic research. Likewise, the moderation of Usenet Newsgroups and discussion groups is peculiar to communication via such groups. There are arguments both for and against the use of refereeing to filter publications and the moderation of
Usenet Newsgroups and Discussion Groups, but it is questionable whether imposing comparable control of the information generally available via the Internet would be possible. The dissemination of Internet-based information differs from scholarly communication and quality controls such as refereeing and editing could be in conflict with the informal communication structures which shape much of the dissemination of information via the Internet. Goffman (1978, p.17) upheld the need for filters which would not alter communication and advocates that any quality filter should act 'as a qualitative point of entry to a given subject', but 'still allow the user to access the entire literature if so desired'. The same arguments would hold true to the filtering of much of the information currently being made available via the Internet.

Post-dissemination peer review of material offers a means of exploiting the benefits of quality assessment by subject experts without interfering with information dissemination. A range of examples of peer review systems for paper-based and Internet-based sources have been discussed. While there is a lack of research indicating the effectiveness of services such as Medical Matrix, the length of availability of the site and the extent of its use would suggest it is of some benefit. It would therefore seem that investigation into such a system for filtering information could be a possible solution to the research problem. For example, LIS professionals might co-ordinate the review of various sites and services by subject reviewers within a discipline in order to assist other library users in identifying high quality materials. However, the main drawback to such an approach is in ensuring involvement of subject experts to act as reviewers. Experts might not always be available or willing to assess resources as and when required, or might not be willing to commit themselves to evaluating materials regularly.

Advocates contest that LIS professionals have a key role to play in quality filtering (Neill, 1989) and research indicates that librarians are as effective in selecting useful articles as physicians in a clinical setting (Kuller, et al., 1993). However, as discussed, information quality is a subjective issue and the problem of selecting and evaluating information is further compounded for LIS professionals because they are generally selecting and evaluating sources on behalf of someone else. As discussed, quality assessment relates to a consideration of the fitness for purpose of an information source within a particular context or setting, and it is possible to identify factors which affect the extent to which a source will fit a purpose. The literature review refers to a range of criteria which have been developed to assist in the selection and evaluation process.
Criteria enable the identification of different factors which affect the quality of information sources, and LIS professionals have used a range of criteria since the turn of the century to assess various types of materials.

However, there are certain fundamental problems with the existing evaluation criteria used by LIS professionals. Many of the proposed criteria are significantly similar to those developed for the selection and evaluation of printed reference materials and online and CD-ROM sources. The nature of Internet-based information means that many of the traditional criteria might be inappropriate. Information available via the Internet is often informal, electronic information is inherently less stable than printed information, and there may not be an individual claiming intellectual responsibility for the compilation of work. Rettig (1996) advocates the need for research into the development of criteria appropriate to Internet-based sources, and in particular, 'criteria that apply to Web resources but not to printed resources need to be identified'. Furthermore, the criteria in the literature generally focus upon information available via the WWW and ignore the availability of vast quantities of information via, for example, Usenet Newsgroups and discussion groups or in FTP archives. In addition, the criteria generally ignore the differences between the information available from an electronic journal compared to the information in a personal home page.

Furthermore, there is a notable difference between the criteria used by the popular reviewing sites and those used by LIS professionals. Where details on the selection process are available, it is evident that the popular reviewing sites focus on issues such as physical appearance and whether material is 'fun' and 'cool'. Smith’s (1997b) comparison of a range of popular reviewing sites indicates greater emphasis on the graphic and multi-media design of sites rather than their content. Likewise, there is a notable difference between the language and criteria used by Medical Matrix and Six Senses. Many of the criteria are similar to those used by LIS professionals, and relate to areas such as the authority, accuracy and coverage of material, as well as the appearance of sites. However, the language used is less formal, the appearance and format of sites receives greater attention, and a numerical rating of sources has been adopted by the services.

Information professionals have been critical of popular reviewing sites and consider the evaluations provided by such sites to be meaningless. Rettig (1996) is particularly
disparaging and argues that they ignore the traditions built up within the profession for assessing information quality. In addition, not all of the sites which rely on peer review have been favourably described (see for example, Cooke, et al., 1996). However, one perspective might be that the lack of research into the development of the criteria used by LIS professionals has resulted in methods which are no longer appropriate to user needs. The criteria have been developed on an ad-hoc basis by information professionals and there has been little research into their validity or effectiveness. Furthermore, there has been little research into how users select and evaluate sources of information, and whether the available criteria accurately reflect the selection process. It is therefore questionable whether existing criteria are a valid or effective guide to assessing information quality.

If evaluation criteria are to be used as a technique for assisting LIS professionals in identifying quality Internet-based information sources, certain problems arise. In particular, questions relate to how Internet users select and evaluate sources of information, and whether their behaviour provides an insight into how LIS professionals should assess sources of information. Furthermore, questions arise regarding whether assessments of quality apply to different types of Internet-based information sources, including information in a message retrieved from a Usenet Newsgroup, an FTP archive, an electronic journal or a personal Home Page available via the WWW.

The study conducted by Schamber (1991a) provides a valuable insight into how users select and evaluate information sources. The methods used, including the open-ended interview technique and content analysis of users' comments on source evaluation, enabled the identification of evaluation criteria which could be used by information professionals to assess information quality. However, the Internet was not widely used at the time of Schamber's study and its use was therefore not considered. It may be possible to adapt and develop the techniques used by Schamber for the purposes of this study. Users could be interviewed regarding a situation where they had used the Internet to look for information. Using such a technique, it might be possible to identify criteria, and compare the issues mentioned by different users and in relation to different types of sources. Finally, the criteria could be tested to assess their effectiveness as a quality filter.
Smith (1997b) comments:

There is scope for future research on evaluation criteria to establish attributes that users regard as important in Internet information sources. This knowledge would assist developers of Web sites and librarians who are evaluating Internet information sources.

The direction of the research was therefore shaped by the need to examine user behaviour in order to develop criteria for assisting LIS professionals in the selection and evaluation of Internet-based information sources.

2.9 Summary

The purpose of the literature review was firstly, to consider definitions of information quality in order to provide the terms of reference for the remainder of the study. Secondly, the literature was reviewed to examine the range of tools and techniques commonly used for assessing information quality, and to consider their applicability to information available via the Internet and for use by LIS professionals.

Information is understood as any structured data sent over networks which has the potential to transform a state of knowledge or knowledge structure, and an information source is any such recorded information which is available for consultation at the time of use. Quality is understood as ‘the totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs’ (British Standards Institution, 1995). Thus, information quality is understood to refer to the ability of information to satisfy stated or implied needs. It is acknowledged that there are identifiable factors which affect the quality of an information source and make it of more or less quality within a particular context or situation.

A wide range of procedures and techniques for assessing the quality of information sources have been examined, some of which have already been applied to information available via the Internet. Each would appear to offer their advantages and disadvantages, particularly in assisting LIS professionals in assessing source quality. Based upon the literature review, an appropriate direction for the research would appear to be the development of criteria for use by LIS professionals to assist in evaluating...
resources accessed via the Internet. However, there are a number of problems with existing criteria, namely:

- they may not be applicable to information sources available via the Internet,
- there are differences between the criteria used by popular and peer review sites, and those used by LIS professionals, suggesting a discrepancy between user needs and the selections conducted by LIS professionals, and
- the lack of research into user prevents any conclusions being drawn regarding the validity and effectiveness of existing criteria in assessing information quality.

There is therefore a need for research into how users of the Internet select and evaluate sources of information. By examining user behaviour, it may be possible to identify criteria for use by LIS professionals in the selection and evaluation of Internet-based information sources. There is also a need to determine whether different types of sources are selected and evaluated using the same selection decisions, or whether criteria are required for different types of resources available via the Internet.

The following chapter provides a detailed discussion of the methodology adopted for developing evaluation criteria for use by LIS professionals in the selection and evaluation of Internet-based information sources.
Chapter 3

Methodology
3.1 Purpose of the chapter

This chapter describes the methodology adopted in the study. The first section provides a background to the methods used and justifies the theoretical and methodological approach taken by the study. The second section describes each stage of the research. There were three main stages of data collection: the information seeking and use interviews, the criteria development and validation interviews, and a review of the evaluation criteria. In addition, questionnaires were distributed prior to each stage of interviewing. Data analysis and theory development are also discussed.

3.2 Theoretical background

This section outlines the development of research in the social sciences generally, and in librarianship and information science in particular, in order to provide a context for the methods adopted in this study. The first section provides a background by examining traditional approaches to research in librarianship and information science. The changes in social science research from quantitative to qualitative techniques, and the impact upon research in LIS, are then explored. Grounded theory as a research strategy and user-centred approaches to information retrieval research are also discussed. Lastly, the relevance of these different theoretical approaches to the study is considered and the methodological choices are justified.

3.2.1 Traditional research in library and information science

The fields of library and information science have a long history of research practice which has tended to fall into two identifiable areas, user needs studies and information retrieval. Research into the needs of library users has been traced back as far as the founding of the Boston Public Library in 1854 (Herner, 1976). Prior to the 1950s, there were a number of studies carried out into information seeking behaviour, including the use of the card catalogue (Herner, 1976). The number of studies has increased rapidly since that time and from 1964 to 1966, Menzel (1966) reports over one thousand information needs and uses studies in science and technology alone.
A 'user study' may be defined as:

An investigation using the various techniques of social science or market research. New information is actively sought from users, non-users or potential users of information of various kinds, and of services and systems (existing or projected) which aim or claim to be information sources (Slater 1972, p.232).

A broader definition of 'user studies' may include literature searches, citation studies or statistical analysis of existing library records (Slater, 1972). Information needs and use studies generally are divided into three groups: general comparative studies of information needs and demands; individual studies of the needs, demands or habits of specific user groups (academics, chemists, physicists, etc.); and information transfer and communications studies (Slater, 1972). In science and technology, such studies include users' opinions and preferences for different services, their information seeking and use behaviour, and investigations into the communication of scientific and technical information (Menzel, 1966). Data collection has involved the large-scale distribution of questionnaires. Typical questions asked include the occupation of the user, reasons for using the library, the type of documents consulted and user satisfaction with the library service provided or information found. Respondents are generally offered predetermined answer categories which facilitate the statistical analysis of results and provide 'lucid answers' which may then be 'presented in a tabular form' (Slater 1972, p.235).

Information retrieval has been the second prominent area of research in library and information science, which proliferated in the 1960s with the development of automation. Tests focused upon comparing manual and automated indexing techniques and the behaviour of index languages. Early methodological concerns included the need to break systems down into isolated comparable factors, the careful treatment of variables to allow comparison between systems over a range of experiments, and an emphasis upon the repetition of experiments to allow the accurate comparison of results (Jones, 1981). For example, the Cranfield projects investigated various indexing systems and index language devices to measure the effect of each on performance. A substantial document test collection was used in each case with a large number of enquiries. In the second Cranfield project in particular:
The searches were carried out in such a way that there was absolute consistency except for a single variable, such as index language or the search rule or the relevance decision (Cleverdon 1967, p.177).

An estimated 300,000 test results allowed comparison and the determination of trends.

In the 1970s, experiments were increasingly concerned with the size of the test collection and the number of queries. Greater emphasis was placed upon the refinement and control of variables, the validity of findings and the statistical significance of results (Jones, 1981). For example, the Aberystwyth tests involved a comparison of five index languages in subject retrieval systems. The indexes were tested using a large document set under laboratory conditions, with controlled search comparisons. One variable was isolated at a time in order to assess the effectiveness and efficiency of each language and the results were analysed using statistical techniques. The tests were particularly concerned with the accuracy and validity of results:

Various kinds of control were needed to remove the possibility of bias in this comparative situation, and some rules were unavoidably artificial; but there was always an underlying set of procedural instructions (for indexing and for searching, for example) that gave general guidance but did not remove the error and inconsistency of the human factor. The object of the experimental designs used, therefore, was to ensure as far as possible that the human factor entered equally into each system (Keen 1973, p.5).

These examples therefore demonstrate a substantial body of research into the information needs of library users and the performance effectiveness of information retrieval systems. The following sections examine the changes in social science research generally and their impact upon the research methods used in LIS research. The intention is to provide a theoretical framework for the research design adopted in this study.

3.2.2 Quantitative and qualitative research

Research methods in the social sciences generally have developed from techniques traditionally employed by the natural and physical sciences where a hypothesis is tested in order that it may be confirmed or refuted. Given situations are simulated under laboratory conditions in order to control variables and specified changes are introduced
to measure the effects. Large samples are used and tests replicated to identify and confirm trends. The results are predominantly quantitative in nature, involving counting or measuring the occurrence of events and the subsequent statistical analysis of results. The information retrieval studies mentioned illustrate the application of scientific methods to social science research. Both the Aberystwyth and the Cranfield tests used large document samples and queries to test index languages under controlled laboratory conditions. Tests were repeated for comparative purposes and to identify trends, and quantitative results were produced which were subjected to statistical analysis (Cleverdon, 1967 and Keen, 1973). In library user studies, quantitative survey techniques have also been applied to examine user behaviour, to make generalisations, establish trends and draw comparisons.

Research techniques which result in numerical data are generally referred to as 'quantitative' and associated with a positivist paradigm. Positivism or empiricism broadly 'embraces any approach which applies scientific method to human affairs conceived as belonging to a natural order open to objective inquiry' (Keat and Urry 1975, p.1). The researcher aims to explain and predict through objective, systematic observation of events: 'To explain something is to show that it is an instance of ... regularit[y]' (Hollis, 1994, p.41). Positivists believe 'perception gives us a foundation for knowledge' (Hollis 1994, p.44), and 'the results of these observations and experiments can be known either with total certainty, or at least with a far greater degree of certainty than anything else' (Keat and Urry 1975, p.13). Positivism has been perceived as a means of justifying or validating social science research:

> There is an underlying claim that there is only one logic of science, to which any intellectual activity aspiring to the title of “science” must conform. Thus, the so-called “social-sciences” must do this if they are to deserve their title (Keat and Urry 1975, p.25).

Mann (1990, p.46) advocates research which involves quantifying library activities to monitor changes, identify trends and make comparisons: ‘Quantitative methods have a great deal to offer librarians in increasing their understanding of library operations’. Likewise, Goldhor (1969) advocates a ‘scientific’ approach to research in librarianship to uncover universal generalisations or laws in the field. He believes the application of a scientific method of enquiry to social science research is entirely appropriate because
observation produces accurate, consistent and verifiable data and is the most appropriate way of acquiring knowledge and truth.

However, the use of traditional scientific research methods in many areas of the social sciences has proved problematic. The social sciences are essentially concerned with interaction between human beings and between human beings and systems, objects or animals. Individuals are complex and a scientific approach is considered 'too limiting and not appropriate for the subject of study' as it is impossible to control all factors relating to human interaction in a laboratory experiment (Hirschheim 1985, p.15). While research into information retrieval has been concerned with attempting to divide a problem situation into individual parts and isolate variables,

The sheer proliferation of explicit parameter settings served to bring out not only the increasing numbers of runs needed for proper comparative experiments, but the difficulties of ensuring a meaningful experimental design (Jones 1981, p.229).

'Scientific' research also aims to identify laws and generalisations. However, critics argue that people and social phenomena are unique and therefore there can be no general laws relating to them, and no accurate predictions can be made regarding phenomena dependent upon human activity (Keat and Urry, 1975). This problem was highlighted in the Aberystwyth index language project. Keen (1973, pp.32-33) concluded that the project 'does not at present provide proofs or laws analogous to those in the physical sciences' due to 'the preponderance of behavioural factors and lack of mathematical models'. Jürgen Habermas, a critical theorist, believed positivist research methods attempt to portray human beings as 'pure functioning of an abstract consciousness' (Outhwaite 1987, p.13). Habermas felt scholars were too concerned with order and predictability and were 'creating' the world they saw through their preconceptions. Hounsell and Winn (1981) also suggest scientific methods oversimplify or obscure the complexities of the social world, leading to inappropriate conceptualisations of social situations.

Furthermore, a positivist approach requires a preconceived thesis and evidence which either confirms or refutes that thesis. The researcher must have prior knowledge of the research area under study and understand the nature of the problem. Without such knowledge and understanding, the researcher will be unable to formulate a hypothesis or
provide respondents with lists of pre-coded answers to test it. Moreover, although positivism relies upon observation, not everything can be observed: 'There are structures, forces and other furniture of the world which are beyond all powers of observation' (Hollis 1994, p.65). Induction can only be verified by further induction:

How do we know that the principle of induction is true? The question sets the notorious “riddle of induction”. Presumably we do not know it by previous observation, because it claims to hold more widely than previous observation. Yet we cannot go beyond previous observation without assuming it to be true (Hollis 1994, p.45).

As a result of a recognition of the problems associated with applying scientific techniques to research in the social sciences, there has been a shift in emphasis from quantitative methods of data collection to techniques involving in-depth, open-ended interviewing, direct observation and the content analysis of documents. Interviews are concerned with direct quotations from people regarding their own experiences, opinions and feelings; observation is concerned with describing behaviour, actions and interactions; document analysis is concerned with a community’s written communications. The use of interviews, observation and documentary analysis has been seen as a way of overcoming the confines of quantitative methods. The researcher need not know a great deal about the subject or understand the nature of the problem as they may begin by observing, listening or reading about a social situation. The flexibility of the techniques allows the researcher to explore the subject under study. For example, in an open-ended interview situation, the researcher is not constrained by pre-determined categories of analysis but may explore an issue in more depth and detail as and when required. Through eliciting opinions and feelings from the participants, the researcher may consider subjective meaning and analyse how human action is affected by context, beliefs and social interaction.

Techniques which are used to generate non-numerical data are generally referred to as ‘qualitative’ research methods. Qualitative research is:

... concerned with the nature of the phenomena under study rather than its incidence in statistical terms, also with the subjective experience by respondents. As its name implies, it seeks the essence or quality of experience (Slater 1990, p.110).
Unlike an experimental design, a qualitative methodology 'has the capability of examining subjects within a full social context' and 'relates empirically with the subject(s) under analysis' (Weingand 1993, p.18). Patton (1990) suggests qualitative research is characterised by a number of themes. It tends to be naturalistic (non-manipulative, non-controlling and concerned with real-world situations as they unfold naturally), inductive (the researcher is immersed in the specifics and details of the data to uncover patterns) and holistic (the whole phenomenon under study is understood to be a complex system that is greater than the sum of its parts). Furthermore, a qualitative enquiry requires the collection of detailed descriptions and direct quotations, personal contact is required (the researcher must get close to the people, situation or phenomenon for data collection), each individual is assumed to be unique, systems are dynamic (change is constant and ongoing, whether the focus is an individual, system or entire culture) and findings are placed in context. Complete objectivity is assumed to be impossible, although complete subjectivity undermines credibility and the researcher should be empathetic but neutral. Finally, the research design is flexible and open to adaptation as the enquiry progresses.

Recent years have seen increased interest in qualitative data collection methods in library and information science research. Human interaction is a central consideration in the development of any information system or service and therefore qualitative techniques can be used to understand 'what users encounter as they move through the complex, multidimensional and dynamic experience of information seeking' (Westbrook 1994, p.252). For example, Grover and Glazier (1985) describe the application of qualitative methods in an investigation of the information needs of city managers. Prior to the study, little was known about the research area. However, through detailed data collection and analysis, the researchers achieved an understanding of the area and could identify roles and patterns in information transfer: 'The research methodologies provided the researchers with a much clearer understanding of an occupational group about which they had known very little' (Grover and Glazier 1985, p.255). The methods allowed exploration of 'the characteristics of groups and their patterns of information transfer so that effective information delivery and retrieval services can be designed and implemented' (Grover and Glazier, 1985, p.249). Furthermore, qualitative methods are increasingly being used to investigate human behaviour in information retrieval research (Fidel, 1993).
Despite the seemingly obvious advantages of qualitative methods to social science research, the validity and reliability of the techniques used and the results produced have been strongly criticised (see for example, Oldman, 1981). Due to the intensity of the methods, qualitative techniques tend to rely upon smaller samples and result in predominantly descriptive data. While this produces 'a wealth of detailed information about a much smaller number of people and cases', the potential for generalisability is reduced (Patton 1990, p.14). The validity and accuracy of quantitative results are assessed on the basis of standardisation and pre-testing of methods, the number of cases studied and the comparability and generalisability of results and therefore, qualitative techniques are criticised because results are not representative or comparable (Oldman, 1981).

Qualitative research is also criticised because of the involvement of the researcher with the researched. Oldman (1981) identifies three objections to this involvement. Firstly, the environment under study may be contaminated because participants will not act naturally if they know they are being observed. Secondly, there is a risk of bias due to the central reliance upon human input. Lastly, the act of being involved requires the establishment of a close relationship which may result in non-impartial reporting.

Quantitative research methods are considered more 'scientific' because, among other reasons, the researcher is detached from the objects of study.

A range of techniques and procedures have been proposed to ensure the validity of qualitative research. While a quantitative study is concerned with representative sampling, standardisation and repetition of methods, and the appropriate statistical analysis of results, in a qualitative study, the validity and subsequent success of the research is dependent upon the competence of the researcher:

Systematic and rigorous observation requires far more than just being present and looking around. Skilful interviewing requires far more than just asking questions. Content analysis requires considerably more than just reading what's there (Patton 1990, p.11).

Other suggestions include an assessment of the coding reliability of content analysis, the use of different data collection techniques to observe the same phenomena or seeking the opinion of subject experts (Fidel, 1994).
Furthermore, critics suggest that in any research project involving human beings, objectivity, validity and bias may be problematic. Slater (1990) proposes that all research has qualitative and subjective elements. For example, in the physical sciences, the researcher must decide what to research and human judgement will therefore affect the results. In the life sciences,

... the fact that the objects of study are human beings introduces some uncontrollable and qualitative elements. Some people get nervous about having their blood pressure taken. So it goes up. Others remain unperturbed (Slater 1990, p.107).

Brenner (1981, p.142) therefore argues:

The rejection of one research strategy and its replacement by another does not, of itself, solve problems of invalidity and bias in data collection, and indeed may even create new problems. The quantitative vs. qualitative methodology debate is somewhat mistaken, not only because any method will lead to bias, but in particular as it is clearly the abuse of traditional methods, not their character as forms of data collection per se, which has discredited the employment of these methods' (Brenner 1981, p.150).

Quantitative and qualitative techniques both have their strengths and weaknesses for library and information science research. The use of quantitative techniques in the Cranfield and Aberystwyth information retrieval studies were, in many ways, appropriate to those projects. However, as Beal (1979) suggests the application of quantitative techniques may be inappropriate for the study of information needs because it leads to little more than a categorisation of information types. Therefore, ‘most research methodologies are not intrinsically good or bad but can be assessed only in relation to the research questions for which they are employed’ (Grover and Glazier 1985, p.250). Patton ‘rejects methodological orthodoxy in favour of methodological appropriateness as the primary criterion for judging methodological quality’ (Patton 1990, p.39). Likewise, Slater (1990, p.110) argues:

If you want to measure how often something happens, and describe its occurrence in very strictly controlled terms, then the quantitative approach will suit your project. If, on the other hand, you are interested in the detailed structure and nature of what is happening, and above all in why, then qualitative research will give a richer answer, more informative material and more insight.
Furthermore, individual techniques may be used to construct either qualitative or quantitative data but it is possible that, in a single research project, both qualitative and quantitative data collection techniques will be used. Using qualitative data collection techniques, Cooper (1992) investigated information management trends in higher education. The qualitative data provided a detailed picture of the research area allowing the development of information management models. Using quantitative techniques, the models could then be validated using a much larger population. The author concludes, 'a loosely organised but deliberate approach to fact finding is a necessary and legitimate exercise in cases where little or no information about the subject is available', which can then be validated using quantitative measures (Cooper 1992, p.19).

### 3.2.3 Grounded theory

Traditional, quantitative approaches to social science research are generally concerned with theory testing and validation. As suggested, this requires a preconceived thesis and evidence which either confirms or refutes that thesis. It is therefore essential that the researcher has prior knowledge of the area and understands the nature of the problem in order to formulate and test a hypothesis. A qualitative approach lends itself to the development of a theory during the research process:

> Instead of beginning with a hypothesis that must be proven either true or false, casting a broad net for data allows the theory to emerge over the process of data collection (Weingand 1993, p.20).

The resulting theory is therefore an end-product of the research process rather than a starting point.

'Grounded theory', first introduced by Glaser and Strauss (1968), is a research strategy which is concerned with 'the discovery of theory from data systematically obtained from social research':

> Generating a theory from data means that most hypothesis and concepts not only come from the data, but are systematically worked out in relation to the data during the course of the research (Glaser and Strauss 1968, p.6).
Grounded theory begins with the implementation of a number of data collection techniques. Glaser and Strauss do not dictate the data collection techniques to be used, nor do they advocate a qualitative or a quantitative approach per se. However, they do suggest a qualitative approach is more applicable in theory generation and advocate the need for flexible data collection techniques which are open to adaptation in order to accommodate the unexpected during the research process. The data is simultaneously collected and analysed in an ongoing and cyclical process to identify recurrent themes and topics, or categories and properties of the data. When categories and properties are identifiable, the theory begins to emerge. Data triangulation techniques and comparison of different cases are used to verify the integrity of the data and expand the theory. Different types of data provide different perspectives from which to understand phenomena and constant comparison between multiple groups adds depth and confirms the theory. The researcher does not aim to provide a ‘perfect description’ of an area, but rather ‘develop a theory which accounts for much of the relevant behaviour’ (Glaser and Strauss 1968, p.30). The theory is not a ‘perfected product’ but ‘an ever-developing entity’ (p.32).

Grounded theory is principally concerned with ensuring the relevance and practical application of the resulting theory. According to Glaser and Strauss (1968, p.237), any theory should exhibit four properties:

... the theory must closely fit the substantive area in which it will be used,
... it must be readily understandable by laymen concerned with this area,
... it must be sufficiently general to be applicable to a multitude of diverse daily situations, and
... it must allow the user partial control over the structure and process of daily situations as they change through time.

By grounding the theory in the data, the theory should not embody the ideals and values of the researcher or popular views and myths. The data will not be forced into artificial categories or be distorted but will fit its supposed uses and be fully understandable by its supposed users. A theory ‘that has been carefully induced from diverse data’ will be ‘closely related to the daily realities’, it will be highly applicable and will be understandable by those working in the area (Glaser and Strauss 1968, p.239). The theory should be abstract enough to be ‘a general guide to multi-conditional, ever-changing daily situations’, be flexible enough ‘to make a wide variety of changing
situations understandable', and 'be readily formulated ... when it does not work in application' (Glaser and Strauss 1968, p.242).

Some commentators advocate the benefits of grounded theory to research in librarianship and information science because the approach attempts to ensure the development of a relevant, workable and understandable theory (see for example, Weingand, 1993, Davenport, 1993 and Mellon, 1986). Mellon (1986), for example, describes the application of grounded theory in investigating student attitudes towards the library. Diaries were kept by a number of students regarding library use which were analysed to identify recurrent themes of anxiety when faced with using the library. The technique provided understanding about why library users acted as they did, a grounded theory regarding library user anxiety was developed, and realistic and relevant methods of addressing the problems could be considered. Likewise, Davenport (1993) describes an investigation into the impact of new media on scholarly journal publishing. Scholarly communication is 'a complex social process' which 'requires an exploratory methodology' to take account of the different interest groups involved and their perceptions of the dynamics of the system (Davenport 1993, p.100). Davenport emphasises that the aim of the study was not to prove a hypothesis but to explore and identify areas of concern and to gain insight into the system under study. The resulting data, 'may assist planners to make recommendations about the aesthetic and functional base of a network which scholars may find congenial' (Davenport 1993, p.100).

3.2.4 A user-centred approach

In conjunction with the shift from a scientific to a naturalistic approach, and from using quantitative to qualitative methods in social science research, there has been a shift from 'systems-oriented' to 'user-oriented' approaches in information systems and services development. For example, with the widespread availability of computing technology, developers began to consider different approaches to the design and development of systems. Early approaches focused upon technological requirements but there has been increasing recognition that 'the failure of information systems is rarely due to technological failure', and that it is 'more likely to be caused by human and organisational problems' (Avison and Fitzgerald 1995, p.6):
Human activity systems are less predictable because human beings may not follow instructions in the way a piece of software does, nor interpret instructions in the same way as other people do or in the same way that they themselves might have done on previous occasions (Avison and Fitzgerald 1995, p.40).

Early approaches to systems development, such as *Structured Systems Analysis and Design Methodology* (SSADM), have been described as 'hard' and have focused upon breaking systems down into isolated variables and identifying technological requirements. Later methodologies, such as *Soft Systems Methodology* (SSM), are more interested in the needs of system users. SSM assumes that the properties of a whole will not be entirely explicable in terms of the properties of the constituent parts, and that problems may not be easy to define, but may be 'soft and ill-structured' (Checkland 1981, p.15). Thus, 'hard' approaches have been shaped by scientific thinking, while 'softer' approaches have 'evolved as a reaction to the reductionism of science and its perceived inability to cope with living systems' (Avison and Fitzgerald 1995, pp.447-448).

Much research in library and information science has also traditionally examined system or service performance from the perspective of the system. Research has been concerned with the extent to which use is made of different kinds of systems and services, and respondents' awareness and satisfaction with existing systems and services. Critics suggest the study of such behaviour is insufficient to explain information needs: 'The idea of making inferences about the purpose of an act simply by observing is unreliable' (Krikelas 1983, p.7). Systems-oriented research is criticised for being constrained by a system definition of what users' needs are, is limited to examining behaviour primarily in terms of user interaction with systems and services and thus, 'the studies reify systems as they presently exist' (Dervin and Nilan 1986, p.12). A lack of user orientation is seen as an obstruction to more efficient and effective system and service development. For example, Breton (1981) suggests electronic databases are not used by engineers because their information needs have not been examined and the services which are available are not useful and therefore not used.

Consequently, there has been a call for 'user-centred' research which 'examines the system only as seen by the user' (Dervin and Nilan 1986, p.16). Such an approach 'implies that information-related phenomena are studied from the user's perspective and that system design and evaluation are centred on the user, not the system' (Fidel 1990, p.86).
User-centred research is concerned with the context of information seeking, rather than simply focusing upon the point of user-system interaction. The user is seen within a physical, social and economic environment, affected by the constraints of their particular role, the task in hand, the organisation within which they work, as well as their perceptions regarding available information. 'Human perception, cognition and structures of knowledge' (Wilson 1984, p.197) are recognised as having an impact upon information seeking behaviour and different information users are understood to possess different cognitive structures which result in different approaches to information seeking:

The aim of a cognitive approach to information-seeking behaviour and information use, ... is to discover how the images and frames of reference of people ... relate to the availability of information, how the choice of information is determined by the image, and how information may change this image, or otherwise affect a frame of reference (Wilson 1984, p.200).

Users are seen as individuals with different needs, perceptions, attitudes and environments. Rather than attempting to make generalisations or predictions regarding behaviour, 'the new theoretical stance ... casts doubt upon the possibility of making statements about users which have any claim to go beyond the individual' (James 1983, p.20). Results are analysed to identify common dimensions which 'provide one with the ability to design information products and services that conform to the attitudes and perceptions of the intended users' (Mick, Lindsey and Callahan 1981, p.351).

There has been an interest in user-centred theories of information seeking behaviour since the early 1980s. In particular, three approaches for investigating and analysing behaviour have been developed: the Anomalous States of Knowledge model for defining an information need (Belkin, Oddy and Brooks, 1982), the Value-Added Approach to information systems design (Taylor, 1986), and the sense-making perspective of information seeking behaviour (Dervin, 1983).

Belkin, Oddy and Brooks (1982) were concerned with the effectiveness of information retrieval systems. They criticise many existing systems because 'the best possible system response [to a request for information] will be the text whose representation most closely matches it' (Belkin, et al. 1982, p.63). Such an approach assumes that users can specify their information need precisely and that their expression of a need for
information will match the representation of documents in the information retrieval system. A theory of ‘Anomalous States of Knowledge’ (ASK) is proposed:

The ASK hypothesis is that an information need arises from a recognised anomaly in the user’s state of knowledge concerning some topic or situation and that, in general, the user is unable to specify precisely what is needed to resolve that anomaly. Thus, for the purposes of [information retrieval], it is more suitable for the user to attempt to describe that ASK, than to ask the user to specify his/her need as a request to the system (Belkin, et al. 1982, p.62).

Thus, Belkin, et al. (1982) are concerned with the design of an information retrieval system which allows the user to represent their problem in terms appropriate to them, rather than appropriate to the system or the documents described in the system. The authors investigated the development of an open-ended interview technique whereby users could describe the problem area which led them to look for information. Statistical word occurrence techniques were then used as a basis for information retrieval.

The Value-Added Approach is concerned with the design of value-added information systems. Taylor (1986) distinguishes between a technology-driven approach to information system design focusing upon system constraints, a content-driven model based upon traditional classifications of knowledge, and a user-centred approach which focuses upon the user and the user’s ‘information use environment’. Taylor (1986, p.4) suggests technology and content driven approaches are ‘no longer enough in this information rich world’ because they fail to understand ‘the contexts from which the need for information arises’ (p.24). The Value-Added Approach is based upon a number of assumptions: that ‘information transfer is an intensely human process’; that ‘the human frame of reference must inform and structure information system design’; and that ‘value is not something intrinsic’ but ‘an information message is given value by someone who “uses” it’ (Taylor 1986, pp.1-5). An information system adds value through the repackaging and processing of information, and therefore, in order to add value, its design must be influenced by those using the system.

The information use environment is defined as:

Those elements that (a) affect the flow and use of information messages ... and (b) that determine the criteria by which the value of information messages will be judged in those contexts (Taylor 1986, p.24).
The approach is concerned with identifying and categorising different types of problems and linking them to different information traits. It assumes that users are more likely to value different types of information when faced with a particular class of problem. Taylor proposes a variety of situation-based problem dimensions (for example, structured/un-structured, complex/simple), which may be set in a context that establishes the user's criteria for judging the relevance of information. The information sought may have various traits or characteristics (hard/soft, quantitative/qualitative) which match the user's criteria.

Sense Making is primarily concerned with understanding and studying information seeking behaviour. An information need is understood to arise because an 'individual's internal sense has “run out”' and 'the person must create new sense' (Dervin and Nilan 1986, p.21). An information need is therefore conceptualised as a 'gap' in an individual's 'sense', and information is sought because an individual can go no further in their situation due to the gap in their 'sense' (Dervin, 1983). A three part model has been developed comprising:

- **SITUATIONS**: the time-space contexts at which sense is constructed,
- **GAPS**: the gaps seen as needing bridging, translated in most studies as "information needs" or the questions people have, as they construct sense and move through time-space, and
- **USES**: the uses to which individuals put newly created sense, translated in most studies as helps and hurts (Dervin 1983, p.9).

Dervin (1992, p.63) advocates 'that sense [is] created at a specific moment in time-space by one or more humans' and satisfaction with an information system or source can therefore only be judged by 'an individual at a particular time and in a particular place'. However:

Sense-making assumes that there is something systematic about individual behaviour when the individual is reconceptualised not as an entity but as an entity behaving at a moment in time-space (Dervin 1992, p.66).

Each of the three dimensions in the sense-making model represents a set of variables and research to date has focused upon examining and identifying categories of these variables. For example, 'situations' have been divided into the different ways
individuals see their situations, 'gaps' have been categorised according to the nature of the questions people ask, and 'uses' according to the nature of information 'hurts' and 'helps' (Dervin, 1983). A variety of populations, situations and systems have been studied, including the information needs of Black, Asian and Hispanic individuals in an 'important recent troublesome situation', the questions donors had prior to giving blood, and the health information needs of south-east Asian refugees during a hospital or clinic visit (Dervin, 1992).

Various approaches for understanding and studying information seeking behaviour from a sense-making perspective have been developed (Dervin, 1983). A 'micro-moment time-line interview' involves asking a respondent to describe a situation by dividing it into individual 'time-line steps'. Each step is described in terms of how the respondent saw the situation, the 'gap' they faced and the help they felt they required. 'Helps/Hurt Chaining' involves asking respondents how each successive 'help' or 'hurt' related to a different 'help' or 'hurt' in order to examine how respondents see information as facilitating or hindering them. In order to assess an information source, 'Message Q/ing' is used to 'tap sense-making during printed message reading' by asking respondents to read a document and stop reading each time they have a question.

Thus, user-centred research generally, and the three approaches considered in particular, are concerned with exploring systems and services from the perspective of the user. The user is viewed as an individual working in an environment, with attitudes and perceptions regarding the systems and services used. The user is 'actively constructing rather than passively processing information' (Dervin and Nilan 1986, p.24). User-centred research recognises that objectivity is not possible in the use of an information system. However, it is possible to explore 'systematic fundamental underlying dimensions to what formerly was considered chaotic individuality' (Dervin and Nilan 1986, pp.23-4).

3.2.5 Theoretical framework and methodological choices

The above section has briefly outlined some of the developments in research within the social sciences generally, and in librarianship and information science in particular, in order to provide a context for the methods adopted in this study. To summarise, there
has been a shift in social science research from using quantitative methods which are generally associated with a positivistic paradigm and theory testing and validation, to qualitative methods which attempt to explore and understand the human experience. This is set against a backdrop of the increasing acceptance of grounded theory as a strategy which focuses on theory development as an end-product of research, rather than assuming the aim of theory testing and validation. Alongside this has been the shift from a systems-orientation to a user-orientation in the design, development and evaluation of information systems and services. The three trends are inter-related and represent a general paradigm shift from scientific methods which attempt to explain, validate and predict, to more recent 'social' science methods which seek to understand human behaviour.

Before considering the influence of these trends on the study, it seems useful to recap the findings of the literature review. Chapter 2 firstly considers definitions of information quality. It then examines the range of procedures and techniques which are currently available for assessing information quality and their applicability to LIS professionals when filtering resources which have been retrieved via the Internet. Information quality is understood to refer to the ability of an information source to satisfy stated or implied needs, and it is acknowledged that there are identifiable characteristics of a source which affect its ability to meet those needs, making it of more or less quality within a particular context or situation. Conclusions are that LIS professionals have a key role to play in filtering information but quality assessment is a subjective process and the problems associated with subjectivity are compounded because LIS professionals are generally selecting and evaluating sources on behalf of a third party. Evaluation criteria can be used as a guide to the different characteristics which affect the quality of an information source and are therefore considered the most appropriate technique for assisting LIS professionals when selecting and evaluating materials which have been retrieved via the Internet. However, there are inherent difficulties associated with existing evaluation criteria. These include a notable lack of research into their development and a lack of evidence to suggest that existing criteria are applicable to information currently being disseminated via the Internet. Moreover, Internet-based sources encompass a wide range of formats while existing criteria have tended to focus on WWW-based materials. In addition, differences between existing criteria suggest discrepancies between those used by LIS professionals and those used
by other groups to assess the quality of sources available via the Internet. This therefore suggests the need for research into the development of evaluation criteria.

The relevance of Schamber's (1991a) study was highlighted in the review. Schamber adopted an open-ended interview technique to discuss users' information seeking and information use experiences, and analysed their comments to identify evaluation criteria. It is proposed that adopting a similar technique would enable an examination of users' perceptions about the quality of the information available via the Internet, thereby enabling the development of criteria which could be used by information professionals in filtering resources. The above discussion now provides a methodological basis for examining user behaviour to identify evaluation criteria. It could be argued that existing criteria are a 'systems-perspective' of source quality because they have been defined in relation to sources. Alternatively, Schamber (1991a) adopted a user-centred perspective by examining users' attitudes and opinions towards information. Discrepancies between existing criteria suggest the need for research into the development of evaluation criteria which account for the behaviour, attitudes and perceptions of individual users towards the information available via the Internet. This should therefore ensure the value and applicability of the results to those users.

Three user-centred approaches to research have been discussed: the Anomalous States of Knowledge model, the Value-Added approach, and the sense-making perspective of information seeking. The ASK model is not relevant here because it relates to how individuals define their information need and the development of appropriate systems, and the Value-Added approach is not relevant because it is also relates to the design of information systems, neither of which are the focus of this study. However, sense-making is concerned with examining and understanding information seeking behaviour. Schamber (1991a) adopted a sense-making approach and used Dervin's (1983) micro-moment time-line interview to examine users' perspectives of the information sources they used. However, there are drawbacks to using the complete micro-moment time-line interview technique which renders it inappropriate for this study. The drawbacks primarily relate to the time required to conduct the interviews which was considered too demanding for the chosen population (this is discussed further under 'information seeking and use interviews').
The study as a whole was therefore influenced by the need to adopt a user-centred perspective of the quality of the information available via the Internet, but the individual methods recommended by commentators in this area were generally not considered relevant. The next issue therefore relates to the methods required to study users’ behaviour. As mentioned in the discussion about qualitative and quantitative research methods, Grover and Glazier (1985, p.250) state: ‘Most research methods are not intrinsically good or bad, but can be assessed only in relation to the research questions for which they are being employed’. Various issues and questions are listed in Chapter 1 which were raised with regard to the overall aim of the research. It is now possible to refine these questions slightly in the light of the results of the literature review (placing the emphasis on the development of evaluation criteria), and to assess how they are best addressed in the remainder of the study.

The questions, ‘what is information quality?’ and ‘what is the most appropriate method or technique for assessing the quality of Internet-based information sources for use by LIS professionals?’ are addressed in the literature review. The second group of questions includes, ‘how do users of the Internet assess the quality of the information sources they access and use?’. By answering this question, it will be possible to address:

- is information quality an issue to Internet users?
- is it possible to identify criteria from users’ assessments of the sources they access and use for assessing the quality of information sources available via the Internet?
- is it possible to identify criteria from users’ assessments which apply across a range of different types of information sources available via the Internet?
- can user assessments be interpreted in order to develop a tool or technique for use by LIS professionals in assessing the quality of Internet-based information sources?

The final question, ‘if a tool or technique were developed, would it provide an effective filter for selecting and evaluating information available via the Internet?’ can only be considered once the above questions have been answered.

The central question of the next stage of the research is therefore, ‘how do users of the Internet assess the quality of the information sources they access and use?’. As mentioned earlier, Slater (1990, p.110) draws a distinction between ‘how often’ questions, which are best answered by quantitative methods, and ‘the detailed structure
and nature of what is happening, and above all ... why’, which is best answered using a qualitative approach. Similarly, Maxwell (1996, pp.59-60) recommends a number of research questions where qualitative methods are appropriate, including theoretical questions which relate to ‘why ... things have happened and how they can be explained’. These quotations highlight the relevance of qualitative methods to the central question of the next stage of this study. A quantitative study could reveal how often people use the Internet or how often they use particular types of sources, but a qualitative study will reveal ‘the nature of what is happening’ and ‘how’ things ‘can be explained’, or ‘how users of the Internet assess the quality of the information sources they access and use’. Furthermore, Patton (1990, pp.94-95) defines areas where qualitative methods are particularly suitable, including ‘process studies’ which investigate ‘how something happens rather than on the outcomes or the results obtained’. This further accentuates the need for a qualitative approach.

Qualitative methods are also relevant where little is known about an area because they facilitate exploration and enable the researcher to seek understanding about the area concerned. Quantitative methods attempt to explain phenomena in statistical terms and therefore:

... require the use of standardised measures so that the varying perspectives and experiences of people can be fitted into a limited number of predetermined response categories to which numbers are assigned (Patton 1990, p.14).

Knowledge and understanding about an area is required in order to define predetermined response categories. When the research began, few studies had been conducted into the use made of the Internet or into how individuals selected and evaluated sources of information. Therefore, any pre-defined answer categories would be based upon assumptions made by the researcher about information seeking behaviour and use of the Internet which would invalidate and bias the research. The use of qualitative methods is therefore appropriate because the researcher can begin by exploring and seeking understanding of users’ information seeking behaviour and how they approach assessing the quality of Internet-based information sources ‘without predetermining those points of view through prior selection of questionnaire categories’ (Patton 1990, p.24).
There are three main approaches to qualitative data collection: open-ended interviews, observation and documentary analysis. An open-ended interview technique was considered appropriate here because it would enable Internet users to discuss their attitudes and opinions about the information available via the Internet. While documentary analysis was not relevant, it was recognised that any interview data could be complemented by data from observing users while they searched the Internet. However, there are drawbacks to conducting observations, notably the time required and the expense. Resources were not available to video respondents at their convenience (which would have been intrusive), and again, it was felt unlikely that the identified sample would be willing or able to devote additional time while the researcher observed them and then interviewed them about their use of the Internet. Moreover, computing equipment was not available at the time of the research to record users’ activities in a less intrusive manner. The interview technique as well as sampling issues are discussed in section 3.3.2.

Thus, the above explains the need for a qualitative approach and justifies the use of an open-ended interview technique for studying the attitudes of Internet users towards the information available via the Internet in order to develop evaluation criteria. The third decision relates to the overall strategy adopted for the research. As discussed earlier, research in the social sciences has traditionally been concerned with theory testing and validation. One approach to this research could be the implementation and testing of existing criteria. The study would begin with the theory that existing criteria are appropriate for the evaluation of Internet-based information sources and would seek to prove or refute that theory. However, such an approach assumes that existing criteria are, to a certain extent at least, already applicable to resources available via the Internet; the limitations of existing criteria have been discussed already and the literature review highlights the lack of studies about use of the Internet or how individuals select and evaluate sources of information. As Hammersley (1981, p.210) argues:

"Unless theory is developed in the context of data collection it is unlikely to be worth testing, being premised on a priori assumptions whose validity is unknown."

Furthermore:
If we rely on our existing knowledge in our research we may, unwittingly, take over from our cultural experience stereotypes of others and stock understandings of their activities which bear little relation to reality.

An alternative approach would be an examination of the information seeking and information use behaviour of Internet users in order to generate a theory regarding how assessments of quality are made. This could then be used to develop guidelines or criteria for use by LIS professionals when selecting and evaluating information sources. Following theory development, the criteria could then be tested in order to validate or refute them as a means of assessing source quality. Consequently, based upon the findings of the literature review, it would seem that theory development is the more valid strategy.

As discussed earlier, grounded theory is a research strategy where the ultimate aim is theory development. The 'major difference' between grounded theory and 'other approaches to qualitative research is its emphasis upon theory development', not theory testing and validation (Strauss and Corbin 1998, p.160). Grounded theory underpins the validity of qualitative methods generally which up until the 1950s had been considered 'a less than rigorous methodology and an unintegrated presentation of theory' (Glaser and Strauss 1968, p.vii). Indeed, Glaser and Strauss's work (1968), and the later work by Strauss and Corbin (1990), have become almost the standard textbooks for researchers interested in theory development. The earlier comments suggest the need for theory development in this study, rather than theory testing and validation, and grounded theory as a research strategy is of obvious relevance.

As mentioned, Glaser and Strauss (1968) do not dictate the data collection methods per se. However, qualitative methods are recommended in theory generation because the techniques are flexible and open to adaptation during the research. Glaser and Strauss (1968) also recommend a broad approach to enable the collection of a wide variety of data which is likely to be of relevance to the theory. They advocate simultaneous data collection and analysis, data triangulation and constant comparison with the original data during analysis to develop a theory, as well as the use of theoretical sampling techniques to fill any possible gaps in the theory. Moreover, once a theory has been developed, they suggest it can then be implemented and tested using qualitative or quantitative methods. These approaches to developing a grounded theory were influential in the study design because they are specifically intended for the
development of a theory. The ways in which the individual techniques were adopted include aiming for maximum variety in identification of the initial sample, use of an open-ended interview technique to explore general perceptions about the quality of the information available via the Internet, and analysis of the first interviews prior to any further data collection. Triangulation and theoretical sampling were also used in the later stages of the study.

As mentioned earlier, the approach proposed by Glaser and Strauss (1968) ultimately aims to ensure the relevance and practical application of the resulting theory. This is achieved through the methods used for analysis in particular. Inductive analysis techniques are used which aim to ensure that any concepts arise from the data itself, rather than the researcher imposing any pre-existing expectations on the data. In this study, one strategy might be to analyse the data using criteria drawn from the literature as the units of analysis. However, a grounded theory approach is to examine the data to identify the themes which arise from it, thereby allowing the categories of analysis (the evaluation criteria) to emerge from the data. Coffey and Atkinson (1996, p.32) distinguish between 'pre-selected codes taken from our reading' and 'starting with the local categories of the actors or informants themselves'. The advantage of the latter approach is that the theory is 'induced' from the data, it is grounded in the data, thereby ensuring its accuracy, validity and applicability (Glaser and Strauss 1968, p.239).

Concerns expressed in the literature review included that existing criteria were not applicable to information available via the Internet, and inconsistencies between different criteria suggest the possible irrelevance of those used by LIS professionals. Therefore, a grounded theory approach to data analysis, and in particular, to the development of criteria, is important because it should prevent a bias towards existing criteria. Moreover, such an approach should ensure the accuracy and validity of the resulting criteria, as well as their applicability to Internet users. The different ways in which grounded theory influenced the research design are discussed further at relevant stages in section 3.3.

The methodology used in this study was therefore influenced by three trends in LIS research: the shift from a systems-orientation to a user-orientation in the design, development and evaluation of information systems; the use of qualitative methods to understand and explore human behaviour; and the use of grounded theory as a research strategy concerned with theory development not theory testing and validation. The study
was driven by the need to examine users' attitudes and opinions towards the information available via the Internet. The central research questions, and the lack of pre-existing research about the area, predetermined the need for a qualitative approach to data collection and analysis. Lastly, limitations of existing criteria necessitated a strategy of theory development in the overall design of the study, and grounded theory is of relevance because the techniques aim to ensure the accuracy, validity and applicability of the resulting theory. The remainder of this chapter describes and justifies the individual methods which were used at different stages of the study for data collection and analysis.

3.3 The research design

The research began with a literature review which shaped the direction of the study. Interviews were conducted in order to examine the information seeking and information use behaviour of Internet users, to examine how assessments of quality were made and to determine the criteria used when assessing source quality. A second stage of interviewing was conducted to develop and validate the findings of the first interviews, and the criteria were distributed for review by LIS professionals. In addition, questionnaires were distributed prior to each stage of interviewing. This section describes and justifies the different methods used in each stage of data collection and analysis.

3.3.1 Literature review

The research began with a literature review. The overall aim of the review was to examine the range of techniques and procedures available for assessing the quality of information, and to determine their applicability to information available via the Internet and for use by information professionals. In addition, definitions of 'information quality' were analysed to establish terms of reference for the study.

Due to the changing nature of the topic and the volume of work being conducted within the area, the literature review was ongoing throughout the course of the research. However, two main periods of literature searching and analysis were undertaken. The
first review was conducted when the research commenced and was completed in September 1995. As mentioned in the introductory chapter, there were very few materials relating to quality assessment of Internet-based information sources when the review was first conducted. The initial review therefore focused upon definitions of information quality, and procedures and techniques for assessing the quality of paper-based and traditional electronic information sources. The second review was conducted towards the end of the research and was completed in November 1997. The review aimed to update the areas initially covered, but the main focus was on material produced during the course of the research relating to information quality assessment of materials available via the Internet. Definitions of information quality were revisited, particularly where they were concerned with information which could be accessed via the Internet.

The discussion of techniques relating to the quality assessment of information sources proved to be an enormous area of interest within the LIS literature, as well as in other disciplines, such as communication studies and computer science. Likewise, terms such as 'information' and 'quality' have generated much debate, not only in librarianship, but also in other fields such as computer science and management studies. Therefore the literature review (Chapter 2) is not comprehensive in its coverage, but aims to outline the significant arguments relating to the various aspects of information quality assessment which were considered relevant to this study.

3.3.2 Information seeking and use interviews

The first stage of data collection was designed to explore the information seeking and information use behaviour of a group of Internet users. In particular, the interviews were designed to examine how users assessed the quality of sources of information they accessed and used via the Internet, and to elicit the criteria used when assessing the quality of those sources.

i. User group

Increasingly widespread and often unrestricted access to the Internet meant that when the study commenced, its users were diverse, but the rapidity of take-up also meant that their characteristics and information needs were largely unknown. However, although it
was not within the original aims of the research, a specific group of users was required to explore use of the Internet in order to ensure a focused study. Moreover, in order to serve the purpose of the interviews, a specified group of knowledgeable Internet users was required to discuss their perceptions of the quality of Internet-based information sources. In the selection of a user group, three initial requirements were therefore identified. Firstly, there needed to be evidence that individuals within the group used the Internet. Secondly, there needed to be a wide variety of sources which were available via the Internet and of potential relevance to the group concerned. Thirdly, the quality of the information needed to be of interest to individuals within the group.

Users of health and medical information were considered because of the implicit need for high quality, accurate and reliable information within these disciplines. It was anticipated that those involved in health and medicine would be heavy users of information generally and therefore familiar with a variety of information sources available in a range of formats. In addition, it was anticipated that users of health and medical information would be highly critical of the sources they accessed and used because the ability to think critically about information has become an increasingly important component of medical and health care training, especially with moves towards evidence-based practice. It was therefore anticipated that Internet users within this group would have developed ideas about the quality of the information available via the Internet, how they approached assessing its quality, and how the information available via the Internet compared to information in other formats, such as journal articles.

Within the areas of health and medicine, there was a wide range of groups who might have been selected for the study population. Examples include doctors in hospitals and practices, nurses and midwives, health visitors, students, educators, researchers, health managers, and those working in the range of professions allied to health care. However, at the time of the inception of the research, few employees within the NHS had access to the Internet, with the exception of those working in an academic environment with widespread access via Janet. Users in an academic environment were therefore selected. Furthermore, this group was readily identifiable and conveniently sited within institutions, which was pertinent to a research study with limited time and resources.
Furthermore, the researcher had access to a sample of Internet users within this group, as well as insight into the volume of potentially relevant sources and indications of levels of usage. During the course of the project, the researcher became involved in Organising Medical Networked Information (OMNI), a project funded under the 'Access to Networked Resources' area of eLib. The aim of OMNI was to develop a gateway service, available via the WWW, to selected and evaluated networked sources within health care and biomedicine of interest to the UK higher education and research community. Members of the project board were interested in approaches to selecting and evaluating Internet-based information sources and the researcher was therefore invited to join the OMNI Advisory Group for Evaluation Criteria. The Advisory Group aimed to ensure all aspects of current thinking were considered in the development of the OMNI guidelines for resource evaluation (1997). Librarians from seven medical establishments were initially involved in the development of OMNI. The librarians at the different sites expressed an interest in the research and were willing to host fieldwork, act as a point of contact within the sites, and offer insight into levels of use of the Internet by library users for work-related information seeking.

ii. Sample selection

The aim of sampling in a quantitative study is to ensure the interview or questionnaire respondents are representative of the wider population under study. Therefore, random and probabilistic sampling techniques are used to enable generalisation of the results to the wider population. In a qualitative study, fewer cases are studied in more detail, and cases are purposefully selected to provide 'information rich' examples which will 'illuminate the questions under study' (Patton 1990, p.169). Purposeful sampling strategies include sampling on the basis of extreme examples to examine cases which are unusual in some way, stratified purposeful sampling which seeks to examine different categories of cases according to specified criteria, and maximum variation sampling which seeks to examine the widest range of cases as possible.

The lack of previous research into information seeking behaviour and the Internet meant that it was not possible to identify users according to categories of behaviour. Therefore, a maximum variation sample was sought to enable data collection from as wide a variety of Internet users within the specified population as possible. Strauss and Corbin (1990, p.181) describe this as 'open-sampling' in the development of a grounded theory.
The researcher cannot assume which respondents will provide relevant data and therefore 'the aim of sampling is to uncover as many potentially relevant categories as possible' and to examine 'those persons, places and situations that will provide the greatest opportunity to gather the most relevant data about the phenomenon under investigation'. Variation was measured according to levels of use of the Internet and the subject areas people were working within. By drawing such a sample, it was hoped that the interviewees would be able to account for as much as possible of the user groups' information seeking behaviour.

In quantitative studies, the size of a sample is pre-determined by the desired statistical significance of the results. However, there are no guidelines regarding sample size in qualitative studies. Instead, the ideal is to sample 'to the point of redundancy', or until no new information is found (Patton 1990, p.186). Patton recognises the inherent difficulties in achieving redundancy due to a lack of time and resources in any research study, and therefore recommends 'judgement and negotiation' in selecting a minimum sample 'based on expected reasonable coverage of the phenomenon given the purpose of the study' (p.86). Schamber (1991a) interviewed 30 individuals regarding their information seeking behaviour in order to identify evaluation criteria. Thirty-two categories of criteria were identified; the first interviewee mentioned twenty of these, redundancy of 30 categories was reached by the seventh person, and the final two categories were mentioned by the tenth and eighteenth interviewees:

This is consistent with the findings of previous studies that a range of cognitive perceptions can be covered by interviewing fewer than ten individuals ... The sample of thirty respondents served to increase the probability that a full range of criteria would be, and was described (Schamber 1991a, p.69).

The same number of interviewees were therefore sought for the first phase of data collection, with a view to conducting further interviews if necessary.

In order to ensure variation in the interviewee respondents, three sites were selected for data collection which would offer access to a range of individuals with different subject interests and levels of use of the Internet. The sites were two medical schools, the Queen’s Medical Centre at Nottingham University (QMC) and the Royal Free Hospital School of Medicine (RFHSM), and a Medical Research Council site, the National Institute for Medical Research (NIMR). Within the three sites, individual respondents .
were identified using a questionnaire as a cost-effective means of contacting a wide range of potential interviewees (Appendix A1). Questionnaire respondents were requested to identify the Internet tools or facilities they used and how regularly they accessed them, together with their department and job title in order to indicate their field of interest. In addition, respondents were requested to indicate whether they could participate in an interview. A contact letter introducing the research was distributed with the questionnaire which mentioned the OMNI project in order to justify distribution within the sites to the respondents.

At the request of the site contacts, individual approaches were required for the distribution of the contact letters and questionnaires. At QMC, the material was individually addressed and sent to 450 people identified using a staff directory as the sampling frame. At RFHSM, an introduction to the research based upon the contact letter was included in a library newsletter on use of the Internet for medical information. The newsletter and questionnaire were distributed to 630 individuals. At NIMR, 200 letters and questionnaires were strategically placed within the library. Thirty-nine questionnaires were returned at QMC, seven at NIMR and 52 at RFHSM, an average of 8%. Twenty-three people agreed to an interview at QMC, six at NIMR and fifteen at RFHSM. A summary of the total questionnaires distributed, the response rates, and the number agreeing to an interview is provided in Table 1 (Appendix B).

The response rates were obviously affected by the different approaches used. The low response rate at RFHSM might be accounted for because the questionnaire was distributed without headed paper in a library newsletter, and may have been perceived as ‘another library questionnaire’, rather than an external research project to which more credence may have been given. It was anticipated there would be little response at NIMR because the letters were not individually addressed. In addition, a low response rate was anticipated at NIMR and QMC because respondents were only requested to return the questionnaire if they could participate in an interview. For clarity, respondents were also asked to tick a box if they could participate in an interview. However, Table 1 indicates a discrepancy at these two sites between the total number of questionnaires returned and the positive responses to participating in an interview. In retrospect, the request to tick a box indicating agreement to participate in an interview may have caused confusion and therefore, all respondents were requested to return the questionnaire whether or not they could participate in an interview at RFHSM.
Of those who agreed to an interview, only five at NIMR and six at RFHSM could participate in an interview during the selected week. The remaining interviewees were recommended by the site contacts as regular users of the Internet, and were independently approached by the site contact. At the QMC, 23 people could participate in an interview. From these, ten were selected with a minimum level of Internet use (daily or weekly use of e-mail and daily or weekly use of one other tool) and with varying subject interests and job titles.

The lack of sampling and the inconsistencies in the approaches used for identifying interviewees at the different sites did not affect the validity of the results because of the exploratory nature of the research. In addition, as described in Chapter 4, an examination of their use of the Internet and their research interests indicates that a wide variety of respondents were interviewed as intended. Furthermore, there was a strong element of self-selection, indicating an interest and enthusiasm in using the Internet for work-related information seeking. As mentioned earlier, in order to serve the purpose of the interviews, knowledgeable Internet users were required to discuss their perceptions of information quality. Interviewing those with no interest or enthusiasm would not have served the purpose of the interviews.

iii. The interview technique

Open-ended responses permit one to understand the world as seen by respondents. The purpose of gathering responses to open-ended questions is to enable the researcher to understand and capture the points of view of other people without predetermining those points of view (Patton 1990, p.24).

Open-ended interviews are the most direct method of eliciting data regarding personal opinions, thoughts, emotions and experiences. Thus, it was felt an interview technique would allow exploration of information seeking and information use behaviour, and in particular, data could be collected regarding attitudes and perceptions towards the information available via the Internet.

A range of qualitative interview techniques are available for collecting data regarding personal opinions and feelings. As mentioned earlier, Dervin (1983) describes an
interview technique specifically designed to examine information seeking behaviour. A ‘micro-moment time-line interview’ involves asking a respondent to describe a situation by dividing it into individual steps, and each step is described in terms of how the respondent saw the situation and the information required. Schamber (1991a) adapted the micro-moment time-line interview in order to elicit criteria used in the evaluation of multi-media information sources and felt the technique was effective in studying users’ perceptions.

Patton (1990) identifies three qualitative interviewing techniques: informal conversational interviews, the general interview guide approach and the standardised open-ended interview. Each technique differs in terms of the extent to which questions are predetermined. In an informal conversational interview, a set of questions arise during the course of a natural conversation. In the second category, the interviewer has a general guide which outlines the issues requiring exploration:

The interviewer remains free to build a conversation within a particular subject area, to word questions spontaneously, and to establish a conversational style, but with the focus on a particular subject area that has been predetermined (Patton 1990, p.283).

In a standardised interview, the interviewer is restricted by the wording of the questions and should aim for minimal variation in the use of probes.

Each of the various interview techniques offers advantages and disadvantages. For example, Schamber (1991a) felt the micro-moment time-line technique was naturalistic, facilitated recall by focusing respondents on their own experiences and enabled in-depth probing. However, the technique was labour and time-intensive, both for the interviewer and interviewees as each session lasted approximately 90 minutes. The informal conversational interview enables questions to emerge from an immediate context but the technique is not systematic and the researcher cannot guarantee the same issues will be covered with all interviewees. Alternatively, the standardised interview aims for minimum variation in the questions asked, but flexibility is reduced, therefore preventing exploration of any issues raised by the interviewee.

The interview guide was selected as the most suitable approach for the study. An interview guide could be developed to ensure coverage of a range of issues, but would
offer enough flexibility to ensure the interviewer was free to pursue issues or explain questions as required. In addition, the interviews were influenced by Dervin's sense-making approach in exploring the context of information seeking but the full micro-moment time-line technique was not adopted because it was felt potential interviewees within health and medicine would not be prepared to devote the time required.

iv. Interview guide

The purpose of an interview guide is 'to make sure that basically the same information is obtained from a number of people by covering the same material' (Patton 1990, p.283). Thus, a guide (Appendix A2) was developed to structure the interviews and ensure the same topics were covered in each interview.

Firstly, the guide focused upon respondent's general use of the Internet (questions 1.1-1.6). The questions examined which Internet tools and facilities were used and how often, the duration of Internet and e-mail use, and from where the Internet was accessed. The questions were factual and easy to answer, and were designed to initiate the session and relax the respondent. In addition, respondents were asked what they used the Internet for generally, including work-related and personal examples. Again, the question was designed to relax the respondent but also to encourage the respondent to begin talking in more detail.

Secondly, the guide examined a critical incident where the Internet had been used for work-related information (questions 1.8 to 1.16). The critical incident technique, described by Flanagan (1954), is often used to examine information seeking behaviour. For example, Andrews (1991) describes the use of a critical incident technique to examine the problems encountered by students when using a large academic library. Urquhart and Hepworth (1995) used the technique to examine examples where clinicians had used the library in order to determine the value and impact of information on clinical decision making. The technique focuses discussion on a real example and therefore facilitates recall of perceptions and feelings:

Once some experience or activity has been described, it is appropriate to ask about interpretations, opinions and feelings. Opinions and feelings are more likely to be accurate and meaningful once the respondent has just verbally relived the experience (Patton 1990, p.294).
The questions relating to the critical incident were also designed to examine the context of information seeking and it was anticipated that the resultant data would provide a valuable insight into why sources were evaluated as they were. Moreover, the questions were designed to encourage the respondent to think critically about their use of the Internet. Thus, respondents were asked to describe an example, the reason for information seeking, what they were hoping to find, how they approached looking for information, and whether they found the information they were looking for. In addition, respondents were asked whether the Internet was the first place they looked for information, whether they looked elsewhere, and why they used the Internet.

The third section of the schedule focused on approximately three sources accessed by respondents in relation to the critical incident of information seeking (questions 2.1 to 2.12). The questions examined:

- why the sources were approached,
- whether respondents found the information they were looking for in the sources,
- whether or not they felt the information was appropriate to them,
- whether the information had an impact upon their knowledge,
- whether it was easy or difficult to access, use or find the information,
- whether or not they used the information,
- any factors or characteristics of the sources which affected their use,
- whether or not they would rely upon the information contained in the sources,
- any factors or characteristics of the sources which affected whether or not they relied upon them, and
- what an ideal source of information would have been or how they might improve the sources they accessed and used.

The questions were designed to elicit an evaluation of the sources accessed and used by respondents by probing them on possible areas of evaluation. They were neutrally worded to avoid mentioning any possible evaluation criteria but were intended to invoke a discussion. Likewise, any probes were neutrally worded to avoid suggesting criteria, but were designed to trigger recall. For example, if a respondent mentioned the accuracy of a source, they were asked how they would assess accuracy.
The questions were drawn from a range of sources. Prior to commencing the research, Stoker and Cooke (1995) examined the criteria used for assessing printed reference works and discussed their applicability to networked resources. The proposed criteria could be divided into three categories: firstly, those affecting the reliability of a source (accuracy, authority, objectivity and genealogy); secondly, those affecting the appropriateness of a source to a user (purpose, coverage, currency and intended audience); and thirdly, those affecting the ease of accessing and using a source (format, arrangement, technical considerations, price and user support). Therefore, the interviewees were asked whether the sources were appropriate to them, whether they would rely on the sources, and whether it was easy or difficult to access, use or find information in order to see which criteria, if any, were mentioned.

Other questions were drawn from Urquhart and Hepworth (1995) and Schamber (1991a). In examining the value and impact of information on clinical decision making, Urquhart and Hepworth (1995) asked respondents to discuss the information they initially sought, whether they found what they were looking for, and the consequent impact of the information they found on their behaviour. These questions were modified by the researcher in order to examine respondents’ perceptions of the information they accessed and used. The question relating to source idealisation was used by Schamber (1991a) to encourage respondents to describe desirable qualities in a source of information, beyond the constraints of the systems they used or knew about, and was used for the same purpose in this study.

The fourth section of the interview explicitly probed respondents about their perceptions of information quality (questions 3.1 to 3.7). Respondents were asked what factors they felt affected the quality of an information source generally or how they would differentiate between a high quality source and a low quality source. They were also asked whether they felt the factors they had mentioned were applicable to all types of information, including printed sources and information available via the WWW, whether they felt the factors affected their use of information, and whether or not they relied on information. They were then asked whether aspects such as the author, originating institution, date, presentation and refereeing affected their use of printed information in the form of a journal article, WWW documents, and an e-mail from a discussion group or a Usenet Newsgroup.
The questions in the fourth section of the interview were neither simple nor straightforward to answer, and this was explicitly stated. Until this point, information quality per se had not been mentioned by the interviewer. The questions were intended to examine whether respondents had an opinion about the issues and whether they had formed judgements about the nature of the information available via the Internet in comparison to traditional sources of information.

Lastly, respondents were asked about their role and the work that they were involved in within the organisation in order to provide some background information on area of interest and the context of information seeking. Finally, they were asked for further comments or questions to elicit information on any considerations foremost in their minds following discussion of the issues raised by the interviewer.

v. Piloting of materials

The interview guide, questionnaire and contact letter were distributed for comment to academics involved in research related to the area within the Department of Information and Library Studies, University of Wales Aberystwyth (DILS), to other researchers working within the area of information quality and the Internet outside the Department, and to the OMNI Project Board. In total twelve people returned comments. In addition, eight pilot interviews were held at DILS. The interviewees were selected because of their interests in health information, use of the Internet or information quality generally.

As a result of the piloting process, a number of changes were made to the interview guide. The first section on general use of the Internet was moved from the end of the guide to the beginning during the piloting stage in order to provide a means of relaxing the interviewee and initiating discussion. In addition, the section dealing with information quality was substantially revised. Initially, respondents were asked some very broad questions which they found difficult to answer because they were too general. The broad questions were kept to determine any issues foremost in respondents' minds. In addition, the questions on different factors relating to journals, documents available via the WWW, and e-mails from discussion groups or Usenet Newsgroups were added. Refereed journal articles are widely recognised as a source of high quality information and are heavily used by academics working in health and medicine. Thus, it was felt they would offer a useful and meaningful point of comparison with the range of
information sources available via the Internet. The questions were revised until they were in a format which explored a wide range of issues relating to information quality. In addition, one reviewer recommended the question, 'How would you differentiate between a high quality and a low quality source?' which was added as a probe for the opening question.

The questionnaire was also revised. Initially a more detailed questionnaire was proposed which included questions regarding whether the Internet tools were used for work or recreational purposes, and from where the Internet was accessed. However, the need for simplicity in questionnaire design was emphasised by reviewers in order to ensure a maximum response rate. One respondent felt the categories of e-mail, Usenet News, WWW, FTP and Gopher were unacceptable and an approach based upon how sources were used would have been more appropriate. However, this would have meant making an assumption regarding respondents' use of information and was therefore rejected. The existing categories offered a simple means of differentiating between Internet uses and was therefore retained.

The problems associated with eliciting expert opinion rather than conducting a full pilot study of the data collection tools was recognised by the researcher. Thus, it was originally intended that a further two pilots would be held at QMC. However, this was not possible due to time constraints. Although this was disappointing, it was felt that the extensive piloting at DILS and the comments received from the various researchers were sufficient. In addition, the first two interviewees were subsequently asked to offer their comments on the schedule. Both felt they had understood the questions and had not encountered any difficulties with the schedule or the questions asked.

vi. Interviews

The pilot interviews were held during April 1996 at DILS. The first two sets of interviews were held on consecutive weeks during June 1996 and the third set in August 1996. Ten interviews were held at each of the three sites and two interviews were held per day for one week, each interview lasting between forty minutes and one hour. The interview times and locations were arranged in conjunction with the respondents and where possible, they were interviewed in their own offices to minimise inconvenience.
Where respondents shared an office, the interviews were held in a library seminar room (QMC) or a vacant office (NIMR and RFHSM).

The initial contact letter and questionnaire were distributed approximately four weeks prior to the interviews. The respondents were sent further information on the interview and a pre-interview form approximately one week prior to their interviews. The further information essentially re-iterated the information already sent with the questionnaire on the nature of the interview. In addition, respondents were asked to consider a critical incident of information seeking where the Internet had been used to look for information in relation to their work, and to note some examples of sources which they had accessed and used in relation to the incident. The respondents were asked to do this prior to the interview in order to save time during the interview itself, and to prepare them for the session, ensuring an example to discuss. Twenty-three interviewees completed the form, and where they had not done so, they were asked about a possible example during the interview itself.

The interview sessions were informal and took the form of a discussion, facilitating exploration and understanding by the researcher of the issues under discussion. The interview schedule was designed to act as a guide and it was used as such. Consequently, not all respondents were asked all of the questions as it was not always necessary. If the interviewer felt a particular question might prevent a smooth transition between points, the question was omitted or used later in the session. Similarly, few of the prompts were used during the interviews. Respondents often covered the areas without prompting or simply needed to be asked 'why?', and any points were clarified if necessary.

The interview technique and guide were successful in exploring the information seeking and information use behaviour of Internet users. The critical incident technique was particularly valuable in focusing respondents on an example of information seeking and the questions on source evaluation yielded a large quantity of valuable data relating to source evaluation.

One problem encountered was a lack of Internet use by one respondent. The interviewee had completed the questionnaire relating to her use of the Internet, but in reality, her staff conducted any Internet searching on her behalf. The respondent discussed her use
of Medline, providing valuable insight into the evaluation of bibliographical databases. A number of other problems required consideration in any further research, namely the lack of realistic pilots and the low response rate to the questionnaire. Any further research required a more generous time scale to ensure full piloting of the data collection tools, greater clarity regarding whether questionnaires should be returned, and more time to return the questionnaire. In addition, a follow-up letter may have encouraged more respondents to return the questionnaires and agree to participate in an interview.

3.3.3 Interview analysis

The aim of analysis was to examine the information seeking and use behaviour of health and medical users of the Internet, and in particular, to develop a theory of how assessments of information quality were made. In addition, the interviews were analysed to determine whether criteria could be identified from the users' assessments, what those criteria were, and whether different criteria were used to evaluate different source types.

i. Qualitative data analysis techniques

There are few detailed descriptions of qualitative data analysis in the literature. However, Dey (1993) outlines a combination of techniques involving the classification of data according to categories, rearranging the data into categories, comparison of the categories and verification with the data in its original form. Strauss and Corbin (1990) discuss similar techniques for developing a grounded theory from qualitative data. As mentioned earlier, a grounded theory is 'inductively derived from the study of the phenomenon it represents' by developing the categories of analysis from the data itself, reorganising the data according to the categories and comparing the properties and dimensions of the categories (Strauss and Corbin 1990, p.23). Strauss and Corbin also advocate returning to the data in its original form in order to validate the theory.

The approach used in this study was influenced by the techniques described by Strauss and Corbin (1990) for developing a grounded theory from qualitative data. The techniques described by Dey (1990) were also drawn upon where applicable. In particular, an inductive approach was taken to ensure the validity of the analysis with
regard to actual information seeking behaviour. Inductive analysis prevents the researcher 'imposing pre-existing expectations on the phenomenon under study' by allowing categories or dimensions of analysis to emerge during the research and 'without presupposing in advance what the important dimensions will be' (Patton 1990, p.44).

ii. Transcription

Twenty-seven interviews were tape-recorded and transcribed in their entirety in order to enable analysis of the interviewees' own words regarding their information seeking experiences. One interview was not recorded because the interviewee wanted to hold the session over coffee and the area was too noisy, and a further two interviews could not be transcribed because the recording was inaudible. Notes were made for these interviews and the notes were transcribed immediately following the interviews. Transcription was more time-consuming than had been anticipated, in part due to the inferior quality of the tape-recordings generally. While this affected the progress of the research, it was essential in order to ensure the complete and accurate recording of the results and to enable inductive content analysis of the comments made by respondents. A sample transcript is available in Appendix A3 and any further transcripts may be obtained from the researcher.

iii. Open coding

Coding relates to 'the operations by which data are broken down, conceptualised and put back together in new ways', and is the 'central process by which theories are built from data' (Strauss and Corbin 1990, p.57). 'Open coding' is the first stage of an inductive analysis, involving close examination of the data in its original form. The data is examined to identify 'discrete instances of phenomena' which are given 'conceptual labels' and grouped together into 'categories' of related concepts (Strauss and Corbin 1990, p.61). Three interview transcripts were selected from each site which the researcher identified as information-rich examples. The selected transcripts were examined line-by-line in order to identify instances of phenomena deemed relevant for analysis. The phenomena were labelled, similarities and differences between the phenomena were identified, and categories of analysis began to emerge from the data.
The process was only conducted for nine interviews because, although a line-by-line approach to analysis is the most generative in terms of categories, it is also the most time-consuming approach.

The categories identified at this stage were:

- levels of use of the Internet,
- reasons for using the Internet for information seeking,
- problems associated with using the Internet for information seeking,
- examples of work-related information seeking,
- evaluative comments regarding the sources used, and
- comments regarding perceptions of information quality generally.

In addition, sub-categories were identified for three categories. The examples of work-related information seeking were divided into:

- looking for background information for a research project, to update knowledge or for a specific presentation or publication,
- accessing or manipulating genetic data,
- downloading computer software,
- posting a query to a Usenet Newsgroup or discussion group,
- looking for funding information,
- conducting a literature search on a bibliographical database,
- looking for a fact about a person or an institution,
- looking for material to supplement teaching material, and
- reading or consulting an electronic journal.

The evaluative comments regarding the sources used were divided into the following source types:

- organisational home pages,
- electronic journals,
- Computer Assisted Learning (CAL) materials,
- image-based information sources,
- FTP sites,
discussion groups and Usenet Newsgroups,
- bibliographical databases,
- genetic sites and services,
- other databases and databanks, and
- other text-based information sources.

The general comments regarding perceptions of information quality were divided into:

- journals,
- WWW documents, and
- discussion groups.

During transcription and initial analysis of the interviews, detailed and extensive notes were made regarding how respondents approached assessing source quality. These notes were used as the basis for the second stage of interviewing (described below) and to develop the first draft of the Evaluation Criteria Document which was distributed for review (also described below).

iv. Axial coding

Axial coding refers to, 'a set of procedures whereby data are put back together in new ways after open coding' (Strauss and Corbin 1990, p.96). By breaking the data up into the relevant categories, it is reorganised 'in ways which are more useful for ... analysis' as 'all the “bits” that belong to a particular category are brought together' and relationships, differences and similarities can be more easily identified (Dey 1990, p.42, 44).

Following identification of the categories using the open-coding technique, the data was reorganised. A copy was made of each interview transcript, and the relevant comments were 'cut' from the transcript and 'pasted' under the category headings using the facilities of a standard word-processor. The data was retained within its original sentence or paragraph at this stage, depending upon the relevance of the surrounding text. The remaining transcript was checked to ensure no relevant data had been omitted and the interviewee number was added to each comment for comparative purposes. The comments were then 'copied' into a master file containing all of the comments from the
different transcripts under each of the category headings. A sample category of analysis is provided in Appendix A4. Approximately one third of the original interview data which added no value to the research was removed at this stage. Examples of excluded material were the interviewer’s questions and discussion by respondents of their own research interests which bore no relation to their use of the Internet.

The categories of analysis were intended to be mutually exclusive. Thus, comments relating to specific sources were listed under source evaluation, but any general comments regarding reasons for accessing sources were listed under perceptions of information quality. However, there was overlap between the sub-categories. For example, respondents used bibliographical databases to look for background information, and they frequently compared the features and facilities of different sources. Thus, the sub-categories were not mutually exclusive as it would have been inaccurate to exclude the comments from one or other category.

The first category (levels of use of the Internet), was analysed to provide quantitative data regarding frequency of access to the various tools and information on respondents’ general use of the Internet. The subsequent categories (use of the Internet for information seeking, problems associated with Internet use and examples of work-related information seeking), were analysed to identify recurrent themes and issues and any differences between interviewees’ comments. The comments were annotated and any thoughts regarding relationships were represented in a diagrammatic format ready for description within the thesis. The comments regarding general perceptions of information quality were also analysed in this way.

The categories relating to source evaluation were central to the theory of information quality and source assessment, and analysis of this section was consequently the most exhaustive. The data was examined for any evaluative points raised by respondents in relation to the specific sources. Evaluative points were either individual words, phrases or whole sentences which related to reasons why sources were accessed or any characteristic of a source which was mentioned. Negative as well as positive comments were identified. Thus, if a reason was mentioned for not accessing a source, this was considered an evaluative comment. During this stage, further source types were identified. The category ‘other text-based information sources’ was divided into catalogues, current awareness services, Frequently Asked Questions, personal Home
Pages and subject-based sites, and some comments from the 'organisational sites' were moved into the subject-based sites category.

The evaluative points were highlighted, and links or relationships between the various comments were identified and noted. Conceptual labels were developed by examining the relationships between the various evaluative comments. For example, in relation to CAL materials, a range of evaluative points were raised with regard to how accessible respondents felt the sources were, such as the speed of access and the cost of accessing materials. Thus, the conceptual label 'accessibility' was defined, and any comments relating to the accessibility of CAL materials were identified. Likewise, in relation to bibliographical databases, evaluative comments related to the subject areas covered, the journals covered and the comprehensiveness of coverage, and were given the conceptual label 'coverage'.

The evaluative comments were copied into tables for each source type. The conceptual labels were defined as 'criteria headings', and the natural language used by respondents was standardised into a list of 'evaluation details'. The evaluation details were listed under each criteria heading with the interviewee numbers alongside. The interviewee numbers were intended to indicate how many respondents had referred to each point, but were not intended to add weight to the different evaluation details. The primary concern was the descriptive value of the data and not its occurrence in statistical terms and therefore, the number of times individual respondents mentioned each point was not noted.

Once the data had been analysed and annotated, and the tables of analysis were complete, the textual version was written (Chapter 4). The text was written by reorganising the interviewees' comments according to the criteria headings and evaluation details, and transcribing the annotations relating to them. Any repetitive quotes or annotations were removed, and the quotes were edited to remove redundant words, such as 'just', 'actually', 'sort of' and 'you know'. The tables were used to add further depth to the text by providing a comprehensive list of the evaluative details which were mentioned, and an indication of how many respondents mentioned each criteria and in relation to which sources. The same techniques were used for the sections relating to the context of source evaluation and general perceptions of information.
quality, but less detail was required and therefore the interviewees were quoted less extensively.

‘Much of the task of qualitative analysis is not just to develop conceptualisations but to examine them in the light of the data’ (Dey 1990, p.52). Therefore, following writing, the original interview transcripts were re-examined in order to verify any points raised in the text and to identify any omissions. In addition, the data in the tables were verified to ensure all evaluative points had been included and to ensure the evaluative points were listed under the appropriate criteria headings.

The process of interview analysis, as described above, suggests a logical progression of steps, and that each step of analysis was autonomous. However, as Dey (1990, p.264) advises:

\[
\text{It is more realistic to imagine qualitative analysis as a series of spirals as we loop back and forth through various phases within the broader progress of the analysis.}
\]

Therefore, the identification of the categories of analysis and definitions for the conceptual labels were ongoing throughout analysis, and the categories were defined and redefined as new areas of relevant data were identified. The first draft of the Evaluation Criteria Document and the second interview schedules were devised prior to completion of analysing the first interviews. Furthermore, verification with the original interview data was not a final, independent step but a continuous process throughout analysis, which has been described as, ‘a constant interplay between proposing and checking’ (Strauss and Corbin 1990, p.111).

### 3.3.4 Criteria testing versus criteria development

The original objectives of the research identified in Chapter 1 included to examine the information seeking behaviour of Internet users to determine how they assess the quality of the sources they access and use, to interpret their assessments to develop a tool for use by LIS professionals when assessing the quality of Internet-based sources, and to conduct a second stage of data collection which would involve implementing and testing the tool in order to determine its value and usefulness to the LIS community when
selecting and evaluating information via the Internet. However, following completion of
the first interviews and an initial analysis of the transcripts, it was evident that there
were problems with the data which resulted in a re-examination of the original
objectives of the research.

i. Issues arising from the first interviews

Open-coding of the first interviews indicated that the interview technique and guide
were successful in exploring the information seeking and information use behaviour of
Internet users. In particular, initial analysis indicated an emerging theory of how
assessments of quality were made, and the questions on source evaluation yielded a
large quantity of valuable data which could be translated into evaluation criteria.
Furthermore, open-coding indicated that different sources were used and evaluated
differently. However, the full range of source types was not explored to the same extent.
For example, while numerous respondents discussed bibliographical databases and
molecular biology resources, only one or two people discussed sources such as CAL
materials, FAQ files or FTP archives, and few comments were made about other sources
such as Current Awareness Services (CAS) or electronic journals. The data relating to
these source types was therefore much less exhaustive and where only one user had
discussed a particular source type, it was difficult to justify the validity of the data. The
researcher was therefore faced with the obstacle that any tool which was developed on
the basis of the data collected thus far would be incomplete.

One option was to develop a tool involving some guesswork to fill in any gaps.
However, this would undermine the objective, 'to interpret end-user assessments in
order to develop a tool or technique'. It would also be difficult to justify that such a tool
accurately reflected 'how users of the Internet assess the quality of the sources they
access and use' (part of the second objective). Likewise, while it was recognised that the
process of implementation and testing would result in data which could be used to
develop the tool, this would be problematic because the data would arise from the
attitudes and opinions of LIS professionals rather than end-users' perspectives of source
quality. There was therefore a need for further research into end-user behaviour to
develop the theory of information quality assessment and subsequently develop the tool.
However, the researcher was faced with a further dilemma because conducting any
additional research along this line of enquiry would result in no time to fulfil the fourth
and final objective, ‘to implement and test the tool or technique in order to determine its value and usefulness to the LIS community when selecting and evaluating information available via the Internet’. It would therefore be impossible to answer the final question asked in Chapter 1, ‘if a tool or technique were developed, would it provide an effective filter for the retrieval of resources available via the Internet?’.

At the outset of the research, it was anticipated that the outcome would be a ‘finished’ product, an evaluation tool which enabled LIS professionals to assess the quality of Internet-based information sources which had been implemented and tested to ensure its effectiveness. Opting to implement and test the tool based upon the available data would have resulted in a ‘finished’ product, but one which had a questionable research-basis. Alternatively, further research into how individuals assess the quality of the sources they access and use would result in a tool which had not been implemented and tested, but one which provided a solid basis for further research. This was therefore considered the preferred option for the remainder of the study.

ii. Criteria development and validation

It was decided that a second stage of interviewing would be undertaken to develop and validate the existing data. The second interviews were intended to examine the assessment of a wider range of source types by additional Internet users. It was anticipated that the interviewees would be selected to discuss specific types of sources to ensure equitable levels of discussion about the full range of types, thereby developing and validating the existing data where only a limited number of respondents had discussed particular sources. In addition, it was anticipated that the interviewees would not be asked to discuss their general attitudes towards the sources they accessed and used as in the first interviews, but to elaborate on the quality issues which had already been raised in relation to the different sources, which would also serve to develop and validate the existing data.

In relation to the development of a grounded theory in particular, the second stage of interviewing was intended to develop the theory of source assessment by identifying gaps in the theory and collecting further data to fill those gaps. Furthermore, the theory would be developed and validated through examining a wider range of cases and through methodological triangulation. Patton (1990) identifies four types of
triangulation: data (different sources of data are used to study the same phenomena), investigator (different investigators are used), theory (multiple perspectives are used to interpret data), and methodological (different methods are used to study the same phenomena). A different interview technique would be developed to explore the information seeking behaviour of a further group of Internet users because:

Studies that only use one method are more vulnerable to errors linked to that particular method than studies that use multiple methods in which the different types of data provide cross-validity checks (Patton 1990, p.188).

Furthermore:

In social research, reliance upon a single piece of data is dangerous because undetected error in the data production process may render the analysis incorrect. If on the other hand, diverse kinds of data lead to the same conclusion one can be a little more confident in one's conclusion (Hammersley 1981, p.215).

The design and conduct of the interviews are discussed further under 'Criteria development and validation interviews'.

As mentioned earlier, a major drawback of conducting further interviews was the resultant lack of time to address the fourth and final objective, to implement and test the tool in order to determine its value and usefulness to the LIS community when selecting and evaluating information available via the Internet. However, it was felt that it would be possible, and that it was desirable, to elicit some feedback from the LIS community which would address this in part. Therefore, in addition to the criteria development and validation interviews, the existing data were simultaneously developed into a draft tool and distributed for review by selected LIS professionals. By eliciting the attitudes and opinions of members of the LIS community who were knowledgeable about assessing the quality of Internet-based sources, it was anticipated that the fourth objective would be addressed in part as the reviewers could assess the potential value and usefulness of the tool when selecting and evaluating information available via the Internet. The review process (and its limitations) are discussed further in section 3.3.8.
iii. Implications of not testing the criteria

The overall aim of the research was to determine whether a tool or technique could be developed to assist librarians and other information professionals in the selection and evaluation of Internet-based information sources. Therefore, at the outset of the research, implementing and testing any tool was considered an important stage because it would enable an assessment of whether the tool provided an effective filter. The review process was primarily concerned with the likely value and usefulness of the tool, and simply commenting on its likely value and usefulness does not provide a sound basis for drawing conclusions about its effectiveness. The limitations of not testing the tool were therefore recognised, namely that it would be impossible to draw any conclusions regarding its effectiveness. However, as mentioned, the chosen direction for the remainder of the study would provide a solid basis for any future research. This could involve implementing and testing the revised tool and suggested approaches are discussed in Chapter 5.

3.3.5 Criteria development and validation interviews

As mentioned above, a second set of interviews was conducted in order to validate and develop the findings of the first interviews. The interviews examined the information seeking behaviour of a wider number of Internet users and attempted to examine in further detail the different examples where the Internet had been used to look for information.

i. Site selection

The interviews were conducted among the same user group for the reasons already outlined, as well as to allow comparison of the results. However, a different site was required in order to provide access to the necessary numbers. During the first interviews, the medical school sites (QMC and RFHSM) provided access to a wide range of users in terms of the subject areas they were interested in and their reasons for using the Internet. However, the research council site (NIMR) was too restrictive as respondents tended to use the same sources for the same reasons (accessing molecular biology resources for
ongoing research work). Therefore, a third medical school was considered, the School of Clinical Medicine at Cambridge University.

Examination of the latest staff directory for the School (September 1996) indicated that a wide variety of subject disciplines were covered. Furthermore, the School was a member of the OMNI consortium, and again the librarian agreed to act as a site contact, distribute materials and arrange a suitable location to conduct the interviews. The librarian provided information on levels of access to the Internet. Access was widely available in all university departments, either in individual offices, via general machines in the departments or via the library. The library itself housed twenty workstations with full Internet access. During the course of the research, factors affecting the quality of information available via the Internet had become an area of increasing concern. Therefore, the librarian was asked whether Internet users within the School had been offered training or information on assessing networked source quality. The library had planned a training programme for end-users, but by the 19th November 1996, only electronic journals had been covered and issues relating to quality had not been discussed. An end-user had also conducted a number of training courses on accessing medical information, but the courses had not examined information quality. Librarians within the Medical Library had been trained in the use of OMNI, but the course had not been made available to end-users. The site was therefore considered appropriate for the second phase of interviewing.

ii. Sample selection

The first interviewees were essentially self-selecting, although a wide variety of respondents were ultimately interviewed. The second interviewees were selected to develop the theory using theoretical sampling techniques. Theoretical sampling refers to 'sampling on the basis of concepts that have proven theoretical relevance to the evolving theory', or those concepts that are:

... deemed to be significant because they are repeatedly present or notably absent when comparing incident after incident and are of sufficient importance to be given the status of categories (Glaser and Strauss 1990, p.176).
Categories of analysis indicate 'where [the researcher] might go to find instances of the phenomenon to which the category refers', as well as 'what to focus in the next interviews' (Strauss and Corbin 1990, p.73). The categories of information seeking situations, which were identified during initial analysis of the first interviews, were therefore used as the basis for theoretical sampling in order to 'maximise opportunities for verifying the story line, relationships between categories and for filling in poorly developed categories' (Strauss and Corbin 1990, p.187). The information seeking categories were used to enable discussion of as wide a range of source types as possible which was the focus of the interviews. Sampling according to the source types might have restricted respondents to the sources which had already been discussed and it may have been difficult to categorise sources in terms understandable to the respondents.

A short questionnaire (Appendix A5) was designed which identified the nine categories of information seeking. Respondents were asked to indicate the situations for which they had used the Internet in the previous twelve months, whether there were any further reasons why they had used the Internet, and whether there were any reasons why they had not used the Internet. They were also asked to indicate whether they could participate in an interview and their preferences for the weeks in which the interviews were to be held. Again, a questionnaire was used because it provided a cost-effective means of contacting a wide range of potential interviewees.

Three hundred and forty-eight questionnaires were initially distributed to all members of staff listed in the staff directory for the School of Clinical Medicine. The questionnaires were distributed with a letter introducing the research. One hundred and one individuals completed the questionnaire, representing a 29% return rate. Another 247 questionnaires were distributed with a follow-up letter in January 1997, with a 25% return rate. Thus, 162 questionnaires were returned in total, with an overall 27% return rate (the results are summarised in Table 25 in Appendix B). Of the total questionnaire respondents, 85 agreed to participate in an interview. However, of these, 39 people did not use the Internet, therefore leaving 46 individuals who used the Internet and were available for interview. Since no rules are available governing sample size in a qualitative study, it was felt all appropriate questionnaire respondents could be interviewed as three weeks were available to conduct the interviews.
Nine respondents were selected for the first week of interviewing as a pilot study, with one for each information seeking category. Two further categories of information seeking were identified on the questionnaires, and three respondents were interviewed regarding their use of the Internet to access commercial information and one person regarding their use of official information. Two respondents were unavailable for interview and two interviews were cancelled. The remaining 29 respondents were divided equally among the nine categories, with the exception of two categories where four respondents each were interviewed (use of the Internet to look for background information and to read or consult an electronic journal). During the interviews themselves, there were some changes to the information seeking examples which were discussed, and between one and five interviews were held for each category.

iii. Pilot study

An interview schedule was devised to discuss an example of information seeking selected from the questionnaire, the Internet sources which might be used in relation to the example, and in particular, the criteria used when accessing and using such sources. A sample schedule is provided in Appendix A6. The interviews were designed to collect quantitative data in order to validate the qualitative data from the first interviews. The interviewees were offered a range of fixed responses from which to choose an answer, and the response categories were based upon the results of the information seeking and use interviews. It was anticipated that this would enable straightforward data collection and that a wide range of questions could be answered in a short space of time. In addition, it was anticipated that data analysis would be straightforward as the results would be compared to the results of the first interviews in order to determine the wider applicability and validity of the evaluation criteria.

The interview schedule was divided into three main sections. The first section collected background information on the respondents' research interests, the Internet tools used and their levels of use. The second section of the schedule clarified the category of information seeking and determined the type of information sources used. Any criteria or reasons for use of the sources were noted. Ten versions of the third section of the schedule were developed, one for each source type defined during the initial analysis. The questions examined the reasons for using the source type concerned and the respondents were asked to indicate whether the reasons affected their use of the sources.
'always', 'rarely', 'sometimes' or 'never'. Respondents were also asked to indicate whether a range of factors and characteristics were 'important', 'necessary' or 'unimportant' in their use of the sources. For example, in relation to FTP sites, questions related to the currency of the software, the institution concerned and the clarity of site lay-out. Respondents were also asked for any further reasons for using the sources concerned, and whether there were any other factors or characteristics which affected their use of the sources.

As part of the pilot study, feedback was elicited on the interview schedule. Three respondents felt the schedule was acceptable and that the points raised were relevant to their use of the sources concerned. However, it was obvious during the course of the pilot study that the categories 'always', 'rarely', 'sometimes' or 'never', and 'important', 'necessary', 'unimportant' or 'no opinion', were inappropriate as the interviewees were forced to fit their responses into an appropriate category. Indeed, respondents explicitly stated that these categories were not appropriate to the responses that they wanted to give. In addition, the questions were considered repetitive and one respondent was unsure of the differences between them. During two interviews, the section on source evaluation was irrelevant because the interviewee had only ever accessed one example of the source type concerned and therefore could not discuss a range of sources evaluatively. The questions therefore required rewording according to the situation concerned, which was inappropriate for an interview of this type. Moreover, a number of broader comments were made which did not fit into the pre-determined categories and the interviewees were more responsive to the open-ended questions, indicating they wanted the opportunity to discuss their use of the Internet in more detail.

Patton (1990, p.289) summarises the disadvantages of closed, fixed response interviews:

Respondents must fit their experiences and feelings into the researcher's categories; may be perceived as impersonal, irrelevant and mechanistic. Can distort what respondents really mean or experienced by so completely limiting their response choices.

This describes the experience which was encountered with the pilot interviews. Although the response categories were induced from previous interview data, and therefore should have been relevant to the subjects, they obviously lacked meaning and
were restrictive. Cognitive processes are difficult to describe, there are a wide range of feelings and experiences associated with use of the Internet, and it was obviously inappropriate to attempt to categorise feelings and experiences in this way. The interview schedule was therefore revised to address these issues.

iv. Use of a standardised open-ended interview

As already mentioned, Patton (1990, p.280) identifies three types of qualitative interview, including the standardised open-ended interview which:

... consists of a set of questions carefully worded and arranged with the intention of taking each respondent through the same sequence and asking each respondent the same questions with essentially the same words.

Adopting a standardised open-ended interview approach appeared a suitable compromise. As the questions are open-ended, the technique provides interviewees with the opportunity to discuss issues in as little or as much detail as required. However, the questions are predetermined therefore ensuring the same issues are raised with each interviewee and data collection is consequently more systematic. Furthermore, as the questions are standardised, there is greater scope for covering a wider range of issues in a limited amount of time than in an interview guide approach.

A similar overall structure was adopted for the open-ended schedules as for the pilot interviews. An introductory section gathered background information regarding subject areas of interest. Essentially the same questions and answer categories were used to examine the tools used and levels of use of the Internet as few problems had been encountered with these questions. Three minor amendments were made: for length of use of the Internet, a 'never used' category was added; two questions, 'From which of the following do you have access available to the Internet?', and 'From where do you usually access the Internet?', were amalgamated; and the phrase 'public access room' was changed to 'computer room' as one respondent interpreted the phrase as a room available to the general public, rather than to the School of Clinical Medicine as a whole.
The second section of the schedule was again intended to clarify the information seeking situation and the sources used, although a number of changes were made. An opening question was added regarding respondents' general use of the Internet in order to initiate the discussion. Respondents were then asked to discuss an example where they had used the Internet to look for information in relation to the information seeking situation, and why they would use the Internet rather than going elsewhere. The interviewees were asked about a critical incident of information seeking because the questions relating to use of sources generally were problematic in the pilot interviews. The critical incident technique was effective in the first interviews as it ensured an example to discuss and provided a focus for discussion.

The third section of the schedule again concentrated on source evaluation. However, respondents were asked to select a particular example of the source type concerned in order to focus discussion. The questions were based upon the areas of evaluation which had been highlighted during initial analysis of the first interviews, and the criteria were rephrased as questions designed to encourage respondents to elaborate on the criteria. The questions were based upon the following areas of source evaluation:

- uniqueness,
- appropriateness,
- subject coverage,
- reputation,
- currency,
- accuracy,
- presentation, layout and arrangement,
- ease of use,
- use of images and graphics,
- access restrictions, and
- overall impressions.

Again, nine schedules were developed, one for each of the different source types listed earlier. Variations included questions relating to the genealogy and refereeing of electronic journals, the format of images and CAL materials, the volume of traffic, group moderation and the participants of Usenet Newsgroups and discussion groups, and the search facilities available from databases, bibliographical databases and genetic.
sites and services. Respondents were also asked two further questions which were designed to offer the opportunity to discuss any issues further: ‘Would you describe this as a source of quality information?’, and ‘How might you improve the quality of the source?’. Finally, respondents were asked for any further comments or questions. A sample interview schedule is provided in Appendix A7.

The schedules were implemented for the second week of interviewing and it was anticipated that if the schedules were once more inappropriate, further changes would be made. However, this was unnecessary and the same schedules were used for the final week of interviewing.

v. Interviews

The introductory letter and questionnaires were distributed in the first week of December 1996 to all staff in the directory for the School of Clinical Medicine. A follow-up letter with a second copy of the questionnaire were distributed in the first week of January 1997. The interviews were arranged by telephone during December 1996 and January 1997, and the pre-interview information was distributed one week prior to each interview. The pre-interview information essentially reiterated the information provided in the initial contact letter and confirmed the interview arrangements. The nine pilot interviews were held in the first week of February 1997, nineteen interviews were held in the first week of March 1997, and fourteen in the first week of April 1997. Between two and five interviews were held each day, each lasting approximately twenty minutes. The interview times and locations were arranged in conjunction with respondents. Where possible, respondents were interviewed in their own offices to minimise inconvenience and where this was not possible, the interviews were held in a vacant office in the library.

The interview sessions were informal and tended to take the form of a discussion, particularly where respondents were asked about their general use of the Internet, to discuss a particular example where the Internet had been used to look for information, and for any further comments or questions. However, the section relating to source evaluation was dictated by the structure of the interview schedule and the questions were adhered to as closely as possible. Where questions were not applicable or required rephrasing, the interviewer digressed from the schedule and notes were made regarding
which questions were asked and how they were phrased. For example, a schedule had not been developed relating to Current Awareness Services and therefore the Usenet Newsgroup and discussion group schedule was modified to suit the purpose.

Some problems were again encountered with the second interviews. While one interviewee had completed the questionnaire indicating recent reasons for using the Internet, on receiving the pre-interview information, he replied in writing:

> When I filled in your original questionnaire, I did so rather cursorily. Whilst my Group as a whole frequently uses the Internet to access genetic databases, I am afraid I used rather the royal "we" when I came to describe myself as a user of genetic databases. The type of Internet use in this circumstance tends to go as follows: "Hey, Carl, can you look up the sequence of XXX on the gene bank and bring it to me!" I am afraid I have not directly used these programmes myself.

The respondents were contacted using the staff directory which did not include research students and research assistants. The above respondent was probably referring to research students or assistants who may have been heavier users of the Internet generally. Indeed, in another example, a research assistant was recommended and consequently interviewed. The interviewee provided detailed and valuable data regarding the evaluation of FTP archives, an area which had previously lacked detail. It may therefore have been of greater benefit to include research students and research assistants in the sample selection, although this would have been difficult in practice due to the lack of a comprehensive list.

A second problem again related to respondents' use of Medline. Respondents thought that they were accessing Medline via the Internet because they simply clicked on an icon from their terminals. However, it became apparent that three respondents were accessing a locally networked version of Medline, while others specifically mentioned accessing it via an Internet site. It was felt that this was not problematic as the interview data provided valuable insight into various factors affecting respondents' perceptions of the quality of bibliographical databases. Furthermore, two interviewees discussed Medline as they did not access any other sources via the Internet.
3.3.6 Interview analysis

A range of criteria was identified during analysis of the first interviews, and the second interviews were primarily analysed to develop these criteria. The interviews were not transcribed verbatim as the necessary time and resources were not available. However, this was not problematic as the interviewer was aware of the areas of interest and could make detailed notes regarding source evaluation during the course of the interviews. Moreover, the interviewees were quoted where salient points were made and the notes were immediately transcribed following the interviews. A sample interview transcript is provided in Appendix A8.

The process of analysis was similar to the first interviews. Data relating to the tools used and levels of use of the Internet were collected and presented in the relevant results tables (Appendix B). The categories for analysis relating to the context of source evaluation had already been developed inductively from the first interviews. Therefore, any comments relating to the context of source evaluation were analysed using the same techniques and the same categories. Likewise, the sources discussed by respondents were identified and any evaluative comments made in relation to specific sources were highlighted. Links and relationships between the evaluative comments were identified and conceptual labels were defined for related comments. Again, the conceptual labels were listed as criteria headings and the comments were copied into the tables for each source type under the relevant headings with the interviewee number (Appendix B).

Once the data had been analysed and annotated, and the tables of analysis were complete, the textual version was written (Chapter 4). Again, source evaluation was considered in more detail than the other sections. However, the write-up is substantially briefer than for the first interviews because there was less data (the interviews were shorter in length and they were not transcribed verbatim). Following writing, the original interview transcripts were re-examined in order to verify any points raised in the text, and to verify the data in the tables to ensure all evaluative points had been included and were listed under the appropriate criteria headings.

The second interviews were intended to develop and validate the findings of the first interviews. Therefore, where respondents simply provided a 'yes' or 'no' response, the data was not analysed as the concern was not with weighting the importance of the
criteria. The analysis focused on where respondents had elaborated on the questions, either positively or negatively, as this provided further insight into the process of source evaluation. Furthermore, despite the drawbacks already outlined in relation to the pilot interviews, the interviewees made a number of valuable comments in relation to the sources they discussed. Therefore, the data relating to levels of use of the Internet, job titles and research interests were analysed, as were any additional comments relating to the context of source evaluation and source evaluation itself.

3.3.7 Theory development

One aim of the study was to examine whether different criteria were applicable to different source types. The results were therefore analysed and described in Chapter 4 according to the different source types mentioned by the interviewees. Furthermore, the results of each stage of data collection are described independently in the chapter. The final stage of analysis was a comparison between the results for each source type, and between the two sets of interviews, in order to identify recurrent issues and develop the theory of information quality assessment.

The text and the results tables (Appendix B) were examined to determine whether there were any issues which were applicable to a range of different source types. It was possible to identify a range of recurrent issues and create a picture of the relationships between these issues. Conceptual labels were developed for related issues, and diagrams were used to represent the different relationships which could be identified between them. It was then also possible to identify issues which were peculiar to the different types of information sources described by the interviewees. Lastly, the diagrams were used to formulate the theory of source assessment (described in Chapter 5), which Strauss and Corbin (1990, p.116) describe as writing ‘a descriptive narrative about the central phenomenon of the study’.

3.3.8 The Evaluation Criteria Document

A draft evaluation tool, the ‘Evaluation Criteria Document’, was devised and distributed for comment and review among LIS professionals. This section provides details of the development of the first draft and the methods adopted for its review. The development,
role and content of the final draft is discussed in Chapter 5 and the final draft itself is provided in Appendix C.

i. First draft of the Evaluation Criteria Document

The draft Evaluation Criteria Document was devised based upon preliminary analysis of the information seeking and use interviews. The document contained an introductory section briefly explaining its purpose and contents, how it should be used and how the evaluation criteria were devised. The main body of the document was divided into nine sections, each section relating to a different source type. The source types were based upon those defined during analysis, with the exception of organisational sites which were subsumed into the text-based information category, and electronic journals which included a section for electronic journal articles. The document was divided into the different source types because initial analysis indicated different sources were evaluated differently. In addition, it was assumed the reader could turn to the relevant section of the document to find criteria appropriate to the source being evaluated, without needing to read through irrelevant text.

Introductory information was provided on each source type, including details of the types of materials included, how the sources were used, and reasons for using the sources via the Internet. In addition, respondents were directed towards any other relevant sections in the document. For example, the introductory information relating to text-based information sources provided a list of examples of text-based information sources and pointed readers towards electronic journals and electronic journal articles. The section suggested that text-based information might be used when looking for background information or to look for teaching materials, and reasons for use might include convenience and the availability of a wide range of sources via the Internet.

Each source type was then divided into the following sections:

- value of the source,
- coverage,
- authority,
- currency,
- accuracy,
• presentation, layout and arrangement, and
• accessibility.

Exceptions included Usenet Newsgroups and discussion groups, which included sections relating to the purpose of the group, the participants and any facilities available, and software sites which included a section on the facilities available. Under each section heading, the criteria were listed with an explanation of the purpose of the criteria and how they might be implemented. For example, in relation to the coverage of text-based sources, criteria included subject coverage, comprehensiveness, pointers to further information and intended audience. The notes expanded upon the criteria and suggested comparing sources with others available. In addition, quotes were taken from the interview transcripts to illustrate the criteria and enliven the document. For example, in relation to pointers to further information:

It has to tell me what I want to know, or failing that, point me to somewhere that will get me the information that I’m after.

At the end of the document, an evaluation checklist was provided for each source type. The checklists comprised all the criteria relating to each source type which were rephrased as questions. For example, the above mentioned criteria were rephrased as:

• What subject does the material cover?
• Does the material cover the subject area comprehensively?
• Who is the intended audience of the material?
• Are there any pointers to further information?

It was envisaged that users would read the detailed sections of the document in order to learn about the criteria and the process of source evaluation, but the checklist would provide a quick reference and day-to-day working tool for source evaluation.

ii. Review of the first draft

As discussed earlier, it was initially intended that the criteria arising from the first interviews would be implemented and tested in order to determine their effectiveness in filtering information retrieved via the Internet. Problems with the data arising from the
first interviews resulted in a need for further research to develop the theory of
information quality assessment. While this would ensure a sound research basis for the
tool, it meant it could not be implemented and tested. However, it was felt that it would
be possible, and that it was desirable, to elicit some feedback from library and other
information professionals on the likely value and usefulness of the draft tool in order to
provide a basis for future research.

Individual approaches were made to twenty librarians and information professionals
who had an interest in information quality issues or were involved in use of the Internet
for particular types of materials, such as molecular biology resources. In addition, a
message was posted to OMNI-Collaborators, a closed discussion list for librarians
involved in selecting and evaluating resources for inclusion in the OMNI database.
Those involved in selecting and evaluating the quality of Internet-based information
sources were selected because it was anticipated they would be able to comment on the
likely value and usefulness of the tool, and the format and presentation the criteria might
usefully take.

The document was distributed to twenty-eight individuals in total, including eight from
the OMNI list, and nineteen people returned their comments. Participants were sent an
open-ended questionnaire (Appendix A10) and requested to comment upon the
following issues:

- the potential value of the document in assisting in the evaluation process,
- the criteria covered and not covered,
- the resource types covered and not covered,
- the language used and the style of writing,
- the volume of information provided in the document,
- the layout and arrangement of the document, and
- any other comments or criticisms.

The limitations of an open-ended questionnaire were recognised. For example, the
technique relies on the writing skills of the respondent, there is no scope for probing
respondents or extending the responses, and it requires effort on the part of the
respondent to complete the questionnaire (Patton, 1990). However, the time and
resources required to conduct interviews was not available and a closed questionnaire
would have prevented respondents elaborating on their comments or criticisms. Therefore, an open-ended questionnaire offered the most appropriate compromise under the circumstances. Moreover, it was assumed that the reviewers would be willing to offer their comments in writing as they were being asked to discuss a subject of interest to them.

The reviewers' comments were analysed in order to determine the major changes required to improve the value and usefulness of the document to the LIS community. In particular, the results were analysed according to the areas pre-determined by the questionnaire by identifying themes and issues, as well as any additional criteria. The reviewers had not been randomly selected to represent the views of the whole community, but purposefully selected according to their interests in information quality and the Internet. Moreover, the results are not indicative of the effectiveness of the tool in filtering information and were used only as a guide to its development.

The results of the questionnaire are described in Chapter 4, and the subsequent changes made to the Evaluation Criteria Document are discussed in Chapter 5. A sample response to the questionnaire is provided in Appendix 10.

3.4 Summary

The methodology used in this study was influenced by three trends in LIS research: the shift from a systems-orientation to a user-orientation in the design, development and evaluation of information systems; the use of qualitative methods to understand and explore human behaviour; and the use of grounded theory as a research strategy concerned with theory development not theory testing and validation. The focus of the study was the information seeking and information use behaviour of Internet users. Qualitative methods were appropriate to the central question of the study, 'how do users of the Internet assess the quality of the information sources they access and use?', and are also relevant where little is known about an area, as here. An aim of the study was the development of a theory of information quality assessment, and grounded theory as a research strategy was considered relevant because the techniques aim for the development of an accurate and applicable theory.
Thirty open-ended interviews were held with users of the Internet in order to explore their information seeking and information use behaviour. The interviews were designed to examine how users assessed the quality of the sources of information they accessed and used via the Internet, and to elicit the criteria used when assessing the quality of those sources. The interviews were inductively analysed to examine how assessments of information quality were made, to determine whether criteria could be identified from the users' assessments, what those criteria were, and whether different criteria were required for evaluating different source types.

It was initially intended that the criteria arising from the first interviews would be implemented and tested in order to determine their effectiveness in filtering information retrieved via the Internet. However, problems with the data resulted in a need for further research to develop the theory of information quality assessment. A second set of forty-two interviews was conducted which attempted to examine in further detail the different examples where the Internet had been used to look for information. A draft evaluation tool, the 'Evaluation Criteria Document', was devised based upon initial analysis of the information seeking and use interviews. The document was simultaneously distributed for comment and review among librarians and information professionals in order to elicit feedback on its potential value and usefulness.

The results of both stages of interviewing and the review of the Evaluation Criteria Document are presented in Chapter 4, and the interviewees' comments relating to source evaluation are tabulated in Appendix B. Furthermore, a final stage of analysis was conducted to identify recurrent issues affecting source evaluation and to compare the results of both sets of interviews. The results of the final analysis were used to develop the theory of information quality assessment which is presented in Chapter 5.
Chapter 4

Results
4.1 Purpose of the chapter

The purpose of this chapter is to present the results of the research. The main stages of data collection were the information seeking and use interviews, the criteria development and validation interviews and the review of a first draft of the evaluation tool. In addition, questionnaires were distributed prior to each stage of interviewing. The results were primarily qualitative and are therefore presented as descriptive text within the chapter. In addition, the interviewees' comments relating to source evaluation were summarised and tabulated in Appendix B, along with any quantitative data which has also been tabulated.

The results of each stage of data collection are presented independently. Chapter 5 attempts to draw together the results and discuss their wider implications. The methods used for data collection and analysis are discussed in Chapter 3 and the tools used are provided in Appendix A. The final draft of the evaluation tool forms Appendix C.

4.2 Filtering questionnaire

A total of 1,280 questionnaires were distributed across three sites and 99 questionnaires were returned (for further details, see Table 1). As discussed in Chapter 3, this is a poor response rate (8%) which can be accounted for by a variety of reasons. However, the purpose of the questionnaire was not to draw conclusions regarding Internet use by medics in academic institutions, but rather to identify potential interviewees according to their levels of use of the Internet. This section therefore provides a summary of the results of the filtering questionnaire, although readers should be aware of their limitations.

The results of the questionnaire are provided in Table 2. The majority (75%) of questionnaire respondents used their e-mail daily. Few read Usenet News, but those that did, used it regularly (82% of respondents did not read Usenet, 7% read it daily, and 8%, weekly). Over half did not use FTP, although almost 20% used the facility weekly. Gopher was generally not used (86%). The WWW was used by almost 80% of the respondents, and was used either daily (22%), weekly (33%), or monthly (16%).
4.3 Information seeking and use interviews

Thirty information seeking and use interviews were conducted. Of these, 21 filtering questionnaires and 23 pre-interview forms were completed, 27 interviews were tape-recorded and transcribed in their entirety and notes were made for the three interviews which were not recorded. The qualitative data is presented within the main body of the text, and an edited version of the interview transcripts is quoted where applicable with the interviewee number in square brackets. Any quantitative data and the evaluation issues mentioned by the interviewees are tabulated in Appendix B2.

The results are divided into the following categories. An initial section describes the interviewees' research interests and the second section examines their levels of use of the Internet in order to provide background information. To place the evaluation of sources into context, the third section provides an overview of the respondent's use of the Internet for work-related information seeking. The fourth and largest section considers the evaluative comments regarding the sources which were accessed and used. The final section examines perceptions of information quality generally and the comparisons drawn between information available via the Internet and information available in other formats.

4.3.1 The interviewees

Table 3 provides a summary of the respondent's job titles and research interests. As discussed in Chapter 3, the interviewees were all based in academic institutions and were involved in health and medicine. Within this setting, a wide range of people were interviewed in terms of the disciplines covered and the positions held, ranging from an undergraduate student, through postgraduate research students, research fellows, lecturers, readers, to heads of departments. While some had a heavy teaching commitment, others did no teaching and were specifically employed in laboratory based research. In addition, some respondents were involved in clinical practice.
4.3.2 Levels of use of the Internet

The results of the Internet tools used and regularity of use are provided in Table 4. The majority of interviewees (93%) used their e-mail daily. Few read Usenet News, but those that did, used it regularly (67% of respondents did not read Usenet, 10% read it daily, and 13%, weekly). Gopher was generally not used (77%). The WWW was used by all the interviewees, with levels of use dispersed among daily (30%), weekly (40%), monthly (13%) and less than monthly (13%). Sixty-five percent of the interviewees accessed FTP either daily (7%), weekly (20%), monthly (10%), less than monthly (7%) or an unspecified amount (10%).

As displayed in Table 5, thirteen (43%) interviewees were subscribed to discussion groups, fourteen (47%) were not subscribed, and two had unsubscribed from groups. One person was not asked the question.

The results of respondents’ length of use of the Internet are displayed in Table 6. The difference between length of use of e-mail and of the Internet was distinguished by the interviewees or clarified by the interviewer, and the results are therefore divided as such. Almost half of the interviewees (47%) had been using the Internet and e-mail for between one and two years. Forty percent had been using e-mail for longer than two years, while only 27% had been using the Internet for longer than two years. Only 10% had been using e-mail and 23% using the Internet for less than a year.

As displayed in Table 7, 27 interviewees (90%) had access to the Internet from their office or laboratory, and five had access from home, although some mentioned that they were in the process of installing access.

4.3.3 Context of source evaluation

In order to place the evaluation of sources into context, this section examines general comments regarding use of the Internet for work-related information seeking. The results are primarily drawn from the questions relating to the critical incident where the Internet had been used to look for information, although some data is drawn from the final section where respondents were asked for any further comments.
i. General use of the Internet

The Internet was used for a range of work and non-work related purposes. Non-work related reasons for use included e-mailing friends and colleagues locally, nationally and internationally, reading local and national newspapers and accessing sports scores. Three respondents commented that the majority of their Internet use was for non-work related purposes, while ten felt their work usage outweighed non-work usage.

A substantial component of work-related use was for communicating with others. In particular, the Internet was considered valuable for communicating with collaborators and for sending and receiving documents for comment and review. Respondents felt that the majority of their Internet use was for communication and that the Internet was invaluable for communication purposes and essential for collaborative work.

No-one explicitly stated that they felt the Internet was essential for work-related information seeking. Respondents had found ‘a lot of semi-interesting stuff’ but ‘there’s nothing that’s really what I would call essential’ [28]. However, two resources which were considered essential were BIDS and Medline: ‘Certainly without BIDS, I couldn’t function. I don’t think a lot of us could’ [1]. In addition, a primary reason for using the Internet was to access molecular biology resources, such as genetic databases. For those involved in molecular biology, ‘the Internet is incredibly useful ... it’s invaluable and there are some things you couldn’t do any other way’ [8].

ii. Examples of work-related information seeking

A range of examples of use of the Internet for work-related information seeking were discussed and the results are summarised in Table 8.

Twelve people discussed examples where they had used the Internet to look for background information in relation to their work. The Internet was used for on-going work, as well as for specific publications, presentations and funding proposals. In addition, examples were mentioned where the Internet had been used to access molecular biology resources, to consult electronic journals, to conduct literature searches and to post messages to Usenet Newsgroups and discussion groups for background information.
Eight respondents discussed their use of the Internet to access molecular biology resources. Some specific examples were mentioned, but the interviewees tended to discuss their use in general terms. For example, one researcher was ‘interested in proteins and genes’ and wanted to compare his data ‘with the vast banks of sequences on the Internet’ [19]. Others mentioned conducting regular checks in the databanks and following references to data from journal articles. The Internet was also used to access the computer software available at the various sites for manipulating and analysing data.

Four respondents discussed examples where they had posted queries to Usenet Newsgroups or discussion groups. One had posted a technical question regarding a piece of broken equipment, another was interested in the ‘latest, best method’ to ‘isolate the vacuole from yeast’ [8], and a third posted a query regarding the availability of a cell line. The fourth interviewee mentioned a number of examples where he had posted queries to elicit the reaction of discussion group participants for use in a medico-legal report, as well as to determine whether an area was of significant interest to justify research.

Medline and BIDS were heavily used, although few specific examples were discussed. Examples included to verify a medical procedure, to determine ‘whether it would be possible or practical to undertake a research project’ [21] and to check a reference. Other reasons for use were to search for publications and presentations, to keep up to date, to look for information on an unfamiliar technique and to look for further information on a subject of interest.

Six individuals discussed examples where they had used the Internet to look for information to supplement teaching material. They were divided between those who used the Internet to look for background information (such as for a ‘starting point to find further information’ [1], as ‘an interesting way of getting some ideas’ [7], to ‘brush up’ on an area of teaching [4] or to keep up to date), and those who were interested in images or multi-media materials for presentation purposes, including Computer Assisted Learning (CAL) materials.

A range of examples were discussed where the Internet had been used to access commercial information, including information on laboratory equipment, the availability
and purchase of cell lines, and to examine information on the manufacturers of
teleconferencing equipment in order to make a purchase. One person mentioned regular
use of specialist sites for information on the prices and availability of laboratory
animals.

Other examples of Internet use were to find facts regarding people or organisations, to
consult electronic journals, to access official information for a report, to access funding
information, to download computer software and for travel information. Two
respondents discussed examples where they had used the Internet to find comparable
sites to those they were creating. One was involved in setting up Web pages for travel
medicine but could not comment further as her staff had conducted the search. The
second was considering building a database and had searched the Internet 'to find
something to compare and effectively contrast' with the site he was building [28].

iii. Information seeking process

A range of approaches to information seeking could be identified from the interviewees' comments. When looking for background information for research, material to
supplement teaching material, sites for comparative purposes and information on
sources of funding, the interviewees were browsing for information. They began with a
keyword search using one of the WWW search facilities and browsed the results
retrieved. For example, in order to look for ideas for a course, one person searched
Yahoo! and 'knocked around until [he] ended up with something' [7]. Another knew a
site existed and 'could easily pick that out' from the 'several hundred Web sites' listed
[22].

Those interested in commercial and technical information either already knew a source existed or asked colleagues if they knew where to look for information. For example,
one person wishing to purchase a cell line posted a query to a discussion list and a
catalogue was recommended. In order to look for information on the manufacturers of
teleconferencing equipment, the user concerned accessed a site he had used before.
Where the respondents did not know a site address, the information seeking process was
often straightforward because they were interested in a particular organisation and could
search for the organisation name. Likewise, the information seeking process was
straightforward when looking for official information or information on people and
places because respondents were interested in a particular individual or organisation. For example, for official information on Europe, the respondent accessed a search tool and 'typed in "The European Commission" as a search term and got their Home Page' [9]; to find the e-mail address of an individual, she 'searched on "German Cancer Research" and up popped the unit' [9].

In the other examples mentioned, the interviewees had used the sites before or knew the location of the sites they were interested in. For example, the same bibliographical databases and molecular biology resources were used regularly. Likewise, the interviewees were already subscribed to the discussion groups or Usenet Newsgroups they posted messages to, with the exception of one individual who conducted a search to find an appropriate group. In order to download software, the user concerned directly accessed the Apple Home Page. To look for conference information, the addresses of the sites were already known. Where the Internet was used to consult an electronic journal, respondents knew the location of the journal concerned, with the exception of one person who conducted a search on AltaVista and retrieved a list of electronic journals.

iv. Reasons for using the Internet for information seeking

Convenience and speed of access, as well as the potential for time-saving, were the most frequently identified reasons for using the Internet for information seeking. For example, 'the book's not in my office and this [the Internet] is on my desk so it's a lot more accessible' [13]. In order to acquire a software upgrade, one user could have written to America but, 'it's just so much easier going to an FTP site ... that way, you've got the software you require in minutes' [2]. The interviewees used the Internet for images which 'people had already taken the time and effort to scan in on the Web' so that they could simply 'copy' them [22]. Access to electronic journals and bibliographical databases also offered potential time-saving because respondents did not have to go to the library. Likewise, posting a query to a Usenet Newsgroup or discussion group,

... doesn't take two minutes ... if nothing comes of it, it doesn't matter but if someone does know ... you're better off than having to search through loads of bits of paper [16].
The Internet was used to access information which was not otherwise available. For example, electronic journals were used where they were not held by the library. Interlibrary loans or personal subscriptions were considered expensive, and cost was therefore also a factor affecting use. Likewise, the data and computing facilities available via various molecular biology sites were not otherwise available: 'The only way to find this is over the Internet' [18]. When looking for background information, 'the medical library wouldn't have a lot in this area' [3], and institutional information, 'I wasn't sure the library would necessarily have the information' [9]. In addition, respondents used the Internet to access a wider range of information sources. The Internet was considered a 'route' to providing 'a broader coverage of the whole area' [6] and 'supplemented' other resources [4].

The Internet was also used to look for information in a different format. For example, educators wanted to present information to students in 'a graphic way' [4]. Three dimensional structures of DNA were used because, 'it's much easier explaining a point if you've got a model you can play with' [6]. Interactive CAL materials were sought as 'an alternative' to textbooks which might enhance the learning experience because they enable 'people to learn at their own pace and flick around', and the students, 'might pick up more' [6].

Respondents used the Internet to access more current information than was otherwise available:

> If I want the most bang up to date view on something then I might do a literature search or use the Internet. If it's something which I know has been around for a long time and it seems to be pretty well-known about then I might well go to a text-book [13].

In particular, bibliographical databases were used to access current information and the Internet was used to look for current commercial information. One person had access to the 'hard copies' of catalogues but 'they get out of date' and the Internet is 'more likely to be up to date' [13]. The Internet was also used to find 'any recent developments' which had been 'missed' by traditional sources [4]. Respondents felt electronic journals were available 'quicker' [6] and genetic data 'evolves so quickly, you can't really look it up in the journals' [17]. Where genetic data was available on CD-ROM, it was more expensive and the Internet provided access to 'a more up to date version' [29].
The Internet was also used because it was available: 'You use whatever services are available to you' [3]. In addition, respondents expressed a feeling of obligation to use the Internet: 'I felt as I was networked I ought to check something on the Internet' [23]. One lecturer expressed a feeling of pressure from students to use the Internet:

There might be things that I've missed [and] some student will put up their hand and say, "Look, what about this?", something that I had over-looked [4].

A further reason for use was curiosity:

It was new and it had just arrived on the computer and I thought it would be an interesting way to look ... it was mainly for the novelty [10].

The interviewees mentioned the ease of searching for information: 'I do find it quite easy to use and that's why I use it for a lot of things' [23]. They were familiar with the sources they used via the Internet and therefore considered it easier to use than the library: 'I don't really know where to start in the library because there are so many sources of information' [23]. Respondents also enjoyed using the Internet: 'It's visually appealing ... it is a bit more stimulating than the books on the shelves' [25]. The serendipity of information seeking attracted some: 'I quite enjoy that, going from site to site ... I quite enjoy that almost chance encounter' [7]. Finally, respondents commented on the advantages of browsing for information:

Nine times out of ten the useful information comes from information that you get in conjunction with the answer that you were originally looking for [9].

v. Problems with using the Internet for information seeking

Despite the many positive aspects of using the Internet described above, the interviewees also specified a range of problems which they encountered while using the Internet to look for information in relation to their work. In particular, they commented on the questionable value and usefulness of the information and the associated difficulties of finding resources of interest: 'You're searching for something, and you're looking for real things, and all you get is page after page of effectively dross' [28].
Difficulties were expressed in distinguishing between academic and non-academic material. For example:

There were things to me, as a person using it for work, that were quite distracting, like “what’s new” pages and “chat” pages ... that was actually quite difficult to find your way through [9].

Respondents felt overloaded by the volume of information which exacerbated their difficulties in finding useful resources: ‘There’s so much to use, you feel as though you can’t use it’ [1], and ‘you haven’t got time to wade through it’ [10]. Some felt any initial enthusiasm for using the Internet wore off: ‘It’s not something that at the moment is generating increased usage. It’s something that you have a flurry of using’ [10].

Some users felt they were more successful in their use of the Internet when they had ‘a proper address to start from’ [10]. Thus, they found useful sites and used them again rather than search for new material. For example, one person had initially spent, ‘endless hours wandering around getting nowhere’, but then ‘got bored of that’, and ‘found one or two places which are useful’ [25]. Sites were also recommended by colleagues or found by following the links from an institutional home page or other subject-based listing. A ‘picks of the week’ service was also mentioned [2]. Where respondents had searched for information, they were often disappointed with the materials they retrieved and felt they were missing out on available information. However, they also felt their use of known sites was limiting:

You just use a couple of things that you like and that’s sufficient to get the information ... you’re missing out on the better sites I would imagine [1].

Consequently there was a feeling that with ‘something like the Internet, the quality is perhaps reduced by the masses of information on it’ [23].

Respondents were critical of the search tools and mentioned the volume of irrelevant results, difficulties in narrowing searches and the time taken to examine results. They encountered difficulties in understanding how the search tools worked and questioned why the same search on different tools resulted in different material. Use of such tools was considered inefficient, particularly in comparison to traditional information retrieval tools, and the time taken to find information could not be justified:
At the moment it [using the Internet] takes up more time than the value you get from it because of the inefficiency of the whole process, and the waiting for something to happen, and then you find that it’s not what you really wanted anyway [10].

Time was a factor influencing use of the Internet generally:

When I’m busy and there’s pressure of work on, it’s the last thing I’ll use as a source of information, but when things are a bit quiet and perhaps I’m a bit bored or I can’t be bothered to look at books any more, then I find the Internet a really exciting source of information [7].

Where respondents did not have Internet access from their desks, they shared a terminal, or they only had access to older and slower computers, the Internet was used less. The speed of accessing the Internet was criticised, particularly by those who required access to images, and to alleviate the problem, the Internet was used in the morning. However, this was ‘not ideal’ [1] because ‘it lengthens the day’ [4] and was not complementary to working habits. Furthermore, some people felt using the Internet was ‘harder work’ than other sources [26]. In comparison, ‘a textbook, you can just pick up and flick through very, very quickly’ [26].

Other issues which were discussed were a lack of knowledge regarding how to look for information, the lack of formal training, and the consequent reliance on colleagues and self-teaching. Generally respondents did not feel this was problematic, but one researcher felt, ‘until people tell us how to use it in step by step instructions ... then I don’t think people are going to use it’ [9]. She felt the Internet was neither easy to use nor self-explanatory, despite feeling she was ‘highly skilled’ in ‘information searching’ because she used BIDS and Medline ‘with no problems whatsoever’ [9]. Other explanations were the user’s ‘level of interest’ [21] and intimidation: ‘There’s an awful lot of people who don’t use it ... because they’re intimidated by it or they ... don’t know what they’re doing’ [1].

4.3.4 Source evaluation

This section examines the interviewees’ evaluative comments regarding the sources which they accessed and used. As can be seen in Table 9, 74 sources were discussed in detail (i.e. respondents answered questions 2.1 to 2.12 about the source). In addition,
respondents drew comparisons with, and made evaluative comments about, a further 49 sources (Table 9). The evaluative comments are discussed below using quotations from the interviews for illustration. The comments relating to source evaluation are summarised in Tables 10 to 24 in Appendix B2.

i. Bibliographical databases

Various evaluative comments were made about a range of bibliographical databases (see Table 10). Essentially the database used was dependent upon availability:

> You have to use what is available. There are some things you would probably love to have available but they’re not. So therefore BIDS gets used a lot ... and Medline now because that’s available too [6].

In addition, respondents used the databases they were familiar with and which they had previously used with success: ‘I’m very familiar with Medline. I’ve used it before and it came up with the goods’ [21]. Furthermore, issues were mentioned relating to the accessibility of the databases, including the speed and reliability of access.

The subject area and journals covered by different databases were discussed. For example, one user felt, ‘if they’re only searching three hundred journals, then that’s of no use unless they’re all absolutely relevant’ [9]. Furthermore, ‘it is important that they inform you ... how many journals they are searching to put that information together’, including an ‘option to find out whether a particular journal is included’ [9]. The retrospective coverage of databases was also highlighted: ‘One or two of them haven’t got that ... many years to search information on’ [9]. The researcher admitted ‘most of the searches’ she conducted were ‘from 1990 to 1996’, but on other occasions she had ‘needed to go right back as far as it’s physically possible’ [9]. The comprehensiveness of coverage was also referred to: ‘If it’s not in BIDS, it’s not published. It’s all comprehensive. It does everything that’s published’ [1].

Bibliographical databases were used to identify any articles which were required in full or to make an assessment of material where the full article was unavailable. Consequently, users were frustrated where abstracts were not available: ‘It is ideal to have an abstract and if every reference had an abstract, then how wonderful the world
would be' [21]. Likewise, abstracts were criticised for not providing the appropriate information or information in the appropriate level of detail:

The title and the authors are not enough. I need to know what was in the meat of the article. And if they just put two or three lines in, leave out the methods and the results and just put the summary ... I [then] know whether it's something I need to be aware of, or I can reject out of hand quite quickly [5].

Respondents also felt 'it would be nice if the whole article was there' [8] but were aware that this was not possible in the bibliographical databases discussed.

The interviewees accessed bibliographical databases for the 'latest articles' [5] and therefore mentioned the frequency of updating: 'That's up to date, updated every week or twice a week, so that would generally be my first choice' [1]. One user highlighted the time delay between journal publication and appearance in the database:

The only slight criticism is that it can sometimes be not fast enough ... sometimes you really want to have what was printed in the journal last week [21].

Evaluative comments were made regarding the searching and browsing facilities available, including the availability of author, title and subject keyword searching, the ability to limit by publication type or to a specific date range, and the ability to browse results. One individual referred to indexing effectiveness:

All you can search on is the abstract, the title and the keywords. It is possible that an article might contain some information that you might be interested in that wouldn't be indicated by the abstracts or the keywords, though as a rule they are [8].

The output facilities were noted, including the ability to return results via e-mail. Data transportability was also mentioned as users downloaded material into local reference management packages, and one person had encountered difficulties with downloading references from EDINA as she 'couldn't actually put that information into [her] own database' [10].

BIDS and Medline were accessed because they were easy to use. For example, one user felt she was 'not that computer literate' and had not received 'any training' but
managed to access Medline, and to get the data [she] wanted very easily'. She therefore commented, 'that is why I specifically like it' [21]. However, others were critical of BIDS. In particular, they were critical of the interface and found the system difficult to search effectively: ‘Sometimes I find that is not as friendly as it might be and it's not easy to get what you’re looking for’ [3]. BIDS was not considered 'intuitive' because 'you don't know where the screens are until you've played around' [5], and time is required to learn to use and navigate the system. In addition, one interviewee felt ‘two or three pages to show you how the screens are linked together' would be valuable [5].

The reputation of Medline was referred to. In addition, the interviewees felt the databases were a reliable source of information because they contained references to refereed journal articles. However, they had found errors 'in terms of references' which was 'hugely irritating if the volume number is wrong, or the page number' [6], and felt, 'anything to do with references and literature ... it’s important it's right’ [6].

One person received Current Contents on disk each week and compared it to BIDS in terms of its ease of use, the interface available and the frequency of updating. Another drew a comparison between the coverage of the different databases she used.

ii. Computer Assisted Learning (CAL) materials

Two people discussed examples of CAL materials which they had accessed via the Internet (Table 11). The first was a lecturer looking for a package to supplement existing teaching materials and the second was a student interested in computer-based methods of learning. Both used the same package which was described as ‘excellent’ [6] and ‘outstanding in terms of quality of information’ [30]. The interviewees also accessed a range of other sites which they compared in terms of their overall usefulness.

Sites were used because they were ‘useful and appropriate’ [6]:

It was appropriate for the level that we wanted to teach the students ... there’s obviously no point presenting things which are either too low or too high above the level that we need them to learn at [6].

The subjects and types of resources covered, the facilities available, and whether there were pointers to further information were mentioned. For example:
It gives them both the clinical relevance of the disease symptoms, ... all the diagnosis, all the procedures that are gone through, images of what the disease looks like and how to spot various things [6].

Currency was also identified in relation to the topics covered:

Some things, like ECG Tutorial, it’s probably never going to change. There might be a new way of presenting a squiggle on a piece of paper, but the basic message will always be the same [5].

The respondents mentioned the reputation of the originating institution and the reliability of the original source of information (whether it had a research basis), as well as the accuracy of the material: ‘We would check quite carefully ... because it is very easy to find somewhere that does not give out useful information, or even disinformation’ [6]. One user had also examined reviews for various packages.

The presentation, layout and arrangement of CAL materials were important factors affecting their use as the interviewees were interested in interactive material which presented information ‘in a slightly different way from a textbook’ [30]. They commented on whether the sites had used the technology appropriately and whether they would enhance the learning experience. One user felt that if the subject area had not been appropriate, he ‘could always work on their Web site and use the way they've arranged the data for [his] own purposes’ [6]. He also commented on the layout and arrangement of the information and wanted material which was ‘pleasing to the eye’ and ‘doesn’t irritate’ because ‘there are too many buttons, too many things to click on, or too few things to click on’ [6]. In addition, ease of using and navigating CAL materials were highlighted.

Speed of access was also referred to, both in relation to the location of sites and whether thumbnail images had been used to improve access speeds:

It’s better to have pictures on a page that you can call up when you want to see them, as opposed to always downloading all these large and detailed images because it takes too long [6].
iii. Current Awareness Services (CAS)

Three interviewees discussed sources which might be described as ‘Current Awareness Services’ (CAS) because they provided access to current awareness information about journals (Table 12). One described the services available from Biomednet, including access to ‘recent’ journals, and a fee-based service for the full-text of journals [30]. He compared the service to others available: ‘They give full-text as opposed to just abstracts’ [30], and commented on the intended audience of the material: ‘Some things are relevant to medical students but there’s a lot more ... for people in specific fields of research’ [30].

A second user mentioned a service which he did not find helpful because it did not cover an area of interest to him. However, he felt a service in the relevant field, ‘would be quite nice ... because keeping up with publications is very, very difficult and very time-consuming’ [3]. Another person did not find a service helpful because:

You only get the titles and it’s such a slow journal, I get the e-mail three months before we get the journal, so by the time you’ve got the journal I’ve forgotten what I was interested in [28].

iv. Catalogues

The American Tissue Culture Collection (ATCC) catalogue, a ‘publicly available’ catalogue on the WWW [16], was discussed by two individuals (Table 13). One commented on its coverage, including whether Europe was covered, and also mentioned the intended purpose and that, ‘they’ve done what they set out to do’ [11]. The second referred to its overall usefulness of and that it was a unique source of cell line information.

One interviewee noted the ease of navigating the site: ‘It was a simple matter of clicking on the relevant icons to take you to the right page’ [16], and both commented on the ease of use of ATCC. However, one was critical of the meaningfulness of the system messages: ‘This is rather stupid. I would prefer them to say, “We can’t find it”, rather than, “Empty Gopher menu”’ [11]. The respondents also noted the availability of search facilities for accessing material, the ability to order material via the site and the availability of contact information for ordering cells.
Both users assumed the catalogue was accurate because it contained factual information about the items in stock: ‘I would like to believe that somebody could make a catalogue that had the items listed correctly’ [11]. Furthermore, the motivation of the people producing the information affected their perceptions of the reliability of the information: ‘I would have thought they could be reliable to tell me what’s there because that’s what their job is’ [11].

v. Databases

One respondent referred to the Wisdom Database at the Wellcome Centre, a database of funding information (Table 14). Problems with the currency of the information and the frequency of updating were mentioned: ‘They don’t update it very often’ [6]. This was problematic because the deadline for funding proposals had passed. Therefore, the user concluded: ‘If you’re going to have a service, you have to keep it up to date otherwise what’s the point in having it’ [6].

vi. Electronic journals

An electronic journal was discussed in detail by one interviewee, and two others commented on factors affecting their use of electronic journals generally (Table 15).

Electronic journals were accessed via the Internet because the printed equivalent was not available in the library and they were therefore evaluated in the same way as any other journal:

There’s no difference between the electronic version and the paper version from the point of view of what I would and what I wouldn’t read [20].

In the example discussed in detail, the respondent was looking for a citation and encountered no difficulties finding the article he required. He did not question the reliability of the journal because it was ‘refereed’ and because he had ‘no reason to believe it’s not a direct copy of the paper version’ [2]. Another ‘would not read a journal that is published on the Internet which was not refereed’, and if it were not refereed, he ‘would not take it very seriously’ [20]. A third commented on the genealogy of
electronic journals: ‘I’d be more suspicious of a journal that didn’t have a written 
version because ... it means it is very new’ [6]. He ‘would probably check how they 
were doing their peer reviewing’ and ‘who is on the editorial panel’ [6].

Cost was a deciding factor in whether respondents accessed electronic journals. For 
example, one person thought their availability sounded ‘attractive’ but added ‘of course 
you would have to pay for that service’ [3]. Another had used an electronic journal via 
the Internet until ‘they closed down free access’ [22]. The service had been of value 
because the library did not subscribe to the journal, but the user did not wish to pay.

One individual mentioned that only current issues of a journal were available via the 
Internet, and ‘the highest quality sort of print-outs require a particular piece of software’ 
[20]. In order to access the software, he had followed a hypertext link and downloaded it 
without any problems. Another user also mentioned he would access electronic journals 
via the Internet ‘as long as it’s a good quality download’ [6].

vii. Frequently Asked Questions (FAQ) files

A Frequently Asked Questions (FAQ) file on HIV testing in ante-natal care was used by 
one interviewee (Table 16). She found the FAQ interesting but not directly relevant to 
her query because the particular issue she was interested in was not covered. In addition, 
she could not use the material because ‘it’s not academic’ and the level of detail was not 
appropriate: ‘This is very basic ... it doesn’t say anything new to me’ [23]. The FAQ 
contained ‘personal opinions’ rather than ‘evidence based or well-established’ 
information and the author ‘could be absolutely anybody’, including ‘a voluntary person 
who had a personal interest’ in the subject [23].

viii. FTP archives

One respondent discussed an example where he had used the Internet to access software 
via an FTP archive (Table 17). He wanted a specific piece of software and directly 
accessed the appropriate organisation’s archive (Apple). The availability of a mirror site 
and pointers to further sites for ‘if one site’s down’ were mentioned [2]. The individual 
used the Internet because he wanted an update ‘as quickly as [he] could get it’ [2]. He
felt the site 'was very easy' to use and the only limiting factor was the speed of access when trying to download large files.

ix. Image-based information sources

Use of the Internet to access images was discussed by two respondents (Table 18). The first was looking for images of the embryology process for teaching purposes and the second, images of caterpillars for his thesis. The first user found a site containing 'some nice graphics' covering the appropriate subject area [4]. He was critical of the site because 'it was American and had American jargon' [4] and because the images were 'two dimensional' [4]. He wanted 'to see some sort of video graphic or a three dimensional graphic' [4]. However, the other sites 'weren't as good' and they 'didn't have such a nice combination of text and graphics' [4]. In addition, the site was easy to use and contained a number of useful navigational aids:

You could jump between images or jump to the next section ... you could flick between the various sections, and then you could go back to the sort of home page [4].

The second person 'found some very nice diagrams showing the virus life cycle' and a page containing images of 'bacillus virus infected insects' [22]. He commented on the coverage of the sites, including bias towards particular subject areas, as well as the availability of copyright information, the image format and the overall quality of the images: 'Sometimes the diagrams ... are fairly badly formatted or are fairly illegible or sometimes in a format that may not be suitable' [22].

x. Molecular biology resources

Twelve interviewees discussed their use of molecular biology resources (Table 19). This group accessed a limited number of sites regularly and used the sites they were familiar with or had used previously: 'It's so good. I've used it before' [1]. In addition, they used sites which had been recommended to them by their colleagues or at talks and presentations, where they knew the site maintainers, or where they had followed a reference from an article.
Users were obviously concerned with the coverage of sites and whether they ‘focused on a particular interest’ [8]. The comprehensiveness of coverage was mentioned: ‘If the information isn’t there, then it means the information doesn’t exist with that source. It’s pretty comprehensive’ [1]. Sites were also used because they provided access to a range of different databases or software for analysing data. For example: ‘There’s lots of different programmes, there’s lots of links as well to other databases, and other tools for protein analysis’ [1]. In addition, some sites were used because they were unique. For example, ‘the information that we want is only in one place’ [18] and ‘it’s the only source for that information in the world’ [19].

There was some overlap between the sites and therefore: ‘I usually go to the EBI because the link is faster to Cambridge than it is across the continent’ [20]. In addition, the currency of the data and the frequency of updating were mentioned: ‘The difference will only be in how recently it’s been updated’ [20]. Respondents were critical of sites which were not updated: ‘One of the problems I find with the OMIM [Online Mendelian Inheritance in Man] is that it gets out of date’ [1], and commented on the process of updating. For example, one site was updated by ‘a full staff of people’ [18], and another was updated ‘automatically ... as they generate it [the data]’ [19].

Sites were used to search for and compare genetic and other molecular biology data. The interviewees therefore commented on the search facilities available, including keyword access via gene or organism name, the ability to search by item accession number, and data comparison and alignment facilities. For example, users mentioned ‘blitz’ and ‘blast searches’ which ‘check all the sequences in the database’ [1]. They also commented on the output facilities available, including the ability to download data and to return results via e-mail or FTP. Factors relating to data transportability and the use of non-standard characters to represent DNA were mentioned as problems had been encountered while searching for and downloading data:

They don’t even vaguely pretend that any of their character maps are written according to a standard ... and if they’re not written according to a standard ... then you can’t search for them [28].

A number of other facilities were also mentioned, including the availability of three-dimensional images of protein structures, links into other databases, and links into
Medline for access to published information. Two people mentioned the provision of file storage space for site users.

Some general comments were made regarding the presentation of sites, such as whether they were 'well-designed' [12] and 'clear' [17]. One person felt that 'pretty' pages were acceptable but frames did not appeal to him [15]. The interviewees generally found the sites easy to use and commented on their intuitiveness. For example:

You could use it ... having never used it and be up and running within a couple of minutes. You don't need any specialist knowledge at all [1].

However, some felt prior knowledge was necessary to use particular sites: 'You know where to look and where to go ... you just need a bit of a background' [17]. One person commented on the time taken to find data: 'You have to go through a lot of layers of menus to get to the information that you want' [18]. Others were critical of the lack of help information and felt help should have been readily available where required. One user described a convoluted process he had devised for data input:

It's unclear from the page exactly how they want the information. They say they want it in "Fast-A format" but I don't know what "Fast-A format" is. And they could really usefully say ... "This is how we would like the information" [19].

He also suggested, 'a filter' to 'reformat' the data automatically 'in the right way' [19].

One of the benefits of accessing molecular biology data via the Internet was the speed of access. However, it was also a limitation: 'The only real problem is the speed of it' [17]. The interviewees mentioned the availability and location of mirror sites which 'makes it easier' [18]. One user also mentioned a site which 'always seems to be moving ... which is a pain' [28]. Other restrictions to access included registration, cost, the use of passwords and the need for membership of a relevant organisation. Individuals found such procedures 'frustrating' as they could not immediately access the data [19].

A range of errors had been encountered while using sites, including typographical errors which might easily alter the meaning of the data, and the misnaming of genes. Errors also arose during the sequencing of data:
When they sequence genes, they don't always get the sequence right ... they
don't submit it knowing it's wrong, but they submit the best they've got [20].

However, respondents were unconcerned about the errors they encountered and felt it
was not always essential that the data was accurate. If an error was suspected, they
might verify the data in other sites, journal articles, by asking their colleagues, or by
repeating experiments. However, one person commented:

The whole sort of biochemistry, molecular biology community relies upon
that [the accuracy of the data]. It's a central repository of this kind of
information, and we assume it's accurate [8].

Factors affecting perceptions of accuracy included the style of presentation: ‘The sort of
style in which it was presented made me feel it was [accurate]’ [10]. The institution
concerned and publication of the data were mentioned: ‘The White Head Institute has a
very good reputation ... you would rely on it’ [18]. In addition, the reputation and
expertise of any funding organisation and of the country of origin were mentioned. The
interviewees also had some knowledge of the processes involved in data entry. For
example:

I understand how the data is collected, how it's put into the database. So I
know there is a possibility of errors but I also know that they try and
minimise them. So that enables me to make a decision about how accurate I
think it is [8].

Other factors which were mentioned were a refereeing process, the availability of details
of the researchers who had submitted the data (and their knowledge and expertise), as
well as references to publications.

xi. Organisational sites

A range of sites were discussed which might be described as a home page for a
particular organisation (Table 20). The predominating factor affecting the sites used was
the organisation concerned, particularly as such sites were used to locate details about
the organisation concerned, to access contact information for individuals within the
organisation, or to access information produced by the organisation.
The subject areas covered and the overall value and usefulness of the information were
discussed. For example, one site initially sounded 'a bit of a prank', but 'was actually
quite informative' and 'an unexpected find' [3]. Users were critical of the level of detail
provided. For example, a departmental site contained 'a bit of text about who works
there and what field they're in' but 'no real meat' [28]. Some sites were used as a
starting place to look for further information and therefore the availability of pointers to
further information, the coverage of any links and their consequent value, were
discussed:

The kind of organisation that our home page has is useful, because it covers
... the major areas of biology that people are interested in and then it gives '
you links to big places [17].

In addition, the interviewees commented on the currency of information and the need for
updating: 'A site that's telling you about current research in the department, it has to
change' [5]. The accuracy of the information was also highlighted. It was assumed that
factual information about the organisation would be accurate and that the information
was as accurate as any paper-based sources produced by the organisation:

Bearing in mind that this is a government department, the information is
going to be as accurate as any published source ... from their Department
[24].

Perceptions of the accuracy and reliability of the information were dependent upon the
institution concerned:

If it was a large institution or academic or commercial institution that I
knew of, and it was a page of theirs, then I would obviously be quite
confident in what I have. If it's a source which I don't know anything
about, or say a less respectable institution or site, then I think you have to
treat it with a little bit of scepticism [3].

However, some respondents noted the problems of relying upon information on the
basis of the institution: 'There might be sort of bias on my part, accepting everything
that the MRC says' [4]. Other factors included:

It's a professional company. I know the people there. It wouldn't be of any
advantage for them to put information which wasn't entirely accurate on
there. I think you do accept certain professional standards which would
mean that I have got no reason to doubt that the information is accurate [2].
The sites were considered easy to use and navigate: ‘They’re all so similar that it doesn’t matter which thing you’re using’ [24]. The simplicity and clarity of the pages were highlighted, as was the effect of presentation on ease of use:

\[\text{It's one of those pages that's very graphical ... it's very, very pleasing to the eye, and very easy to manoeuvre around. There are pages where information can be presented in a rather dull and drab and incoherent way. But this one is very easy [2].}\]

One person discussed the categorisation of information, the use of navigational features and the meaningfulness of the links between pages. Another mentioned the availability of images and whether they were necessary. The language of material from Europe was mentioned, as was the speed of access: the information was ‘easy’ to find, but ‘difficult in terms of time and effort, because it’s so slow’ [9]. Comparisons were drawn between the different sites in terms of their ease of use, the level of detail and the arrangement of information. For example, ‘I do get a lot of the MRC literature ... but this was much more extensive and it had it all classified and categorised’ [4].

xii. Personal Home Pages

Various examples of personal home pages were discussed (Table 21). One user had been searching for information on plutonium and retrieved the home page of an individual ‘who had changed his name to plutonium’ [3]. Others had accessed the personal home pages of patients, one with Hodgkin’s Lymphoma and another with HIV.

The respondents discussed the overall value and usefulness of the information available via the home pages. One page was described as ‘a bit amusing’ but also ‘a time waster’ [3], and another as ‘an incredibly elaborate home page’ which involved ‘an enormous amount of work’ and contained ‘all sorts of interesting information’ [28]. The interviewees commented on the novelty of pages: ‘I’ve never seen anything like that before’ [28]. The contents and features of pages were mentioned, such as the inclusion of detailed diaries from patients, or lists of ‘publications and references’ [19]. The interviewees also commented on the currency of the information and the availability of links to further information of interest.
xiii. Search facilities

Respondents made a range of evaluative comments about the search facilities they used (Table 22). As mentioned earlier, they were critical of the search tools and mentioned the volume of irrelevant results, difficulties in narrowing searches and in understanding how the tools worked. For example:

Some of them you can put in your words and then you can restrict to certain categories, but the categories seem to be fairly vague ... and still I've come up with reams and reams of stuff that really doesn't seem relevant [28].

One person mentioned the duplication of the same sources in his search results and that he only wanted a link to the top page of a source. Three others mentioned the problems of restricting results to medicine so that when they input a term such as 'virus', only references relating to the medical definition would be retrieved. The search tools were not considered easy to use and the lack of help information was criticised: 'It would be nice to go on to Magellan ... so that it really explains how you should go about searching it' [28].

Other comments related to the comprehensiveness of coverage and the limitations of tools because they were restricted to WWW-based resources:

Some how pulling those things together would be an ideal source of information ... so you typed in “yeast” and “vacuole”, and what you got back would be a list of resources that might be links to Newsgroups, that might be links to peoples’ home pages ... there might be links to databases if that’s appropriate [8].

In addition, the speed of searching and the reputation of one tool were mentioned.

xiv. Subject-based WWW sites

A range WWW sites were discussed which could not be described as ‘personal’ or ‘organisational’ home pages, but which focused upon a particular subject area (Table 23). For example, one medic discussed a site providing access to information on garlic. The site was used due to the subject area and the breadth of coverage. It covered ‘a whole range of natural products’, and provided ‘the depth and range of interest’ that was
required [5]. The site provided references, pointers to further information and contact
details. The respondent was impressed with the level of detail, particularly in
comparison to other sources, and the professional lay-out and arrangement of the
information:

Some of the sites we found rather transient. The way this was organised
suggested it wouldn't be a transient phenomenon, there one day and gone
the next. This looks like somebody is going to keep it up to date because
it's put together well in the first place [5].

A second interviewee accessed an encyclopaedia for paediatrics. He was critical of the
site because the authors were not evident from each page of the source and 'it wasn't
very interesting' [26].

Three respondents discussed sites which primarily provided links to sources within a
particular subject area. These were valuable for finding information, rather than as a
source of information in their own right. The subject area covered, the
comprehensiveness of coverage, and the selectivity of the links were mentioned. For
example:

They claim to have all the virology sites in the world ... if you find another
site you can tell them and they will obviously investigate it and see if it's
worth putting on [22].

The availability of descriptive information was mentioned: 'The link gives a short
description of what the site had' [22]. Users also commented on the currency of the
information and the usefulness of identifying 'the date [a site] was last modified' which
saves the user from 'trawling through the same old information' [22]. They were not
critical of indicators that sites were 'under construction', but instead associated this with
updating: 'It's often nice to see ... "These sites are under construction" or "Frequently
updated\"' [22]. Search facilities and the layout and arrangement of links were also
mentioned:

It would probably take a very long time to scroll through a list on all that,
so it was useful that it was in a fairly sensible order [22].

Two interviewees highlighted the knowledge and expertise of the site maintainer: 'It's
important that someone who knows what they are doing has ... set that up' [16].
One interviewee had accessed a site for telemedicine which provided details of research in the area, links to commercial sites for information on equipment, as well as links to related projects and other sites. He commented on the subject area covered, the inclusion of a bibliography, the currency of the information, the availability of a facility to update information about his research, and noted: 'It's quite a new site. It's improving all the time' [25]. He felt the site was well organised and easy to use.

xv. Usenet Newsgroups and discussion groups

A number of interviewees discussed examples where they had posted queries to Usenet Newsgroups or discussion groups, browsed the discussion via a Usenet browser, or followed the discussion of an active group (Table 24). The respondents did not distinguish between Usenet Newsgroups and discussion groups (hereafter, groups), with the exception of one person who mentioned the different modes of access. They are therefore dealt with together.

The interviewees were already subscribed to the groups or frequently accessed them via Usenet, but also mentioned finding out about new groups through other groups, colleagues, reviews in journals and training courses. Observations were made regarding their overall value and usefulness. For example, one group was described as 'a source of rubbish' [18], while another was 'a phenomenal information resource' [13]. The groups were considered a useful means of keeping up to date with research and other interests, and the subject area covered was obviously the over-riding factor affecting those used. Other issues included whether the participants were local, national or international. For example, one user was interested in 'a British list' due to the irrelevance of material posted on American lists [26]. Other users mentioned the nature of the material, such as whether 'new WWW sites of interest' were posted [8], as well as job advertisements and meetings information.

Groups were also used to seek the advice or opinions of others. Therefore, the knowledge and expertise of the participants was a factor affecting usage. For example, one individual 'wanted to get the opinion of other people, [his] peers, as to what they would do' [26]. Additional factors were the number of people subscribed:
You get about eleven hundred people on this world-wide so that's a phenomenal information resource because there's a very good chance if you're having a problem with something ... someone somewhere else has already seen it [13].

Some comments were made regarding the volume of material posted. For example, 'you get lots of messages in a day and it's too much' [24]. The volume of postings obscured relevant information and users had consequently unsubscribed or stopped reading particular groups. However, one user had been disappointed with the lack of response to his enquiries and felt 'there's something to be said for having a lot of general information available, even if one trashes the e-mails without reading them' [29]. Another respondent was particularly critical of unmoderated groups. He had found a group 'very useful' until 'it became an unmoderated group' when:

All of a sudden, noise came in, and you'd log-in in the morning and find fifty or sixty postings, and it was a total waste of time from there on [27].

However, moderation did not necessarily affect the groups used by the other interviewees: 'Those are the subjects that I'm interested in so I would look at them anyway' [16]. Some commented on the benefits of unmoderated groups: 'It's not moderated. That's part of the beauty of it ... It can make things a bit anarchic at times' [13].

A range of features and facilities were mentioned, including the ability to search an archive, as well as the retrospective coverage of the archive. Features of discussion groups included whether there was a list administrator or whether subscription was automatic, and whether administrative messages were posted to the group. In addition, the availability of information on the scope and purpose of a group was mentioned.

The reliability of the information retrieved via Usenet Newsgroups and discussion groups was questioned. In particular, there was concern regarding 'who's replying to messages' and 'on what authority' [16]. The information was compared to other sources: 'You can't expect the same level of accuracy as you would from BIDS' [8], and one person preferred to ask his colleagues: 'I know whether I can rely on what that person tells me' [18]. However, one individual adhered to the medical advice given by list participants, and the same interviewee used the responses from a discussion group for a legal report: 'I said, "I put this case on the Internet and eight out of ten people said
they would have behaved the same way that Dr. X did”” [26]. He recognised the need to be critical of the information but felt:

One makes a judgement about the accuracy of it [information] wherever one finds information ... that's probably scientific training, to query information that's available, and that includes peer reviewed journals [29].

Whether or not the interviewees relied on the accuracy of the information was dependent upon a number of factors, including the nature of the information. For example, factual information was considered easy to verify but ‘more open or discursive’ information required more ‘caution in deciding when it's reliable or not’ [16]. Different participants were recognised and users were wary of those who frequently posted messages: ‘You just can’t know everything about everything’ [16]. The ‘reasonableness’ of the information affected perceptions of reliability, particularly if ‘all other sources of advice’ had been ‘exhausted’, and ‘if it seemed like a reasonable course of action’ [26]. In addition, whether sources had been cited in a message was noted because ‘if they're any good, they back it up with references’ [13], and ‘that’s something you can check up on yourself’ [16].

4.3.5 Information quality

The final section of the interviews examined general perceptions of information quality. Respondents were asked what factors affected the sources they used, their perceptions of quality and their perceptions of reliability. Comparisons were drawn between information available via the Internet and information in other sources, particularly refereed journal articles.

i. General factors affecting quality and reliability

The reputation and experience of the author affected perceptions of the quality of a source. For example, ‘If you’ve got very good people that write lots of things ... then you’re going to have a good source of information’ [16]. Similarly, a well-known and reputable organisation involved in the production of a source affected perceptions of quality: ‘It depends on the qualifications and the magnitude of importance of the centre’ [3]. However, respondents were aware that material could be biased by an author or
institution, as well as by publishers or sponsors: ‘Certain people can put more emphasis on things than I believe is correct’ [1]. Likewise:

If you think of the tabloid papers ... there's a factor in the quality, and that would be influenced by a political party or the ownership of the newspaper or their vested interest [23].

The reputation of a source was considered an indicator of quality: ‘Everything is the reputation of the source’ [26]. In addition, whether a source had been recommended, and by whom:

If my boss came along and said, “I've found a really good book. You must get hold of it”, then I would assume that it is alright [28].

A range of factors were mentioned relating to the content of sources, including the level of detail, whether information was based upon research or opinions, the breadth of coverage and factual accuracy. The lack of ‘real information’ available via the WWW was highlighted and users selected material according to whether it looked likely to be ‘wishy-washy’ or whether it would have ‘any meat’ [28]. Currency and updating were also mentioned: ‘It's got to be kept up to date. So it's got to be a living page rather than a dead page’ [5]. Further factors were the intended audience, the availability of references to published sources and pointers to further sites. The style of writing was also highlighted:

If it’s written well, you think, “Yes this is a good paper” ... I don't know how much that affects the quality of the information, but it certainly affects whether or not you are going to read it. And if it’s written in appalling English ... I would automatically be sceptical about the data as well as the quality of the information [28].

Various factors were also mentioned relating to the presentation of information such as whether ‘something is well put together’ [1] and ‘well thought out’ [6]. Clarity of presentation was mentioned, including the ability to identify easily ‘keywords’ [12] and the need for a minimal number of clicks to locate required information within a WWW site. For electronic information, ease of use was considered important: ‘If it’s not easy to use, I would probably choose to use another system that might not give me such good quality of information’ [9]. Users commented on the aesthetics of screen design and wanted sites ‘to be attractive so that you want to use them’ [19], but not ‘gimmicky’,
which was considered 'cheap and tacky' [4]. They highlighted the physical appearance of material, including the availability of an index, or 'a good menu system' [5], and the screen design and layout:

It’s got to be a nice blend between the background and the foreground. The font has got to be easy to read. The important headings have got to draw your eye to them, so they’ve got to stand out in bold or block capitals or whatever to make the information easy to access [5].

One interviewee discussed the importance of the first page of a source in indicating content.

Another factor was accessibility as users wanted WWW sites which were easy to find and ‘readily available’ [2], as well as fast to access and ‘consistently available’ [2]. Others mentioned the time taken to access information via the Internet, including the effect of site location: ‘I use sites in this country ... it is extraordinarily frustrating trying to use sites in the States in the afternoon’ [19]. Likewise:

I don’t like it when they’ve got lots of graphics in ... because it takes ages to load them. So I tend to find that if it’s taking a long time, I’ll stop loading and try somewhere else ... I tend to get things that are easy to get and if it’s proving difficult, I’ll ignore it [7].

One person mentioned problems associated with the ease of updating and changing electronic information. He felt it was 'easier to have a text book' because ‘it isn’t changing and you can get to know your way round it, whereas the Internet can change' [13].

Issues relating to presentation affected the ease with which information could be accessed and used. However, these were considered secondary to the content of a source:

Appearance does matter. It’s not the be-all and the end-all of it or anything like that. If you’re faced with a really good looking page that’s easy to read, you’re more likely to read it, you’re more likely to glance your eye over it [28].

Likewise: ‘High quality is about the content of the source ... it’s mainly to do with the content rather than the presentation’ [7].
Factors affecting perceptions of the accuracy and reliability of sources included whether information was from a 'reputable' institution, a refereed journal, or an unknown individual:

If it was an official page or a journal page or something like that, I would feel happier ... you're never one hundred percent sure if it's personal [24].

The expertise of the author was mentioned:

It depends a bit who said it ... is it a lay person out there who has got an interest in something like flying kites, or is it somebody who is researching in how kites fly in the air? [23].

Other factors were the reputation of the source, quality of presentation and provenance: 'The reliability of a source of information is much more to do with the provenance of that source' [13]. Journals were considered reliable due to the refereeing process: 'It may not be the best research in the world, there may be flaws in the methodology, but at least it's been peer reviewed' [5].

Whether or not the interviewees would rely on a source was dependent upon the nature of the information and the purpose for which it was to be used. For example, 'things to do with ethics ... you've got to be a little bit more sceptical' than material on anatomy intended for teaching purposes [7]. They did not use the Internet to access information which they needed to rely upon but used other sources, namely refereed journal articles. For example, for 'something important', one interviewee would 'look in the scientific literature' in order 'to see that the basis of whatever it is they were saying is sufficient', but added, 'it depends how important it is' [8].

Respondents relied on their own knowledge and expertise when assessing accuracy, and where a source contained accurate information, they were more likely to rely on any other information from that source. For example:

If they've got ten points that they're making, and if you know one to eight are right, then I suppose you are going to say, "Well, nine and ten probably are as well" [28].
Individuals would also attempt to verify information elsewhere by conducting a literature search, examining any references or reproducing the results.

ii. Use of the Internet and journals

Refereed journals were considered highest in a hierarchy of information sources: ‘You tend to regard refereed, peer reviewed journals as being the main source of information to quote’ [3]. They were regarded as more reliable than information available via the Internet due to the refereeing and editing processes which were seen as quality filters, enabling increased confidence in the accuracy and reliability of information. For example:

The problem is, whereas most of the journals I would read are peer reviewed ... anyone can put anything on the Internet. It goes back to the quality, and although I might believe it because it’s a government department, it still hasn’t been through peer review [24].

Respondents felt quality information was published in journals and ‘therefore won’t be available on the Web’ [29]. Consequently, they used the Internet ‘as a source of reference information rather than ... for information about [their] scientific field’ [11]. However, some felt they evaluated information from the Internet in the same way they would evaluate a journal article. For example, one person would not ‘apply different criteria to what would be a high quality Web site’ [7], and another ‘would give the same sort of criteria to sources over the Internet as ... to printed information’ [18].

iii. Effect of the author

The interviewees looked at the author of a journal article to identify authors they were familiar with and ‘tend[ed] to make a judgement ... about the quality on the basis of an author that ... has got a good reputation’ [8]. Likewise, ‘if it’s the name of somebody who is a leading player ... then that’s going to give more clout to it’ [13]. Familiarity with an author provides background ‘on their approach to the work’ [17]. Where individuals were unfamiliar with the author of a journal article, they would ask others or conduct a literature search to determine whether the author had published elsewhere and in which journals.
However, articles were not selected on the basis of an author, other than when conducting an author search, but were selected primarily on the basis of their subject relevance. The author was ‘a secondary consideration’ [27]:

Anybody has a right to write papers, everybody can write good papers, and in a way, it shouldn’t matter who the author is. It’s the information in the paper that is important [23].

The interviewees also examined the author of WWW sites or pages to look for those they recognised and to identify their knowledge and expertise. For example, one felt ‘anybody can write anything’ on the Internet and would therefore look for ‘academics’ or authors with ‘the appropriate knowledge’ [23]. However, some felt examining individual authors on the WWW was problematic due to the numbers involved, and because ‘a lot of the stuff is from America’ and they ‘don’t know who these people are’ [7]. Moreover, the problems associated with finding author information were noted: ‘On some of the sites, you haven’t a clue who is the author’ [10].

Again, the over-riding factor was the content:

If it’s a magazine on the Internet and I was doing some research then I might be more inclined to look through and see who the authors are where I needed it. But it’s not that important to me ... It’s the quality of what’s there which is really the most important [24].

iv. Effect of the institution

The interviewees examined the originating institution of journal articles as, again, well-known and reputable institutions affected their perceptions of quality and credibility: ‘One always takes more seriously an article from a laboratory that’s well known’ [29]. Work from ‘a minor centre’ requires closer assessment in terms of the methodology and the sources of funding [5]. The institution also provides background information: ‘You tend to know what projects are going on ... in specific institutions’ [4]. Respondents also mentioned ‘reservations about countries’ [11]. For example: ‘So much of it is European or North America or Japan and ... if it’s from somewhere other than that, you tend to notice’ [8]. In addition, the country of origin affected the relevance of an article. For
example, one researcher concentrated on articles from Europe because articles from elsewhere were irrelevant to her work in the UK.

Again, individuals felt they would not select journal articles on the basis of the originating institution or country:

There might be a good piece of work that I’ve come across from an institution that I’ve never heard of, but it doesn’t prejudice my reading of it [4].

Articles were selected on the basis of their subject content and evaluated according to the quality of the work:

It [the institution] is something that I would glance at ... but if the information was relevant to what I was doing, and it was in a quality journal, then I’d assume it was a valid source of information [30].

The interview respondents did examine the originating institution of WWW sites or pages, and felt it took on heightened importance due to the number of individual authors involved. The institution concerned affects perceptions of the reliability and credibility of information:

You almost certainly recognise institutions like the CDC in Atlanta. That would make you stand up and say, “Right, OK, that’s a centre of excellence”, or Collindale for example. That’s ... the first thing I focus on [21].

WWW sites and pages were accessed because of the organisation concerned. For example: ‘You get sites from all around the world, and you do tend to favour ... institutions that are more reliable’ [30]. One person commented on the lack of refereeing of information on the Internet and the institution provided a filter:

On the Internet, not having any kind of referee for it ... you have to be a bit more cautious about it ... you look at something because it comes from, say, the Sanger Centre or The White Head Institute. You wouldn’t just look around for anything [17].
v. Effect of the date

The date of a journal article was used to determine its currency. It enables the reader to place a study in perspective, particularly as currency can affect the accuracy of medical information: ‘Some things are correct at the time and then they are superseded and outdated’ [1]. Respondents were interested in the date research was conducted and would also examine the date of article submission in comparison to the date of acceptance because ‘that tells you a lot about how much work they had to do in the meantime’ [6]. However, the need for up to date information was dependent upon the subject area concerned. For example, ‘certain fields don’t move particularly quickly’ [1], whereas ‘in something like DNA, it’s no good having a reference from 1990. It’s got to be 1995 or 1996’ [5]. In addition, the age of the information could indicate value as ‘some of the best stuff is really old’ [27] and ‘if you’re reading a journal ... if it was written in the seventies ... it sort of transcends time’ [28].

Some people felt the date of information available via the WWW was ‘very important’ [30] and affected the sites they used: ‘I probably wouldn’t bother to even open anything that was older than a few years’ [16]. They were interested in whether information had been updated: ‘The update is important. You can tell with some sites, they’re updated fairly regularly ... which is quite useful’ [5]. However, the currency of information available via the Internet was often assumed and many interviewees therefore felt they would not look at the date of material. For example, one stated, ‘I tend to think it’s all current’ [25] and another, ‘it’s never occurred to me that it could be old information that’s been hanging around there for years’ [7]. However, one user suggested the date of material might be an issue of increased importance in the future.

Furthermore, not all those interviewed had seen a date on the pages they had used, and the ease of establishing the currency of Internet-based information was compared with journals:

I would try and find that out, if it was relatively easy to find. I don’t think it’s as well organised on the Internet. At least with a journal, you know where the dates are [24].
vi. Effect of length of availability

Some of the interview respondents felt the length of availability had an impact upon their perceptions of the quality of a journal and of the articles it published. They felt they would examine articles from newer journals more carefully, including placing ‘more emphasis on who has written the article and what institute they are from’ [13]. Furthermore, two suggested they would not look at some new journals and others commented that newer journals might be less accessible because libraries might not subscribe to them.

The interviewees discussed a hierarchy of scientific journals based upon a range of factors, including the reputation of the journal and its impact factor, as well as the length of establishment. The position of a journal in the hierarchy affected perceptions of both journal quality and the quality of the papers it published. For example:

If it's a very well-established, a well-respected journal ... then you're much more likely to put more faith in things which appear in that journal [13].

Consequently, readers were interested in both older and newer journals, and reputation affected their use. For example:

In only the last eight to ten years, there have been a couple of AIDS journals have come out ... they're read by a lot of people and they are quite reputable, even though they are relatively new [24].

However, there were a range of other factors which affected the journals used, particularly their subject coverage. Respondents mentioned the disadvantages of older journals, including their ‘stuffy old ways’, the ‘set ideas’ of the editorial board [2], and the ‘more general medical’ coverage as opposed to ‘newer journals’ which ‘tend to be more specific’ [24].

Due to the newness of the WWW, the interviewees did not feel length of establishment was an issue: ‘It’s such a new medium that the length of establishment of a site doesn’t really give you an indication about much’ [2]. Individuals were more likely to examine sites because they were new and discussed conducting searches to ‘see if any new sites have appeared’ [22]. One person mentioned the popularity of sites: ‘You may look at the
number of times it’s been accessed if they’ve got a counter on it and think, “Oh, that’s popular” [2].

vii. Effect of presentation

The presentation of journal articles affects the ease with which information may be accessed and assimilated. For example, poor images and graphs may be difficult to decipher and users ‘want to get as much information out’ as ‘quickly’ as possible [2]. The style in which an article is written also affects ease of use: ‘Presentation, that’s more important, not in terms of what you might think of the data, but whether you struggle to read it or not’ [8]. One person mentioned the use of adverts which he found irritating because they ‘break up articles and destroy your train of thought’ [6].

However, presentation did not affect the journals or journal articles used: ‘It doesn’t affect whether or not I read it, no. It might annoy me, but it wouldn’t affect whether or not I read it’ [20]. Content was the over-riding factor: ‘If the information is good then it is going to be worth the effort to read it’ [13]. For material of peripheral interest, respondents felt they were more likely to read an article ‘if it looks easy and nice and clear’, whether or not it is ‘related’ to their work [17]. However, one person felt she would reject a paper if she could not decipher the data ‘because you’re then making assumptions about the way in which the data has been presented and ... you might be wrong’ [9].

Some interviewees felt the presentation of information available via the WWW was more important than with other information sources. Presentation affected the ease with which information was accessed and used, and respondents commented on the need for clarity in the layout and organisation of material, the use of large images and the necessity of images. For example: ‘Any graphics that are not necessary ... they prevent the information from coming through as quickly as possible’ [11]. In addition, the aesthetics of screen design were highlighted:

I find this quite important when you spend a lot of time in front of a VDU. I can’t stand things that flash and gaudy colours and stuff like that. I quite like just reading text on simple plain, grey backgrounds with blue thumbnail links [4].
Two of those interviewed felt the presentation of information would affect the sites they accessed and used. One felt that where there was a 'choice between more or less user-friendly' sites, he would choose 'the more friendly ones' [20]. However, others felt presentation was 'a secondary consideration' to content [2]:

More important is whether the site is interesting or not ... how it's presented for work is not really important. You can't get more boring than a journal article but you've still got to use them ... It's whether the information is good [24].

Moreover, one individual felt presentation was not an issue because all the information on the WWW was presented in the same way.

viii. Effect of refereeing

The majority of journals within health and medicine are refereed, with the exception of some 'newspaper type journals' [27], and respondents assumed that all those they used were refereed. They viewed the refereeing process as an essential quality filter:

If you've got a peer reviewed journal ... you tend to get fairly good and reliable information that's been reviewed by people who are already established in the field [16].

However, some were sceptical of the effectiveness of the refereeing process and felt it was 'easy to get refereed information published, even if it's not correct' [1]. Furthermore, 'sometimes referees are not that good so you go through the process but it's not particularly good or a shrewd process' [24].

With the exception of electronic journals, it was assumed that information available via the Internet was not refereed. Consequently, the information was considered to be less reliable and errors were the result of a lack of refereeing:

It's best to assume most of it hasn't been that well reviewed because you see plenty of mistakes ... you just see basic typos. If you think that people can still make basic typos on an electronic page then it implies that there hasn't been that much thought put into it [6].
Information available via the Internet was treated differently because it had not been refereed:

I don’t see it in the same way as ... a peer reviewed journal which is a contribution which is assessed for its scientific merit by a reviewer ... people can put anything on the Internet if they think it might be interesting to someone else, irrespective of whether it’s got any merit to it whatsoever. I think when you read it, you actually read it with that idea that ... that no one has assessed it for whether this is worthwhile information [7].

4.4 Information seeking questionnaire

One hundred and sixty two information seeking questionnaires were returned in total, a 27% return rate. Further details are provided in Tables 25.

As displayed in Table 26, use of bibliographical databases for literature searching and to look for background information in relation to research were the most common reasons for using the Internet (52% and 50% respectively). Other prevailing reasons were to access electronic journals (36%), to download software (31%), and to look for material to supplement teaching materials (22%). Fewer people had used genetic resources (17%) and information on funding (15%), or had posted a query to a Usenet Newsgroup or discussion group (14%). Thirty-five percent had not used the Internet for any of the reasons listed.

Further reasons for using the Internet were to access commercial resources, other molecular biology resources, conference information, or for communications purposes (see Table 27). Other uses were to follow the discussion of a Usenet Newsgroup or discussion group, for information on a particular area of work, and for information on courses. Each of the following were accessed by one respondent: patient education information, job information, news, and official information. One person had used the Internet to 'play'.

As summarised in Table 28, the factors affecting non-use of the Internet were lack of access (29 people) and lack of familiarity (28 people). Further reasons were: other people conducted any information seeking for the person concerned, the respondent lacked time to use or learn to use the Internet, other sources were adequate or more
relevant, and the Internet was considered of no interest. Four people expressed an intention to use the Internet and three commented on the speed of access. Three people used the Internet for communication purposes only.

4.5 Criteria development and validation interviews

Forty-two criteria development and validation interviews were held. Detailed notes were made during the interviews which were transcribed and analysed. The results are presented in a similar format and order to the first interviews, although the discussion of the results is obviously shorter. An initial section provides details of the interviewees’ research interests and the second section examines levels of use of the Internet in order to provide some background information. General comments regarding use of the Internet are presented in the third section. The fourth and largest section examines the evaluative comments regarding Internet-based sources. The evaluation criteria mentioned by the interviewees are summarised in Appendix B4 (Tables 36 to 48).

4.5.1 The interviewees

Table 29 provides a summary of the respondents’ job titles and main subject area of interest. As discussed in Chapter 3, the interviewees were all linked to the Clinical School at Cambridge University. Within this setting, a wide range of respondents were interviewed in terms of the disciplines covered and the positions held. Some respondents were involved in teaching, while others were primarily involved in laboratory based research or clinical practice within the hospital.

4.5.2 Levels of use of the Internet

The results of the Internet tools used and regularity of use are provided in Table 30. The majority of interviewees (90%) used their e-mail daily. Few read Usenet News (5% read Usenet daily, 7% weekly, 7% monthly, and 2% less than monthly). Gopher was generally not used (90%). The WWW was used by most interviewees (95%), with levels
of use dispersed among daily (29%), weekly (40%), monthly (17%) and less than monthly (10%). Sixty percent of the interviewees accessed FTP, either daily (2%), weekly (12%), monthly (19%) or less than monthly (26%).

As displayed in Table 31, ten interviewees (34%) were subscribed to discussion groups, 29 were not subscribed (69%), and three had unsubscribed from groups.

The results of the length of use of the Internet tools are displayed in Table 32. Over half of those interviewed (55%) had been using e-mail for more than two years, 29% had been using e-mail for between one and two years and 14% had been using it for less. The respondents had been using the WWW less than a year (29%), between one and two years (33%) or over two years (33%). Seventy-six percent had never used Usenet; of those that had, 14% had been using it for longer than two years, 7% between one and two years, and 3%, for less than a year. Similarly, 40% had never used FTP, but 29% had been using it for longer than two years, 34% between one and two years, and 7%, for less than a year. Gopher had never been used by 71%, but 26% had been using it for longer than two years and 2% had been using it between one and two years. Fourteen percent had been using discussion groups for less than a year, 10% between one and two years, and 7% for longer.

As displayed in Table 33, the majority of interviewees (69%) accessed the Internet from their own terminal at work, a further nine (21%) from a shared terminal at work, and twelve people (29%) usually accessed the Internet from home.

4.5.3 Context of source evaluation

In order to place the evaluation of Internet sources into context, this section examines any general comments regarding use of the Internet, examples where the Internet had been used to look for information, and reasons for use of the Internet. In addition, problems associated with use of the Internet for information seeking are considered.
i. General use of the Internet

The majority of the respondents Internet use was for communicating with friends and colleagues. Again, no one explicitly stated that the Internet was essential for work-related information seeking. However, the importance of Medline and BIDS was underlined and the dramatic impact of molecular biology resources on medical research was emphasised. The molecular biologists felt access to the Internet had made working life ‘easier’ and the Human Genome Mapping Project (HGMP) was described as a ‘source of essential information’ and ‘one of the tools of the trade’ [70]. Few people mentioned non-work related reasons for using the Internet, but examples included to access newspapers and computer games.

ii. Examples of work-related information seeking

A range of examples of use of the Internet for work-related information seeking were mentioned which are summarised in Table 34. Twenty-two people mentioned use of the Internet to access bibliographical databases and fourteen mentioned access to molecular biology resources. Other reasons were to download software, to access electronic journals, to look for contact information, and to look for background information for on-going research or a presentation. Respondents also mentioned looking for commercial, technical, funding, travel, conference or official information. The Internet had also been used to find out about a particular organisation, to browse a Usenet Newsgroup or discussion group, to look for patient education information or information about patients, and to keep up to date in an area. Five people mentioned looking for teaching materials, such as images or CAL materials, and three had looked for background information for teaching purposes.

iii. Information seeking process

The interview respondents were not asked how they approached looking for information. However, some mentioned that they did not use the Internet to browse for information and commented on the lack of organisation of information and difficulties in using search engines. The same sites were used regularly and the importance of recommendations from colleagues regarding useful sources was emphasised. One
individual had used a search tool to look for electronic journals, another had used a search tool to find an e-mail address, and a third, to find technical information.

iv. Reasons for using the Internet for information seeking

Again, convenience was a significant factor affecting use of the Internet as the interviewees had access from their desks and did not have to go to the library. Speed of access, the potential time-saving and the potential cost-saving were also mentioned. Some individuals noted the ease of accessing and using information available via the Internet and their familiarity with the resources available. The Internet was also used to access materials which were not otherwise available. Particular examples were molecular biology resources, bibliographical databases, electronic journals, sources of funding information, conference information and software.

Other factors affecting use of the Internet were the currency and format of the materials. Respondents sought current contact, commercial and funding information, and mentioned the currency of molecular biology resources and electronic journals. Format was mentioned in relation to CAL materials as users were looking for teaching materials in an alternative format to text books. The Internet was also used through curiosity to see what was available and because of the novelty value and one person mentioned peer pressure to access the Internet. Another discussed using the Internet because she could look for commercial information anonymously; she assumed the company concerned had no knowledge that she had been looking for information and therefore could not contact her further.

v. Problems with using the Internet for information seeking

A range of problems had been encountered while using the Internet to look for information. In particular, the value and usefulness of the available information was questioned. For example, one respondent had used the Internet to look for medical information but found the available material was neither relevant nor useful and was 'anecdotal' [50]. The lack of organisation, the volume of material and the associated difficulties in finding useful resources were highlighted. Furthermore, some interviewees expressed disappointment with the resources they had retrieved, which was
blamed on their lack of expertise in using the Internet. They felt they were missing out on ‘better’ sources and therefore they were not realising the full potential of the Internet as an information resource.

Users were frustrated with the speed of access, and mentioned the time wasted waiting or looking for information. One respondent described the Internet as ‘a waste of time’ [54]. Another felt the popularity of the Internet had resulted in slower access and had therefore reduced its value because the information was not easily and quickly accessible. One user had browsed the WWW but felt it was ‘so slow’ and ‘crashed so frequently’ that access was ‘hopeless’ [55]. Again, the interviewees felt the Internet was inefficient for information seeking and other sources, such as Medline, textbooks or the library, were more convenient.

The interview respondents commented on their lack of knowledge in using the Internet, the limited amount of help information that was available, and difficulties using any available help information. The need to spend more time learning to use the Internet was recognised, but those interviewed did not have any time. For example, one respondent was aware that a number of Usenet Newsgroups were of interest to him but did not have the time to use them.

4.5.4 Source evaluation

This section examines the interviewees’ evaluative comments regarding the sources they accessed and used. As can be seen in Table 35, 45 sources were discussed in detail (i.e. respondents answered the questions in section 3 of the interview schedule about the source). In addition, evaluative issues were raised in relation to a further 43 sources (Table 35). All of the comments relating source evaluation were analysed and translated into evaluation criteria and are presented in Tables 36 to 48 in Appendix B4, with the interviewee numbers listed to indicate how many respondents referred to each criteria. The criteria are briefly discussed in the main body of the text below and supplemented with salient points made by the interviewees.
i. Bibliographical databases

As displayed in Table 36, fourteen respondents discussed bibliographical databases and a range of factors affecting their usefulness were mentioned. The interviewees obviously used the databases which were most appropriate to them and were concerned with the subject areas covered, the journals indexed by the databases, and the comprehensiveness of coverage within their area. One person emphasised the value of the retrospective coverage of Medline. Respondents also commented on the value and usefulness of abstracts, and were critical of references which did not include abstracts, or where abstracts had been truncated to limit the word count. The source of information used to create the abstracts, and whether they had been written by the original author, were also mentioned. Some interviewees wanted access to the full articles directly from the database concerned, but were aware of the database limitations.

The search and output facilities were highlighted, including author and keyword searching, as well as some of the more sophisticated features of Medline (automatic keyword mapping, the ability to amend and re-run search statements), and of the BIDS ISI databases (the citation search). Other useful features included the ability to narrow searches and limit them by date. A range of factors affecting the ease of using and searching bibliographical databases was mentioned, including whether systems were intuitive, and whether help information was available which was clear and useful. Respondents also mentioned other user support features (training courses and telephone help-lines). The clarity of the screen layout and the volume of information on each screen were discussed. Two interviewees were critical of the repetition of steps in BIDS and felt more ‘short-cuts’ or ‘defaults’ were needed when searching the database [45]. Database accessibility was affected primarily by the speed of access, but other factors included cost, whether a password was required and the mode of access. Two people mentioned the unreliability of accessing databases from their terminals.

The interviewees felt currency affected the usefulness of bibliographical databases, particularly the frequency of updating and the time delay between the publication of articles and their appearance in the database concerned. Accuracy was also mentioned, including the need for accurate reference details.
Comparisons were drawn between different bibliographical databases in terms of their coverage, comprehensiveness of coverage, currency, ease of use, the interface used and the search facilities available. In addition, one person discussed the availability of different versions of Medline via the WWW. He questioned the differences between the version he was accessing and the others available, and also commented on the motivation of the service provider in enabling free access to Medline.

ii. Computer Assisted Learning (CAL) materials

As displayed in Table 37, one interviewee discussed a CAL package which he had accessed to supplement a taught course. He used the package because it was appropriate in terms of the subjects covered, the purpose and the intended audience. However, some subject areas were dealt with 'superficially' and the respondent noted inaccuracies in the material [38]. He mentioned the uniqueness of the package, sponsorship for its development, and that it had been produced by a university department. The material was interactive and was downloaded and used locally. However, the respondent was critical of the speed of access and the 'robustness' of the package as it did not always work [38]. The availability of a searchable glossary was also mentioned, as was the volume of information per screen.

A second person mentioned accessing CAL materials for comparative purposes with the materials that were being developed internally. He commented on restrictions to accessing materials, including the need for ‘special permission’ and an application form [57]. In addition, the availability of reviews of the material was mentioned.

iii. Current Awareness Services (CAS)

Two people discussed CAS (Table 38). Areas of concern were the coverage of services, including the material covered, and the scope and breadth of coverage. Keyword descriptors of individual postings and the ability to submit a subject profile to the service were considered useful and assisted in assessing relevance. Another useful feature was the availability of contact information for each posting. Information currency affected the usefulness of the services as one user had received information prior to the deadline date for funding applications but in comparison, he received a
paper-based copy after the funding deadlines. The accuracy of information (whether
deadline dates were accurate), the purpose of the service and the intended audience were
also mentioned. One user had registered for a service which involved proving his
eligibility. One mailing list was described as ‘the best way’ to access information on
sources of funding in a particular field [54].

iv. Catalogues

One person discussed the *ATCC* catalogue to access cell line information (Table 39).
She compared the site to other resources in terms of its coverage, currency and search
facilities, and felt the site was ‘better’ than others she had seen [66]. She discussed the
coverage of the site generally, as well as the uniqueness of coverage and the level of
detail provided. Pointers to further information, and in particular, pointers to journal
references enhanced the coverage. The catalogue was up to date, easy to use and fast to
access, although the site had been unavailable on some occasions. The availability of
contact details and help information on searching the catalogue were noted. Overall, the
respondent felt the site was ‘very useful’ and ‘well set-up’ [66].

v. Databases

The *Wisdom* database for information on sources of funding was discussed by one
interviewee (Table 40). He used the database because it was the only one available for
the area concerned. The purpose of the database, the material covered, including the
comprehensiveness of coverage and the level of detail provided were mentioned. In
addition, he compared the level of detail to other sources which he felt provided too
much information. The database was easy to use and ‘well laid out’, the screens were
clearly presented, and there was ‘not too much’ text on each screen [34]. However, the
respondent was critical of the database because it was not up to date, it was not updated
regularly and it was not fast to access and use. Furthermore, he accessed the database
using Telnet and felt it would be more ‘convenient’ to access it via the WWW [34].
vi. Electronic journals

Three people discussed electronic journals in detail, and a further five made evaluative comments regarding electronic journals which they had accessed and used. As displayed in Table 41, a range of factors were mentioned which affected the usefulness of electronic journals. However, electronic journals were used primarily for the subjects covered and because the journals were not otherwise available. Thus, areas of concern were the subject coverage, whether the full journal was available on the WWW, or whether only the contents pages or a limited number of articles were available. The availability of an archive providing access to back issues of the journal, the retrospective coverage of the archive and the search facilities available were also mentioned. Search facilities included subject, author and volume number searches, the ability to limit a search by date range, and the overall usefulness of the search facilities.

The journal reputation, the reputation of the editorial board and the institution responsible for the journal, and the genealogy of the journal, including whether there was a printed equivalent were all referred to. One user mentioned the stringency of the refereeing process. In addition, currency affected the usefulness of journals, including whether the electronic version was more up to date than a printed equivalent. One respondent questioned the purpose of a site and whether it was purely to advertise a printed journal as the electronic version was available six months after the printed version.

Factors affecting the accessibility of electronic journals were cost, including whether sites provided free access to parts of the journal only or whether subscription was required for access to the full journal, whether a password or registration was required, and the need for additional software to access sounds or images. One user had encountered difficulties in accessing and downloading additional software. The slowness of accessing electronic journals was mentioned, as was the availability of a mirror site and the location of journals, both of which affected access speeds.

The interviewees discussed the ease of using, navigating and searching electronic journals and commented on their general presentation, layout and arrangement, as well as the clarity of any graphics or images, the necessity of images and the availability of a contents list. They compared electronic versions to the printed equivalents in terms if
their ease of use and the images available. Overall impressions included that a journal was 'invaluable' [57] while another was simply 'good' [67].

vii. FTP archives

Two individuals discussed FTP archives and offered a range of evaluative comments, as displayed in Table 42. The general coverage and purpose of sites were discussed, including the software available, the availability of upgrades, trial versions and older versions of software, the coverage of mirror sites compared to the original site, and the availability of software for different hardware platforms. The reputation of the site itself and of the organisation responsible affected the sites used. For example, one respondent felt that if a site was recommended on a Newsgroup 'then you know it's going to be good' [59], and an academic address gave an FTP archive 'credibility' [59]. One site was described as 'very useful' [32], and another, 'probably the best in the UK' [59].

Facilities affecting the usefulness of sites were the availability of contact information, expiry dates for shareware and freeware, information on file sizes (to make an assessment of the likely time taken for a file to download), the status of files (whether they had been used), file origins, and information on software version numbers. In addition, 'well-maintained' sites were considered more valuable, and the users mentioned continuous maintenance and the availability of 'dedicated staff' to ensure maintenance [59]. Search facilities were useful, as was the availability of help information for the search facility, and help information for the site generally. One interviewee discussed the ease of using and downloading software from one site and the usefulness of available help information.

Factors affecting accessibility were the location of sites and the consequent speed of access, the availability of mirror sites, reliability of access and the provision of an onward link where sites had moved. The cost of accessing software and the modes of access available were also identified.
viii. Image-based information sources

As displayed in Table 43, three of those interviewed accessed sites primarily for images for teaching purposes. Factors affecting the images used were their coverage and currency. The frequency of updating and the usefulness of a date for images were mentioned, as were the overall usefulness of images, and the image resolution (high resolution images were required for presentation purposes), the format of images and the storage size which affected access speeds. The interviewees also discussed the value and usefulness of any explanatory information and the level of detail provided about the images. Other factors were pointers to further images and the expertise of those responsible for the images.

ix. Molecular biology resources

Various evaluative comments were made about a range of molecular biology sites, as displayed in Table 44. Sites were used which provided access to the subject area of interest to the researchers. Thus, they commented on the purpose of sites and the materials covered, including the scope, comprehensiveness and uniqueness of coverage. Sites were also used as a gateway to a range of databases or other molecular biology resources, as well as to access data analysis software. In addition, details of published references and links into Medline or the full-text of articles, not only affected perceptions of the accuracy of data, but also enhanced the coverage of sites.

The interviewees were concerned with the currency of data. Factors affecting currency, and the ability to determine currency, were the frequency of updating, whether an update date was available, and whether sites had an updating policy. One described a site as 'unique' in terms of its currency [72]. Those interviewed were aware of the problems associated with inaccurate data, and felt useful features were disclaimers, the availability of general contact details as well as contact details for specific researchers, and a feedback mechanism to notify sites of inaccurate data. Some sites incorporated quality controls prior to data submission and the purpose of one site was to act as a repository for data from refereed journal articles. The interviewees used reputable sources or sites provided by reputable organisations, and the availability of an editorial team, the length of establishment of sites and their genealogy, the motivation of the institution responsible for the site and the source of any funding were identified.
The search facilities available affected the ease of accessing the data. The search facilities referred to included alignment checks, homology searches, keyword searching and sequence comparison facilities. One respondent mentioned a facility to specify the stringency of a search by requesting the nearest match or less related sequences to his query. Output facilities included options to download or print data, and the ability to e-mail or FTP data. One user suggested the provision of details on how many pages would be printed might be useful.

The presentation, layout and arrangement of sites were also discussed, including whether sites were generally well-laid out, pages were aesthetically pleasing and whether information had been usefully categorised. Respondents specified the ease of using, logging onto, downloading from and navigating sites, whether sites were intuitive and user-friendly, whether help information was available which was useful and helpful, and whether help information was context sensitive. In addition, the availability of further support, such as telephone help-lines and training courses, were also noted. Some interviewees commented on improvements made to sites and whether a feedback facility was available to suggest improvements. One person felt advertising on sites was ‘abominable’ and therefore should be omitted [31].

Factors affecting the accessibility of sites were the speed and reliability of access and whether a mirror site was available. Some sites required registration or passwords, others were charged for, and access to one site was limited to researchers in the field. Different modes of access were available to the various sites, including via Telnet or FTP, and one user noted difficulties with system compatibility.

The sites were compared in terms of their cost, coverage, currency of the data, ease of use, frequency of updating, location, the search facilities available, and the speed of access.

x. Organisational sites

As displayed in Table 45, nine respondents discussed organisational sites, and a range of factors affecting their usefulness was discussed. Again, they were concerned with the purpose of sites and the subject areas covered, including the intended audience, the
range, scope, comprehensiveness and uniqueness of coverage. For example, one was
critical of the Department of Health pages because the information was 'too brief' and
access was only provided to a select range of resources [50]. Pointers to further
information enhanced coverage, and the coverage of pointers and whether they had been
selected and evaluated were highlighted. The interviewees were also concerned with the
reputation of the institution responsible for the site and the expertise of the authors.
They mentioned the accuracy of the information, the currency, the frequency of
updating, whether an update date was available, and the motivation of the authors in
keeping the information up to date.

Other comments related to the ease of using sites, including whether they were intuitive
and well-laid out, and whether sites were aesthetically pleasing, whether an index was
available or information had been categorised, the length and clarity of pages, the
volume of information per screen, and the length of site addresses. One person noted the
meaningfulness of any hypertext links, and another commented on the clarity of writing.
Others noted the coverage of graphics, their purpose, the speed of access to them and
whether they were necessary. One user mentioned accessing a site which was acceptable
without viewing the graphics.

Factors affecting accessibility included the location and speed of access. Other issues
were the availability of contact information and evidence of any improvements to sites.
Organisational sites were compared in terms of their coverage, comprehensiveness and
accuracy of the information, its ease of use, presentation, layout and arrangement, the
quality of the graphics and the speed of access.

**xi. Search facilities**

One respondent commented on a search tool, as displayed in Table 46. He was critical of
the tool because it provided no information on how materials were searched or on
whether the service had been updated, and it lacked descriptive information about the
resources retrieved. He was also critical of the relevance of the search results and
generally did not find the tool 'very useful' [59].
xii. Subject-based WWW sites

As displayed in Table 47, three of those interviewed discussed sites which might be described as 'subject-based' WWW sites. Again, they discussed the coverage and purpose of sites, including the subject areas covered, the scope of coverage and their intended aims and audience. The availability of pointers to further information, whether pointers had been selected and evaluated, and the value and usefulness of pointers were noted. One person mentioned whether the hypertext links were up to date. The reputation and expertise of the authors and institution concerned were also specified. Contact information was considered useful, as were evidence of improvements and a facility to recommend improvements. Accessibility issues included cost, speed and reliability of access and whether a password or registration was required. One respondent noted the ease of using of a site.

xiii. Usenet Newsgroups and discussion groups

As displayed in Table 48, twelve respondents made a range of evaluative comments regarding Usenet Newsgroups and discussion groups. They browsed the groups which covered the subjects they were interested in or were aimed at a particular audience. In addition, they alluded to the general coverage, whether groups were regional, national or international, whether groups were unique for a subject area, and the types of resources covered. They also commented on the number of participants in groups, the location of participants, and their expertise. One respondent also mentioned the reputation of a group which was 'widely known' for job information in his area [69], and another mentioned the expertise of a FAQ compiler for a group.

The interviewees also commented on a range of administrative issues, including whether an individual was responsible for group administration, and whether any administrative information was available, such as list owner details, a list of members, or details on the scope and purpose of groups. Facilities mentioned were the availability and coverage of an archive, facilities to search the archive, whether it was possible to receive messages in digest form and the frequency of the digest, and whether a group FAQ or group home page were available. Two people commented on the value of using subject conventions for identifying the content of messages as they could easily delete potentially irrelevant messages.
Accessibility issues include the mode of access available (whether the group was available via Usenet or as a discussion group), the ease of subscribing and unsubscribing from groups, the volume of traffic, and whether groups had a closed or unrestricted membership. For example, one respondent had unsubscribed from a group where the volume of traffic was unmanageable.

4.6 Reviewers' comments on a draft evaluation tool

A draft evaluation tool was devised and distributed for review by a range of library and information professionals. Nineteen people returned their comments and this section provides the results of their feedback.

4.6.1. The value of the tool

The reviewers were generally positive about the potential value and usefulness of the tool. They felt it was 'thorough', 'clear', 'definitely of use', 'easy-to-use, portable, concise and comprehensive'. One stated, 'no library should be without it'. They felt the explanatory notes and quotes added value and organising the tool by resource type was considered useful and 'filled a gap in work in this field'. They approved of the 'longer discussion' with the 'shorter checklists', and felt the checklists were the most useful feature which were likely to become 'the major working tools'. One individual particularly liked the use of questions in the checklists.

The reviewers felt the tool would be of value to librarians involved in evaluating Internet-based sources, particularly for resources about which little was known, such as molecular biology resources. They also believed it would be valuable to less experienced staff or for training purposes. One person suggested, 'it will help to turn evaluator's attention to factors that users consider important'. Others also suggested it would be valuable to library users by providing 'a succinct way of getting an idea of the quality issues of the Internet'. The development of a different version aimed at non-information professional Internet users, such as doctors, nurses and students, was
suggested. In addition, the tool was considered of value to those involved in selecting resources for gateway services or for those involved in the development of WWW sites and pages.

One reader was sceptical of the value of the tool and stated that ‘experienced librarians undertake evaluation of any materials almost subconsciously’. Another felt that the evaluation process is ‘not structured’ but rather evaluators:

> Often make an instant decision as to the value of a source and would be extremely unlikely to go through this when looking at sites.

She emphasised the importance of ‘personal recommendations about good Web sites’ but conceded ‘it would provide some useful starting points’. Likewise, another reviewer was ‘finding in practice’ that assessments were made ‘on a gut instinct, based on a combination of these criteria’, but felt reading the tool had ‘brought up some issues [she] hadn’t considered and reminded [her] of others’.

Some reviewers were concerned ‘that too many of the criteria require substantial research in order to evaluate the resource and this is not something many will undertake’. Examples were the length of establishment of a source, the reason for establishment, the time delay between journal article acceptance and publication, the reputation of the author and the stringency of the journal refereeing process. One commented on the subjectivity of the evaluation process and suggested the need for objective criteria, and another suggested dividing the criteria into ‘primary’ and ‘secondary’ criteria, relating to ‘objective measures’ and ‘matters of personal taste’. Another proposed indicating the relative importance of each criterion in relation to the different source types.

Other general comments related to the need for more examples, including screen shots and hints on evaluating the screens. It was felt more examples would enrich the document and could be used to emphasise the medical subject area. However, the reviewers were aware that any examples might become outdated and that the author would need to avoid making potentially libellous statements.
4.6.2 Criteria

Some reviewers felt the tool was ‘comprehensive’ and did not suggest any additional criteria. Others provided a range of suggestions which are outlined below.

In relation to the coverage of material, additional points included the importance of any introductory information on scope and purpose. The reviewers highlighted the need to evaluate pointers to further information and asserted the value of ‘link sites’. Criteria included whether links were annotated and selected for inclusion, selected but not annotated, or not selected, as well as whether links were still functioning. Three reviewers were critical of ‘under construction’ as a criterion, which was described as an accessibility issue. One felt the ‘use of such signs is childish and/or defensive’ and ‘all sites should be growing and none should be made available until they are ready’. The need to enlist specialist help in assessing subject content in some cases was also highlighted.

The term ‘value’ was considered ‘vague’ and ‘utility’ or ‘scope’ were suggested as alternatives. Two reviewers felt value referred to ‘an overall assessment of the site and something which you could only come to after assessing the other criteria’. One felt the main emphasis in any evaluation was on assessing the value of a source and ‘whether it contains sufficient useful information for the user groups’ concerned. The use of ‘real information’ was questioned and ‘original content’ proposed as an alternative.

One person suggested that ‘subject matter and audience were so important they should be separate categories in their own right’. Another commented on the intended user of a site or source, and questioned whether this was subsumed into the other criteria or needed to be independently identified. In addition, the use of ‘scope’ and ‘collection management’ criteria were suggested:

These two criteria acknowledge the fact that when evaluating a resource in terms of deciding if it should be included in a subject gateway, you need to evaluate the resource itself and its relation to the aims and audience of the subject gateway ... a resource could be of an extremely high quality but if it does not meet with the needs of the intended audience, it should be rejected.

A distinction was drawn between static and dynamic sites in relation to assessing currency. For example, an anatomy lecture or health statements might remain valid for.
several years, as opposed to a news service which would be of limited value after a few weeks. The need for the date of information was also emphasised.

In relation to the authority of sources, inclusion of publishers was suggested. One reader questioned how the reputation of a source might be evaluated and suggested that this would depend upon the experience of the evaluator. However, he conceded that reputation was 'a pragmatic thing' which he would examine first because of his 'faith in origin', and commented: 'I won't rule out other things, but will start with what I know'. Another reviewer identified the need to determine whether a site was an 'official' source. Difficulties in identifying the author of a source and validating their credentials were also highlighted, and information on the individual or institution responsible, as well as a link back to the main page of a site or document, were considered valuable. One person felt 'too many take the view' that the reputation of an author is 'an infallible criterion' and that 'some authors rely on this to put out rubbish'. Others questioned how material copied from one site to another should be dealt with, both in relation to the potential for loss of 'organisational authority', as well as the updating of material.

The ease with which accuracy might be assessed was described as 'a function of the subject domain'. For example, mathematical formulae might be verified more easily than political theories or areas of academic controversy. One reviewer disagreed that information on personal home pages was unlikely to have a research basis as researchers' home pages may report their own work. Another suggested information on institutional pages may have been through an internal editorial or review process.

With regard to the presentation, layout and arrangement of information, reviewers felt images should not only be clear, but also 'not superfluous or spurious, not added simply to improve the look of the page'. Forms and whether they had been used appropriately were mentioned, as was the need for 'non-graphic, non-frames and non-Java versions' of documents. A further presentation issue was whether too many short pages or too few long pages had been used. The impact of presentation on the ease of finding information within a site was discussed, such as whether a search mechanism, site map or index were available, as well as the impact of spelling and typographical errors on the recall of information. One reviewer stated 'users tend to be very influenced by presentation'.
The time taken to access sites was considered significant because ‘it may be an excellent site, but if it takes ages to download, there is no chance of using it’. The ‘ease of finding the site’ was criticised because ‘this will be subjective and not reflect on the resource so much as the Net skills of the user’. Reviewers also underlined the frustration of registering to use sites and the inconvenience of remembering passwords. Someone had encountered sites offering a facility to bookmark an internal page following registration, thus avoiding the need to re-register, and routes for registered users who had forgotten their passwords. It was felt cost required a more prominent placing than under ‘accessibility’ and ‘restrictions’, and that cost related, not only to the cost of a document, but also value for money and relative cost in comparison to other sources.

One person was concerned that it was ‘not sufficiently clear’ how the proposed criteria related to the different features of the WWW and the Internet, as opposed to paper-based information sources or information available in other formats. In addition, the need to compare different resources providing access to the same or similar information was emphasised, particularly in relation to the presentation of information and its accessibility.

Suggestions of criteria for electronic journals related to the advantages of an electronic format compared to a paper-based equivalent, including the need to evaluate any additional features, such as feedback facilities or links to other electronic sources. The availability of review articles, brief communications, news items and letters, as well as regular articles, were listed. The timeliness of an electronic journal in relation to its printed equivalent was specified, particularly as some journals disseminate the electronic version after the paper-based equivalent.

The reputation of a journal was considered a useful indicator of quality, but a factor which may change over time. One reviewer suggested consulting an expert in the field, and impact factors were also mentioned. Another was uncomfortable with the phrase ‘genealogy of a journal’ and suggested using ‘provenance’. Two people noted that it is not normally possible to determine the referees of medical journals, although the names of editors are generally available. Sponsorship by a learned society was felt to indicate an ‘academic need’ for a journal rather than ‘a commercial opportunity’ and was therefore proposed as a useful indicator of authority. Another reviewer proposed identifying whether an electronic journal was included in Medline: ‘If it were known
that a purely electronic journal was indexed by Medline, end-users would probably consider it contains good quality information'.

In relation to the presentation and accessibility of electronic journals, one assessor felt it should be easy to locate the latest issue of an electronic journal, any other issue by date or by volume and issue number, articles by an author, and articles with a particular word in the title. He also specified the need for links from citations in an article to the citation list at the end and back again, and mentioned the availability of links from citations to abstracts, full-text articles or other related sources where available. The availability of an archive and facilities to search the whole archive, rather than individual journal issues, were also mentioned. One person felt the treatment of figures and tables was important, such as whether they were included, and whether in-line images, links or thumbnail images had been used, or whether they were 'all stuck together at the end in a muddled mess'. Registration and charging policies were mentioned, as was the availability of a version for high quality print-outs. Where only selected parts of journals were made available, one reviewer recommended examining how articles were selected for inclusion in the electronic version.

The importance of the criteria relating to restrictions to accessing or using CAL materials was emphasised, such as software and hardware requirements. Other criteria included whether a product was commercial or academic, and consideration of audio quality for multi-media resources. One individual felt 'used for their format' under presentation, layout and arrangement was unclear and required elaboration, and also suggested 'ease of finding the material' under accessibility was ambiguous. In relation to sites containing images, two people felt more prominence was required for the clarity, features and format of images. Another mentioned the size of image files. The need for information on copyright status and clearance was highlighted:

This stuff can get a bit lost and there is nothing worse than finding a brill picture you want to use but not being able to trace who to ask for permission.

The date the images were taken was also identified in addition to the date the images were produced.
A range of comments were made for the evaluation of Usenet Newsgroups and discussion groups. Two reviewers indicated an inconsistency in the language used as the 'value of the source' had been used for all types except Usenet Newsgroups and discussion groups where the heading was 'intended purpose'. In relation to purpose, published articles, promotional materials or studies of the list were identified as further sources of information. One person felt moderation was as an 'authority/accuracy factor' rather than a coverage issue, and another suggested examining whether participants were lay people, researchers or practitioners as this might affect the 'noise ratio' and the accuracy of responses. However, as one person emphasised, the accuracy and reliability of responses would depend upon individual contributions and each response would require an independent evaluation.

One reviewer commented on 'the extent to which the group keeps its focus on the stated purpose' and felt that 'if people wander off topic, this decreases the value of the group as an information resource'. Thus:

One measure of value ... is the proportion of questions that get answered on the list, and whether threads develop, or are there just loads of one-off messages, or is there real exchange and discussion.

The same person commented on list administration facilities, such as:

Is it automated subscription/unsubscription? Is there a human on hand to help? Do they have a quick way of dealing with mail loops? A code of conduct for the list? A regular administration message distributed to all members? Does the owner try to control flaming, inappropriate use?

In relation to sites providing access to software, the availability of user guides or manuals to accompany packages were identified. Reviewers were concerned with whether test or demonstration versions of software were available, and also specified the need for virus checking facilities and the need to browse or search for software by filename, platform or type of application.

Few comments were made in relation to the criteria for general databases and databanks. The inclusion of any quality controls was mentioned, and one reader noted that some databases might be available in different versions, and questioned whether each version would need to be considered independently.
In relation to coverage of bibliographical databases, the need, not only to examine the absolute number of journals covered by a database, but also the journals themselves was emphasised:

Does [the bibliographical database] cover the 200 journals that I need most? Does it cover only US journals or Japanese too? Is it only journals or does it have patents, books, conference proceedings, etc.?

One individual felt the timeliness of a bibliographical database was the only criterion of any importance. She cited the example of PubMed which she felt was problematic to search, but was used because of its timeliness. Consulting a standard reference work, such as Walford, was recommended to determine the reputation of bibliographical databases. Indexing accuracy was mentioned, as was the availability of a thesaurus. Reviewers felt the availability of help information was 'very important', including basic help information and extended search guidance. One reader felt links to any available full text articles would be a useful feature. Cost and the availability of different charging systems were also mentioned, such as by subscription, time used or the number of records downloaded. The statement, 'whether the information provided is adequate to make an informed judgement' was considered ambiguous by one reviewer and required clarification.

A number of comments were made in relation to 'Genetic sites and services' by one reader. He felt the title was 'a bit narrow and may not convey the right idea' and suggested broadening it to 'Biological data' or 'Scientific data' to include a wider range of resources, such as the ATCC catalogue and other chemical databanks. In relation to coverage, he felt 'some sites are useful because they have a focused coverage, they eliminate overlaps, or include only certain types of things', and emphasised 'knowing what the coverage is, is the most important thing'. He also mentioned Nucleic Acids Research which prints annual descriptions of the major databanks and could be used to identify coverage and authority. He also recommended examining the length of time a resource had been established, and emphasised the need for standard report formats and help information.
4.6.3 Resource types

As mentioned, organising the tool by source type was considered useful. However, one reviewer, 'began to doubt the premise that it is worthwhile having the different resource types' and felt, 'it would be interesting to see what actual overlap there is'. An alternative breakdown was suggested according to the function of the source, such as 'advocacy, informational or personal'.

Suggested revisions included combining 'electronic journals' and 'electronic journal articles' to save space without sacrificing clarity. One person felt there was unnecessary overlap between the 'databases and databanks' section and 'bibliographical databases', and another felt there was overlap between these sections and the 'genetic resources' section. Two individuals were unsure about the category, 'sites containing images' and proposed either 'image banks' or 'image-based information' to be used in conjunction with the other source types. Another felt 'text based information' was unclear 'given that several of the other classes of information ... are text based'.

Some commented on the need to differentiate between different types of WWW sites, such as informational pages, learned and professional society pages, organisational sites and personal home pages. Additional categories were directories of people and organisations, commercial sites, statistical sources and news services. Furthermore, one person felt:

The inclusion of genetic sites makes [the tool] very specific to medical resources. If this was excluded it could be applied to any subject service.

4.6.4 Language and style of writing

The reviewers generally felt the document was 'clear and readable', 'well written', 'straightforward and avoids unnecessary technicalities', 'easily understood' and 'informative but not patronising and straightforward but not superficial'. However, some terms and phrases were confusing, many of which have already been mentioned. Others were 'under construction', which was described as 'Net jargon which novices may not comprehend', 'home page' and 'source':
I presume "the source" means the thing that is being evaluated? It sounds a little as though it might mean the original source of the information (i.e. a printed work, or someone's head).

A short definition of the source types at the beginning of each section was suggested. One individual proposed a glossary, but another felt this would not ‘add anything except extra pages’.

The tool was described as a 'little formal' by one reviewer, while others felt it was informally written which was complemented by the formal structure. Furthermore, ‘the quote boxes interjected helpfully during reading of the document’ and:

The mix of formal criteria, explanatory notes and informal quotes is likely to appeal to people with different learning styles ... this mix makes the report lighter, easier to read and somehow more grounded.

4.6.5 Volume of information

Some of those asked to assess the tool found it large and ‘a bit of an effort to plough through’, while others concluded ‘it’s not hard work at all’. However, the reviewers were aware that the tool was not designed to be read in a linear manner but consulted as necessary, and therefore indicated that the individual sections were acceptable. As mentioned, they anticipated that the checklists would become the principal working tool and therefore thought users would initially read through the explanatory notes but use the checklists on a daily basis.

The explanatory notes and quotes were considered useful and enhanced the document. The notes ‘help to set the criteria in context’ and the quotes ‘lift what otherwise might seem a dry document and root the criteria in real users’. In particular, some felt ‘it does make it more meaningful to see how other people evaluate stuff on the Net’. However, one person criticised the notes for stating ‘the obvious’ in some instances, while others found the quotes ‘distracting’ and ‘unnecessary’ as they did not ‘add a huge amount of value’, particularly as they did not know ‘how representative' they were. Furthermore, one reviewer felt some quotes were meaningless because they had been taken out of context and including the occupation of the person quoted was suggested.
Some of the readers stated there was too little information in the explanatory notes and wanted 'more guidelines on how to conduct an evaluation', such as 'where to look to discover subject coverage'. One noted that the bullet points were sometimes expanded in the explanatory notes, but not always. Furthermore, additional introductory information on the intended audience of the tool was requested, including 'how and when to use this document' and on the intended use of the checklists. An introductory section outlining the criteria which appeared in most sections, such as authority, currency and accuracy was also proposed.

4.6.6 Layout and organisation

The reviewers generally felt the tool was clearly laid out, easy to use and well-organised, therefore encouraging 'an organised approach to evaluation'. However, the repetition in the explanatory notes was criticised and extensive cross-referencing was suggested to alleviate the problem, although the potential for confusion was recognised. Other recommendations were 'a general checklist with only the specific criteria that were unique to a resource type in the separate sections' or 'to organise by criteria, and discuss how particular criteria applied to different formats'.

The checklists were considered the most useful feature and one individual therefore felt they should be at the front of the tool, while another felt there should be a reference at the end of each section to the relevant checklist. Another person felt it might be more useful to have the checklists at the end of each section 'so that if a user wants to refer back to more detail they don't have to search for the correct section'.

A hypertext format using links to connect between the different criteria and checklists was suggested as a clearer and more widely accessible means of presenting the criteria, which might include links to sites as evaluation examples. Other ideas included using different coloured paper for different resource types and a booklet to make the tool 'more handy'. In addition, more spacing was suggested in the explanatory text and more prominent headings for 'electronic journals' and 'electronic journal articles'. One reviewer was critical of the right justification and the use of shading for the quotes as she felt it made them difficult to read. Another suggested putting the checklists into 'a table which you could photocopy to fill in for each resource'.

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4.7 Summary

This chapter has presented the results of the research. The main findings of the information seeking and use interviews relate to:

- levels of use of the Internet,
- examples of using the Internet for work-related information seeking,
- reasons for using the Internet and problems associated with its use,
- how a range of different source types available via the Internet were selected and evaluated,
- how information quality is assessed generally, and
- how refereed journal articles are assessed in comparison to information available via the Internet.

The criteria development and validation interviews also relate to levels of use of the Internet, examples of using the Internet for work-related information seeking, reasons for using the Internet, problems associated with its use, and the selection and evaluation of Internet-based information sources. The results include an analysis of the comments made by LIS professionals regarding a first draft of a proposed evaluation tool. A wide range of criticisms and recommendations were made relating to: the suggested criteria, the source types, the language and style of writing, the volume of information, and the layout and arrangement of the tool.

The chapter has presented each stage of data collection independently. Chapter 5 draws together the results of each stage of data collection to develop a theory of information quality assessment. Based upon the theory, a final draft of the evaluation tool is proposed for use by LIS professionals in the selection and evaluation of Internet-based information sources. The wider implications of the results arising from the research are considered by comparing them to other studies described in the literature, by considering their validity in relation to the methods used, and by appraising their generalisability. Possible approaches to testing the Evaluation Criteria Document are also examined. Conclusions and recommendations are offered in the final chapter.
Chapter 5

Discussion
5.1 Purpose of the chapter

The purpose of this chapter is to draw together the various strands of the thesis and to discuss the wider implications of the results. Chapter 4 examines the results of each stage of data collection independently and the evaluation issues mentioned in relation to each source are summarised in Appendix B. In this chapter, the results are drawn together to develop a grounded theory of information quality assessment. Based upon the theory, an evaluation tool is proposed for use by LIS professionals in the selection and evaluation of Internet-based information sources. The wider implications of the results arising from the research are considered by comparing them to other studies described in the literature, by considering their validity in relation to the methods used, and by appraising their generalisability. Possible approaches to testing the Evaluation Criteria Document are also examined.

5.2 A grounded theory of information quality assessment

This section draws together the significant findings of the research to develop a grounded theory of information quality assessment. The context in which sources were evaluated is initially discussed. A theory of assessment is then proposed, central to which are the issues mentioned during the interviews affecting users’ perceptions of the quality of the sources they accessed and used. In addition, issues which are peculiar to different types of information sources available via the Internet are discussed.

5.2.1 The context of source evaluation

A significant finding of the research is that the Internet was not considered a source of high quality information. In particular, the comparisons drawn between information available via the WWW and refereed journal articles during the first interviews suggest that refereed journal articles were considered highest in a hierarchy of information sources. The respondents recognised the limitations of the refereeing and editing processes, but generally perceived them as essential quality filters which increased their
confidence in the quality of the information. They felt that one drawback of the information available via the Internet was that it had not been reviewed by a subject expert. Consequently it was assumed that high quality information was not disseminated via the Internet, and refereed journal articles were used where high quality information was required. There were some exceptions which serve to add further weight to the perceived importance of peer review. For example, electronic journals were considered a source of high quality information and were assessed in the same way as paper-based journals, but reference was made to whether they were refereed and had a paper equivalent. Bibliographical databases were also considered a high quality source because they provide access to the abstracts of refereed publications. Moreover, emphasis was placed upon the perceived value of sources which had been recommended by colleagues.

The Internet was not considered essential for work-related information seeking. The results highlight the central role of the Internet for communication purposes as numerous people commented on the benefits of e-mail, the majority of the questionnaire and interview respondents accessed their e-mail daily, and fewer accessed and used the WWW regularly (see Tables 2, 4 and 30). However, BIDS and Medline were described as essential for information seeking, probably because refereed journal articles are central to the work of medics based in an academic environment. Likewise, molecular biology databanks were considered an essential source of raw data for biomedical researchers. Both of these source types were accessible prior to their availability via the Internet, and access was still sometimes available via alternative means, such as on CD-ROM. The sources were accessed via the Internet because it was more convenient than going to the library, or in the case of molecular biology sources, because the data was not otherwise available, it was faster or more convenient to access them, or the sources were updated more frequently.

A wide range of source types were discussed during the interviews, many of which might not be described as 'traditional' information sources. For example, the Internet was used to download software, to access raw data from molecular biology databanks, to browse or follow the discussion in Usenet Newsgroups and discussion groups, or to access materials in an alternative format to paper-based materials (images or multimedia teaching packages). Examples which might be considered more 'traditional' included where the interviewees were interested in finding background information in
relation to their teaching or research, to access facts about people or places, the use of electronic journals, or the use of bibliographical databases.

Furthermore, individual respondents accessed and used a limited range of sources via the Internet. Although the first interviewees were asked to discuss three examples of sources which they had accessed and used, some had never used three (Table 9). They often used the same sites regularly, and used the sources they were familiar with, they had used before with success, or which had been recommended to them by a colleague. Few people discussed searching or browsing for information via the WWW as this was considered an inefficient means of information seeking. Instead, they felt their use of the Internet and the WWW was more successful when they knew a source existed. Moreover, some respondents had only used the Internet on one occasion, such as during a training course, or had never used the Internet and therefore discussed Medline which was accessed via a local network.

The above discussion implies that the interviews yielded little data which could be used to develop a theory regarding information quality assessment. However, some users did search the WWW, such as to look for background information in relation to their research or to look for multi-media teaching materials, and they differentiated between the different sources they examined. Others discussed why some sources were used regularly, as well as the reasons why they initially accessed the materials they used. Furthermore, individuals frequently criticised the sources they used, they made suggestions for improvements, and drew comparisons with other materials. These discussions resulted in a large volume of data regarding the evaluation of different source types which is presented in Chapter 4 and Appendix B, and which forms the basis of the theory of information quality assessment.

5.2.2 Generic evaluation issues

The interviews were analysed according to the source types because one aim of the research was to determine whether different criteria were applicable to different types of sources available via the Internet. However, by reading through the text of Chapter 4 and examining the tables in Appendix B, it was possible to identify recurring issues which apply across the source types. A detailed examination of these indicates that
indeed there are a range of issues which affect the value and usefulness of different source types available via the Internet. These issues, and in particular, the relationships between them, are central to the theory of information quality assessment and are discussed below.

i. Purpose

An initial consideration in the assessment of the different sources was their purpose and whether the intended purpose was compatible with the needs of the user concerned. A range of factors were mentioned which relate to purpose, including the aims and objectives of the source, the intended subject coverage, the scope (whether there were any limitations in the coverage), and the intended audience. The audience was of particular concern where the interviewees were interested in information for research or teaching purposes because information was required at a certain level of detail or to be appropriate for a particular level of understanding. The reviewers also emphasised the value of a statement of intent for a source. The purpose of a source is inextricably linked to its coverage. An assessment of purpose relates to an initial consideration of what a source aims to achieve, whereas an assessment of coverage relates to an examination of what the source actually achieves.

ii. Coverage

The motivating factor affecting whether the information contained in a source was used related to whether the source covered the appropriate area of interest to the user. Factors affecting coverage were the subject areas covered, the types of materials covered, the comprehensiveness of coverage and the retrospective coverage. In addition, the level of detail provided about different subjects or the depth of coverage, and the range of subjects covered or the breadth of coverage were also identified. The level of detail or depth of coverage of a source is obviously related to its intended audience. Users were concerned with two issues, namely whether the information was pitched at an appropriate level of detail and whether sufficient information was available for their needs.
Various people mentioned the availability of pointers or links to further sources of information which enhanced coverage. This issue is of particular relevance to information available via the WWW, but was also mentioned in relation to, for example, molecular biology sources, image-based sources and Usenet Newsgroup or discussion group postings. A range of factors affected the value and usefulness of any pointers, such as whether they had been selected and on what basis, and whether any descriptive information was available.

iii. Authority and reputation

The respondents frequently discussed issues relating to authority of individuals or institutions involved in the creation and dissemination of sources. Assessments of authority were based upon a range of factors, but in particular, the knowledge and expertise of those producing the information. Sources were considered authoritative because they were written by an expert on the subject or an institution with recognised knowledge and expertise in the field. Authority is inextricably linked to reputation. Respondents used sources which had been successful, useful or valuable on previous occasions, which were recommended to them by their colleagues, or because an individual or institution who was well-known for their knowledge and expertise in an area was involved in the production of the information.

The authority and reputation of sources affected whether or not users initially accessed them, as well as the extent to which they relied upon the information and their perceptions of the relative strength of a source within a field. The reputation of the institution was of increased importance in relation to information available via the Internet because of the number of possible authors. Furthermore, under certain circumstances, the institution responsible for a site or source was the primary reason for accessing material. For example, one user mentioned the reputation of the Centre for Disease Control and accessed their site rather than conduct a search for information because she felt they would be the most likely institution to provide access to the required information.

A number of different techniques were mentioned for assessing authority and reputation, including conducting a literature search in order to determine whether an author had published in a field before and whether they had published in refereed journals. The
expertise of an author was evaluated by determining whether they were a professional in a field or a lay person with a passing interest in the subject. Some interviewees had examined reviews and the reviewers also mentioned consulting any reviews which might provide an expert assessment of a source. The reviewers also emphasised the importance of details regarding the individual or institution responsible for information, and whether a source was considered an official source in the field.

The interviewees also expressed reservations relating to their assessments of authority and reputation. The potential for bias introduced by an author or institution was mentioned, as was the potential for an individual’s or institution’s reputation and expertise to change. Furthermore, it was noted that any individual or any institution could produce high quality information despite being a newcomer to a field. The reviewers also highlighted the difficulties associated with identifying an individual responsible for information and the drawbacks of placing too much emphasis upon reputation.

iv. Accuracy

An assessment of accuracy primarily relates to the factual accuracy of the information. The interviewees generally used their own knowledge and expertise when assessing accuracy, and one reviewer also noted the need for subject expertise. In addition, the interviewees discussed conducting a search and comparing the results from different sources. However, a number of people noted that the ease of assessing accuracy was dependent upon the nature of the information, and compared, for example, scientific data which can be either correct or incorrect, with political theories where there may be no right or wrong answer. Furthermore, the importance of assessing accuracy was dependent upon the needs of the user: it was often essential that information required for teaching purposes was accurate, whereas users of molecular biology sites were generally unconcerned by the inaccuracies they encountered.

Perceptions of the likely accuracy and reliability of sources were affected by a wide range of factors, including whether the information had been through a refereeing or editing process; whether the information was based upon research; whether there were any references to other sources of information; the perceived authority and the reputation of the source; the knowledge and expertise of any authors or organisations.
responsible for the information; the currency of the information; and the potential for 
bias introduced by any authors or institutions involved in producing the information. 
Furthermore, perceptions of accuracy were affected by the quality of presentation or the 
amount of care and attention paid to the development of a source. For example, 
typographical and spelling errors were cited as examples which affected perceptions of 
accuracy. Some users noted that it was possible to contact sites regarding any 
inaccuracies, and felt this indicated a concern for accuracy.

v. Currency and maintenance

The currency of a source relates to how up to date it is. The Internet was used to look for 
information because those interviewed thought it would be more up to date than 
elsewhere, and individual sources were used because they were updated more frequently 
than others. A date indicating when information was produced or last updated was 
referred to as a useful means of assessing currency, as well as being useful because it 
prevented users looking through information they had seen before.

The currency of the information and the frequency of updating were of increased 
importance in relation to some sources and subject areas. For example, the molecular 
biologists felt it was essential that the data they used was current. Other users 
highlighted the problems of outdated funding or contact information which can become 
inaccurate, while others were unconcerned with whether teaching information was up to 
date as the information did not always need to change. The frequency of updating 
obviously affects the currency of an information source and was mentioned in relation 
to, for example, bibliographical databases, molecular biology sources, current awareness 
services, and sources of funding information.

The maintenance of a source is related to its currency, particularly the frequency of 
updating. An area of concern was whether sources were 'well-maintained', and issues 
mentioned included the currency of any hypertext links. Responsibility for maintenance 
was also mentioned as the interviewees felt that if an individual or group maintained a 
site voluntarily, they might lose interest and therefore not maintain sites in the long 
term. Examples were also cited where users could contact a site maintainer to update 
information. The reviewers were critical of any indication that sites were 'under
construction', but those interviewed felt this was a positive indication of site maintenance and assumed the terms had the same meaning.

Some of those interviewed assumed that all of the information available via the Internet was current. As more information is made available via this medium, and as an increasing volume has been available for any length of time, currency may become an issue of increased importance. Indeed, one person suggested he might have placed more emphasis on the date of information if the interviews had been held five years later.

vi. Accessibility

Accessibility refers to those factors affecting entry into a source of information. The Internet was used to access information because it was more convenient and faster than going to the library and consequently, users were critical of sites which were slow to download. Comments related to the site location, the number and size of images, whether thumbnail images had been used, the availability of a local or less heavily used mirror site, and the mode of access (whether sites were available via the WWW, FTP or Telnet), all of which affected the speed of access. The ease of finding sources was also mentioned, including the provision of a hypertext link where sites had been re-located, or sites which were continuously moving. Furthermore, one reason for using the Internet was the relative cost of the information and the interviewees were therefore generally reluctant to pay. Other constraints on access, such as registering, the need to obtain permission or input a password, were also considered frustrating because they prevented easy access to the information. The language of the information was also mentioned.

Generally, the predominant factor affecting whether a source was accessed was the subject area covered, although other considerations included the reputation and perceived authority of a source. Aspects relating to the level of detail, the currency and the accuracy of the information often affected whether the information was consequently used. Moreover, the accessibility of a source was sometimes a determining factor affecting initial access to a source, as well as those sites that were used regularly. However, its impact was dependent upon the perceived importance of the information to the individual user. For example, when browsing the WWW, users were less likely to wait for slow sites where the information was not central to their work. Under certain circumstances, accessibility was the over-riding reason affecting the sources used.
example, one user described a site providing access to journal information which he described as 'valuable'. When the site began charging for access, he no longer used the site.

vii. Presentation and arrangement

This section refers to the presentation and arrangement of information within a source. The presentation and arrangement of information is a problematic area of assessment because users often expressed their personal preferences and tended to make general statements rather than expanding upon the factors which affected their feelings. For example, in relation to the aesthetics of screen design, some interviewees advocated the benefits of plain pages and were critical of bright colours, while others preferred the use of images to enliven 'dull' pages. Likewise, they used phrases such as 'good overall design' or 'well-designed', without elaborating on the factors affecting their perceptions.

As with accessibility, the presentation and arrangement of information was generally a secondary consideration to its content. However, its significance was again dependent upon the importance of the information to the user, as well as the nature of the source being used. For example, users would 'plough through' a badly written or presented journal article of interest to their work, but were more likely to examine a well-written and clearly presented article of peripheral interest. One person noted that refereed journal articles are particularly unattractive but must be used regardless of their presentation. Furthermore, some users felt the presentation and arrangement of electronic information was of increased importance due to the time spent using a computer. In addition, users were interested in locating teaching materials which presented information in an alternative format to text books and therefore, the presentation of the information was central to their needs. The issues mentioned included whether the format added value to the information and whether it might enhance the teaching and learning experience.

Other issues affected the ease of accessing and assimilating the information within a source, and included the organisation of information, the availability of facilities for navigating and searching material, the meaningfulness of links between different pages, whether screens were clearly laid out, whether there was too much information on each
screen, the style of writing and whether the source was well-written. As mentioned under accuracy, the ‘professionalism’ of presentation also affected some users’ perceptions of the overall quality and accuracy of a source.

viii. Ease of use and user support

Various comments were made regarding the ease of using sources. Again, the interview respondents tended to make general comments on whether a source was ‘easy to use’, rather than identifying the particular factors which affected their assessment. Many comments related to the presentation and arrangement of the information, such as whether any search facilities were easy to use or whether it was easy to navigate between different sections of a source. User support features were also mentioned, such as help information, training courses, telephone helplines and the availability of contact information. These facilities were criticised or complimented in relation to whether help information was clear and whether it was context sensitive, whether system messages were meaningful, the response times for telephone helplines, and whether a response was received to e-mails or telephone messages. A further factor was whether sites were ‘intuitive’ or whether training or familiarity were required before a site could be used effectively.

ix. Comparison to other sources

As mentioned already, much of the data relating to how respondents assessed information was drawn from the comparisons they made between different materials. Comparisons were drawn between different Internet sites, and between Internet-based materials and information in other formats. Such comparisons are intrinsic to any evaluation because the assessor will be deciding which source to use, often from a range of potentially relevant materials. Comparisons highlighted, not only whether one source was ‘better’ than another, but also whether sources were unique, either in terms of the format or the subject areas covered.

The reviewers emphasised the need to draw comparisons between the cost and relative value of different sources, as well as between the format of the information available via the Internet, and information in other formats. The LIS profession is constantly
restrained by a lack of financial resources, justifying a concern with value for money and the potential benefits to be offered by information in a different format.

**x. Overall impression**

Those interviewed often initiated or closed the discussion with a general statement of the value and usefulness, or their 'overall impression', of different sources and of the information contained in them. For example, sources were described as 'excellent', 'outstanding', 'not very interesting', or a 'source of rubbish'. An overall impression was either created through extensive and frequent use, because the source had provided the required answer, or from an initial impression. In addition, the interviewees and the reviewers highlighted the value of reviews which enable an examination of the overall impression of another knowledgeable user. The importance of recommendations from subject experts was also identified.

**5.2.3 Source specific issues**

In addition to the generic issues identified above, it is possible to distinguish factors which are peculiar to the different types of sources. This section defines the different source types identified during analysis, comments upon the applicability of the generic issues, and summarises the issues which are specific to each source type. While it is recognised that the Internet provides access to a wider range of source types than those identified, and that alternative categorisations have been used elsewhere, the following are the source types which were identified through analysis of the interviewees' comments.

**i. Bibliographical databases**

'Bibliographical databases' are databases of references to the published literature. Many of the generic criteria were discussed in addition to a range of further factors. When considering the coverage of databases, issues included the journals covered, the comprehensiveness of coverage of journals within an area and the ability to determine which journals were covered. Links into the full-text of articles or other databases were highlighted, and one person referred to the coverage of different versions of *Medline*.  

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Furthermore, bibliographical databases were used in order to search the literature and assess the relevance of any references, and therefore various points were raised in relation to the availability and usefulness of abstracts: the level of detail, the value and usefulness of the information, whether abstracts were available for all the records, whether abstracts had been truncated. Other factors were errors in the references, the frequency of updating and the time delay between publication and appearance in the database. Different searching and browsing facilities were discussed, as well as output facilities and the ability to upload data into reference management packages.

ii. CAL materials

CAL materials are multi-media packages designed to enhance teaching and learning through the use of computing technology. CAL materials were accessed because individuals were interested in information in an alternative format to traditional teaching materials. Many of the generic criteria were identified, but areas of notable concern were the subjects covered, the intended audience (whether the material was appropriate for the student group concerned), and whether the format of the material added value to the information. The ease of accessing materials was also mentioned as the interviewees were concerned with the facilities available to students and the length of time spent waiting for materials to download. Additional factors were whether material was produced by an academic or commercial institution as this affected perceptions of authority, and the availability of features or facilities which exploited the electronic format, including the availability of self-test materials, images and video graphics.

iii. Current Awareness Services

Current Awareness Services (CAS) are services which are designed to alert users regarding a particular topic or issue, such as on journal contents or sources of funding. A limited amount of discussion focused on CAS, and issues mentioned were the coverage, the level of detail provided, the intended audience, the currency and timeliness of the information, and the frequency of distribution of mailings. Timeliness relates to whether information is received at the right time for when it is needed. For example, in relation to services concerned with journal information, the service was of little value where the information was disseminated too far in advance of the journal itself. Further issues
were the ability to restrict services to subject areas of interest and to identify easily the subjects covered by individual postings.

iv. Databases and databanks

Databases or databanks are generally a collection of data items, usually numeric or textual. Two respondents discussed databases of funding information and catalogues were also discussed which can be defined as databases. The reviewers also mentioned statistical sources which could be included here. Bibliographical databases and many of the molecular biology sources could also be described as databases or databanks, but these have been dealt with independently as a wide range of issues were mentioned which are peculiar to their assessment. The issues mentioned related to purpose, coverage, the level of detail provided, ease of use, the search facilities available, the ability to order material from a site and the availability of contact information. In addition, the importance of currency and the frequency of updating were emphasised.

v. Electronic Journals

The electronic journals discussed during the interviews were generally an electronic version of a paper-based refereed journal and were used via the Internet because the paper-based version was not available locally. The interviewees specified that they would evaluate an electronic journal in the same way as a paper-based journal, and therefore many of the issues relating to their evaluation can be drawn from the general comparisons of refereed journals with information available via the Internet.

Many of the generic issues were again discussed. In particular, the motivating factor affecting use of a journal or journal article was the subject area covered. In addition, a range of issues were exclusive to the assessment of journals, notably those relating to the editing and refereeing processes and the reputation of the journal. These included the impact factor of the journal, its genealogy (the length of establishment and the availability of a printed equivalent), the reputation and experience of the editorial board, and the stringency of the refereeing process. Respondents referred to a hierarchy of refereed journals within health and medicine based upon the reputation of the journal, the stringency of article selection and the consequent quality of the material which was
published. However, the different factors were not mutually exclusive and some individuals placed more emphasis upon certain aspects than others. For example, some were interested in new journals, but they were considered high quality publications because they covered the appropriate subject area and had a reputable editorial board. The interviewees also commented on the accuracy of individual journal articles, noting that this was related to the quality of the research. The length of time between article acceptance and publication was also highlighted as an indicator of quality.

Comparisons were drawn between printed and electronic versions of the same journal in terms of the coverage, currency, format, and cost. The reviewers emphasised whether the whole journal was available, and if not, how the different parts had been selected, as well as the availability of features which exploited the electronic format. They also discussed issues relating to the presentation, arrangement and accessibility of journals and journal articles, including the ease of access to individual journals from a site, articles within a journal, and different parts of an article.

vi. FAQ files

‘FAQ files’ are files of frequently asked questions with the answers relating to a specific subject area or issue. Only one FAQ file was briefly discussed and some of the generic issues were mentioned, namely the subject area, the level of detail, the knowledge and expertise of the authors, the accuracy and the research basis for the information.

vii. FTP archives

FTP archives are collections of files, such as software, textual or numerical data, which can be accessed and retrieved using the File Transfer Protocol. Few people discussed FTP archives and those that did used FTP archives to download software. However, the points they raised would be applicable to any FTP archive. In addition, one person discussed his use of FTP archives extensively and mentioned a wide range of issues. Those interviewed also focused upon the sites themselves, rather than an evaluation of the software they accessed.
Many of the generic criteria were noted, particularly those relating to accessibility (speed of access, availability of a mirror site, availability of file sizes to assess the likely time required to download software). Factors affecting currency were also highlighted as archives were used to access software upgrades. Issues included how regularly sites were updated and the availability of information on software version numbers. In relation to coverage, the types of software available, the format of the software, whether software for different platforms was available, and the availability of information relating to the software itself were also mentioned. The reputation of the institution hosting the site affected the archives which were used as, for example, some institutions and sites were considered reputable, while others were the parent organisation responsible for the required software. Accuracy was not mentioned, although one reviewer referred to the availability of virus checking facilities. The availability of different search facilities was mentioned and one user noted the availability of help information.

viii. Image-based information sources

A number of people discussed both sites providing access to images, as well as individual images themselves. Many of the generic criteria are applicable, such as the subject areas covered and the availability of pointers to further images. Less prominence was placed upon currency, authority and accuracy, although the date images were created was specified. Additional issues related to the accessibility and presentation of sites, such as the computer storage format and size of images, the image resolution and clarity, whether images were black and white or in colour, whether video clips were available, and the ease of navigating between images. Other considerations included the availability and usefulness of any explanatory text, the balance between text and images, and the availability of copyright information. There were some contradictions as respondents were concerned with the speed of access to images, but also wanted high quality images, and were aware that the higher the quality or image resolution, the longer the images would take to access. Comparisons were drawn between different sites, and between images available via the Internet with those in textbooks, in terms of the image quality and clarity.
ix. Molecular Biology Sources

The Internet provides access to a vast quantity of molecular biology data, and 'molecular biology sources' refers to any collection of such data which is of interest to molecular biologists, including genetic sequence and protein databanks. The users discussed numerous sources which might be included under this heading, such as sites offering a gateway service to different databases or those offering access to an individual database. The coverage of sites was of particular concern, including the databases covered by a whole site, the data covered by individual databases, the software and data analysis facilities included, and links to further sites and sources.

The reputation of sites and the institution responsible for a source affected those used, and thus, the criteria relating to authority and reputation were applicable. As mentioned earlier, the interviewees were aware of the potential for inaccurate data, and while they felt this was not always problematic, various features were considered useful (warnings of likely inaccuracies, any quality control mechanisms, facilities to correct inaccurate data, links to published papers, details about the researchers responsible for the data). The range of specialist searching and data analysis facilities, the output facilities, the use of standard characters to represent DNA and the availability of three-dimensional structures or images were also highlighted.

The volume of molecular biology data being produced is now far in excess of what is publishable in any printed source, and the Internet consequently offers access to a unique data resource. However, many sites are similar in their coverage, particularly as the data is often deposited from the same original source. Thus, coverage and accuracy were not always considered useful points of comparison, and respondents compared the frequency of updating and the location.

x. Organisational WWW sites

'Organisational sites' refers to those sites available via the WWW which provide information about a particular organisation, and might be described as a home page for the organisation. The reviewers mentioned a range of additional sites, such as professional and learned society pages and commercial pages, which might also be included under this heading. Many of the generic issues were discussed in relation to
organisational sites. Issues of particular concern were the reputation of the institution which, as already discussed, can affect the sites used as well as perceptions of the accuracy and reliability of information. Users also highlighted the availability and ease of locating contact information, the level of detail provided and the currency of the information, particularly where they were interested in finding information about the organisation concerned or individuals at the organisation.

xi. Personal home pages

Personal home pages are those pages or sites available via the WWW which are designed and maintained by an individual, and the information primarily relate to their personal interests. Few personal home pages were discussed, but where they were, many of the generic issues were mentioned, including purpose, coverage, the level of detail and the knowledge and expertise of the author. Again, the availability of contact information was of interest, as was information about the individual’s research interests.

xii. Search facilities

‘Search facilities’ are the range of tools and facilities, including search engines and subject trees, used to search the information available via the Internet and the WWW in particular. The inclusion of search facilities as a source type is problematic as they were not used as a source of information in their own right but as a tool to locate other information sources. However, the respondents critically discussed the search facilities they used, and ultimately it was felt that an examination of the criteria relating to them would be useful for LIS professionals. Likewise, the use of search facilities is comparable to other sources, notably bibliographical databases. The issues included the searching and browsing facilities available, the ability to narrow searches by subject area or type of information, the automatic removal of any duplicates from search results, the usefulness of the subject headings used, the volume of information provided in the search results and the ease of using the facility. One person commented on the difficulties of searching different types of resources, such as Usenet postings and WWW documents, as well as the comprehensiveness of coverage.
xiii. Subject-based WWW sites

'Subject-based WWW sites' refers to those sites or pages available via the WWW which have a particular subject focus. Obviously there was some overlap between organisational sites, personal home pages and subject-based sites as often the latter two formed part of the first or a personal home page focused on a particular subject area. However, individual pages were assessed with regard to the reason for their use (whether they were used to find information about an institution, an individual or a subject area). Again, the generic issues were mentioned but the subject area and resources covered were obviously of particular concern. In addition, the availability of pointers to further information was emphasised, as was the expertise of those involved in creating and maintaining the site, the level of detail, the intended audience and the arrangement of information.

xiv. Usenet Newsgroups and discussion groups

Usenet Newsgroups and discussion groups were used in three ways: to post a query; to 'lurk' in order to follow the discussion; or to browse previous messages. Thus, both the individual messages and the groups as a whole were discussed as an information source. Usenet Newsgroups and discussion groups are often discussed separately in the literature. However, it was apparent during the interviews that both were used for the same reasons and the interviewees had similar perceptions of the information available, although one user did mention the different modes of access. They are therefore discussed together.

A wide range of issues were exclusive to the evaluation of Newsgroups and discussion groups. For example, the numbers, location and expertise of group participants were discussed. The volume of traffic affected the usefulness of groups as an information source, and group moderation was considered beneficial in controlling the volume of traffic. The implementation of subject conventions for 'labelling' the content of messages was also highlighted as a valuable feature. The reviewers tended to focus upon the nature of the discussion, the availability of a group archive with search facilities, a group administrator and their role, and the availability of a home page providing background information. Furthermore, the reviewers felt moderation affected the accuracy of the information posted to a group and was not a coverage issue.
Some of the generic criteria were applicable, particularly those relating to coverage. However, others were less relevant such as currency, presentation and arrangement, accessibility, and ease of use and user support. The questionable accuracy and reliability of information available via Usenet Newsgroups or discussion groups is generally considered a major drawback to their use. However, those interviewed did not expect to rely upon the information to the same extent they would rely upon a refereed journal article. The groups were not considered a source of high quality information, but a source of advice and opinions or a source of factual information relating to meetings and conferences. However, an individual message was considered more reliable if there were references to published information or the author was recognised as an expert in the field. One person relied upon the information, but conceded that his perceptions were affected by the 'reasonableness' of the information and the reputation of the author.

5.2.4 The nature of source evaluation

Through an analysis of end-users' comments regarding their information seeking experiences, it has been possible to identify a range of factors which affect the quality, or end-users' perceptions of the quality, of a range of different information sources available via the Internet. In addition, it has been possible to highlight the factors which are of particular importance when assessing different source types.

In the literature review quality is defined as 'the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs' (BSI, 1995). As suggested by the quotation, quality refers to an understanding between a customer and a supplier, and therefore there can be no definitive statement of quality because its definition will depend upon the needs of the customer concerned. This is particularly pertinent to information available via the Internet because there are so many potential customers and suppliers of that information. The results of the interviews confirm this understanding of quality. Different factors affecting the quality of sources were mentioned by different users depending upon their reasons for using the Internet and the nature of the source used.
Quality assessment is dependent upon both contextual and subjective factors. Context refers to 'the circumstances relevant to something under consideration', and subjective means 'proceeding from personal idiosyncrasy or individuality; not impartial or literal', 'proceeding from or belonging to the individual consciousness or perception' (Oxford English Dictionary, 1990). Alternatively, objectivity is defined as 'external to the mind', 'dealing with outward things or exhibiting facts uncoloured by feelings or opinions; not subjective' (Oxford English Dictionary, 1990). The majority of the issues discussed could not be defined as 'objective' measures of source quality. Possible exceptions might include the truncation of the abstracts in a bibliographical database or typographical errors in a document. However, different issues affected the value and usefulness of the different sources, and the issues which were mentioned were affected by the needs of the users, and consequently, their own feelings and opinions.

Quality assessment is not an independent stage in the use of information but a process. It is possible to identify three autonomous stages to this process and different assessment issues are of increased importance in relation to each stage. Firstly, specific issues affect whether an information source is initially accessed: those relating to the accessibility of a source (e.g. cost, location, speed of access, the need to register); those affecting perceptions of the authority of a source (e.g. its reputation, the knowledge and expertise of the user, whether the source has been recommended); and any information about the purpose of a source (e.g. in particular, its intended coverage and intended audience). Secondly, there are a range of issues which will affect the ease of accessing and using the information contained in a source, and can affect whether the required information is located. These issues primarily relate to the presentation and arrangement of the information (e.g. the organisation of information, the availability of any search facilities, the style of writing) and again, the accessibility of the source (e.g. speed of access). Thirdly, certain issues affect whether information is used. These relate to the subject areas covered, the level of detail and whether it is appropriate for the user concerned, the currency of the information, and perceptions of the likely accuracy of the information. However, the importance of the different issues is dependent upon the needs of the user and the reason for using the source. For example, some users referred to the over-riding importance of the subject area covered, irrespective of the ease of accessing or using a source, while others were reluctant to pay for potentially valuable information.
Furthermore, quality assessment was not a straightforward procedure involving an identification of the presence or absence of different features or facilities. Instead, quality assessment is a complex process involving consideration of a wide range of inter-related issues which are of varying importance depending upon the context of information seeking. For example, while factual accuracy might be an indicator of quality, there are a wider range of considerations which affect users’ perceptions of the accuracy of a source, including the knowledge and expertise of the author or the quality of presentation, and the importance of assessing accuracy corresponds with the reason for information seeking. Moreover, the knowledge and expertise of the author might affect a user’s perception of accuracy, but a source will not be of value unless it covers the appropriate subject area and in the appropriate level of detail.

A final question relates to what was actually being assessed by the users. ‘Information’ is defined in the literature review as a ‘any structured data which has the potential to transform a state of knowledge or knowledge structure’, and an ‘information source’ as ‘any such recorded information’. As mentioned, many of sources which were discussed during the interviews might not be accommodated by a traditional understanding of an information source. The Internet encompasses a much broader range of source types than has previously been encountered and one of the motivations for the research was the need to examine the issues affecting the quality of such source types. Moreover, many of the assessment issues did not relate to an assessment of ‘information quality’, but rather an assessment of the service or source providing access to information. For example, information might be described as ‘accurate’ or ‘current’, but the availability of user support or the ease of accessing a source is extraneous to the information itself. Consequently, quality assessment is much broader than simply ‘information quality assessment’, but relates to source quality, service quality and information quality.

5.3 The proposed evaluation tool

This section describes the development of an evaluation tool, the ‘Evaluation Criteria Document’ (Appendix C). The role of the tool is discussed in the light of the results of the research, the theory of quality assessment and the reviewers’ comments regarding an earlier draft of the tool.
5.3.1 The development of the tool

As discussed in Chapter 3, a draft evaluation tool, the 'Evaluation Criteria Document', was devised based upon an initial analysis of the information seeking interviews. The nature and format of the tool was also based upon impressions gained through conducting and transcribing the interviews. For example, it was recognised that devising a simple list of evaluation criteria would not suffice because the users' assessments of quality were complex. Furthermore, initial analysis indicated that different types of Internet-based sources were evaluated differently and therefore different criteria were required for each. Consequently, a document format was used, rather than a simple list of criteria, and a resource specific approach was taken.

In devising such a document, introductory information was required to explain its purpose, contents and intended use. Likewise, introductory information was required on each source type, including details of the types of materials included and a reference to any other relevant sections. Each source type was then divided into areas of evaluation identified from the analysis, and issues for assessment or criteria were listed with explanatory notes. In addition, quotations were taken from the interview transcripts to illustrate the criteria and enliven the document. At the end of the document, an evaluation checklist was provided comprising all of the criteria for each source type which were rephrased as questions. It was envisaged that users might read the detailed sections in order to learn about the criteria and the process of source evaluation, and the checklists would provide a quick reference tool for day-to-day use.

The final draft of the Evaluation Criteria Document (Appendix C) was completed following full analysis of the interview transcripts and the reviewers' comments. Through the analysis, it was evident that the assumptions described above were correct, namely that there was a need for a document due to the complexity of quality assessment, and a resource specific approach was required because different issues were applicable to different source types. However, numerous changes were also required. In particular, the 'generic evaluation criteria' section was added as it was possible to identify issues which were applicable across a range of different types of information sources. Indeed, while the reviewers were positive about the resource specific approach, they were critical of the volume of repetition in the first draft, and the addition of the generic criteria substantially reduced this. The source specific sections were retained to...
address any issues peculiar to each source type, with pointers towards any appropriate
generic criteria. The checklists were also kept, partly because the reviewers felt they
were the most important part of the document and would become the major working
tool, but also because they provide a list of all the possible questions relating to each
source type drawn from both the generic and the source specific sections. The checklists
are placed together at the end of the document to ensure ease of location and use.

One reviewer was critical of the resource specific approach and another proposed
dividing the tool according to the 'function' of different sources. However, as discussed
earlier, the issues mentioned by different users were dependent upon the source types
used, and the source types were identified through inductive analysis of the
interviewees' comments. Furthermore, the function of the source is intrinsic to many of
the source types. For example, organisational sites are defined as such because they
provide information about an organisation, and subject-based WWW sites provide
information relating to a particular subject area.

During the development of the first draft, the notes and guidelines were kept to a
minimum as it was assumed that users would require a smaller and more compact
document. However, the reviewers requested more information on the evaluation
process, on the intended audience of the document, and on how the document should be
used. Therefore, the introduction was expanded to address these issues and the
guidelines on the criteria were extended to include any additional points raised by the
interviewees and the reviewers. In particular, the textual analysis written into the results
chapter, the results tables and the theory of information quality assessment were
extensively drawn upon to develop the explanatory notes. The quotations were retained
as some reviewers felt they were valuable and made the material easier to read.

The reviewers suggested a number of valuable criteria based upon their personal
experiences and knowledge of different Internet-based sources. However, there were
some contradictions between the reviewers' and the interviewees' comments. For
example, the reviewers felt moderation of Usenet Newsgroups and discussion groups
affected accuracy, while the interviewees felt it affected coverage. The focus of the
research was the end-user perspective, and therefore their position took precedence.
Moreover, the role of a group moderator, as identified in the literature review, is
generally to assess the subject relevance of the messages posted to a group rather than to
ensure accuracy. Likewise, the reviewers were dismissive of 'under construction' symbols on WWW sites, while the interviewees felt they were a positive sign of site maintenance. Again, the end-user perspective was adhered to.

The reviewers also offered contradictory opinions about the tool. For example, while some reviewers felt the explanatory notes and quotations added value and provided a context for the criteria, others felt the notes stated the obvious and the quotations were meaningless. Meeting the needs of a wide range of potential readers is always problematic in developing any such tool, and the lack of implementation and testing meant that a certain amount of guesswork was required in its development. Therefore, a lowest common denominator of understanding was aimed for and extensive guidelines were provided. To compensate, experienced evaluators not interested in learning about the process of source evaluation are referred in the document to the checklists.

Some of the reviewers' suggestions were not adopted. For example, different formats for the evaluation tool were proposed, including an electronic format using hypertext links between the different sections. The addition of examples was also recommended to enrich the document, the value of which could not be doubted. While the potential benefits of these different suggestions were recognised, they were outside the scope of the study and the researcher was constrained by a lack of time. However, these are areas which might be considered for any future research. Other reviewers noted the need for an equivalent tool aimed at end-users. The results of the research illustrate the impact of the Internet on those involved in health care and medicine but the results also highlight a number of problems associated with use of the Internet for accessing information, including a lack of confidence regarding information searching and quality assessment skills. This is perhaps another area of concern for future research which could investigate the most appropriate format a tool should take for use by health care and medical users, as well as the training and implementation issues associated with any such development.

The reviewers were also interested in the relative importance of the different criteria. The theory relating to quality assessment indicates that different issues were of increased importance, depending upon the needs of the user and the source used. Furthermore, the relative importance might be indicated by the number of times each criterion was mentioned in relation to each source type, as displayed in the results tables.
(Appendix B). However, as Schamber (1991b, p.131) suggests in conclusion to her study, ‘it would be natural to assume that the criteria that were mentioned less often were less important’, but ‘the study was designed primarily to encourage respondents to generate criteria for descriptive purposes and not to rank the criteria’. While the value of indicating the relative importance of the criteria is recognised, this research was also concerned with the identification and description of the issues affecting source quality, and the interviewees were not explicitly asked to rate the relative importance of the different issues. Therefore, it would be misleading to attempt to rank the criteria and such an approach was not adopted. Moreover, one reviewer highlighted the need for ‘objective’ measures of information quality, and another recommended dividing the criteria between ‘primary’ or ‘objective measures’, and ‘subjective’ measures relating to ‘matters of personal taste’. As already discussed, the users’ assessments of quality were dependent upon the context of information seeking and the source used, and few issues were mentioned which could be defined as entirely objective. The suggested approach was therefore not adopted.

The implication of the reviewers’ comments relating to objectivity and the ranking of the criteria is that they were interested in an objective means for rating sources. As discussed in the literature review, many of the popular reviewing sites have adopted a numerical approach in order to rate materials, as have some of the peer reviewing services such as Medical Matrix and Six Senses. Advocates argue that a numerical value provides an objective assessment, as well as a method for comparing different information sources and characteristics of information sources. A further argument is that ranking enables a consolidation of the subjective views of several individuals in order to arrive at a more meaningful measure. However, any such ranking must be based on an evaluation made by someone and is therefore no more objective than any other evaluation. In addition, problems arise regarding how ranks are assigned and the meaningfulness of the numerical values. The results of this study underline the subjective and the contextual nature of quality assessment. When considering the central role of the needs of the user and the source used in information quality assessment, it would be impossible to define one source as ‘statistically “better”’ than another (Miranda and Mongeau 1991, p.92). Consequently, attempting to assign numerical values to the different criteria would be meaningless and has not been examined during the course of the research.
However, a dichotomy appears to exist between the subjectivity (and complexity) of the process of information quality assessment, and a desire for objective measures of quality. This suggests there may be scope for further research into the relative importance of different evaluation criteria and whether a numerical rating system could be developed. This might involve examining:

- why some criteria were mentioned by some users and not others,
- why some criteria were mentioned in relation to some sources and not others, and
- users' perceptions of the relative importance of the different criteria generally and in relation to specific source types.

The results of research could then be used to assign numerical values to different evaluation criteria, enabling the numerical rating of sources. This would then require a process of implementation and testing to assess whether the resultant ratings provide a meaningful and 'objective' measure of information quality.

5.3.2 The role of the tool

The document is intended as a guide to the selection and evaluation of information sources available via the Internet, and is intended for use by LIS professionals. As discussed, there can be no definitive statement of a 'quality' source of information because perceptions of quality are dependent upon the needs of the individual user as well as the nature of the source used. Furthermore, the results indicate that quality assessment as a complex process. Different issues affect users' perceptions at differing stages in the use of an information source, there are a wide range of issues which might be considered, and these issues are inter-related and of increased importance depending upon the needs of the user and the nature of the source used.

The full range of issues mentioned during the course of the interviews are included in the Evaluation Criteria Document. The issues relating to information quality are extensively discussed in order that the document might serve as a training manual for inexperienced evaluators or those unfamiliar with a particular type of information source. The checklists are intended as the major working tool and are designed to offer a comprehensive list of issues relating to each source type. However, the document is not
intended to be prescriptive, nor is it assumed that evaluators will attempt to conduct an assessment of all of the criteria. The tool is intended as a guide for the reader to identify the most appropriate issues according to the needs of the user and the source used. Moreover, the document is not intended to be read in a linear fashion but consulted as and when required.

Three reviewers referred to the subconscious nature of the evaluation process and authors elsewhere have noted difficulties associated with formalising the evaluation process. For example, Stevens (1986, p.16) differentiates between the theoretical criteria defined in the professional literature for evaluating information sources, and the practice of evaluation whereby 'professional judgement is involved and where other elements that cannot easily be categorised somehow always come into play'. Stevens proposes an initial decision of which criteria should be used, followed by an application of the criteria, while bearing in mind the needs of the users concerned. Furthermore, Hofman and Worsfold (1997) advocate the development of evaluation criteria as an attempt to formalise the selection process:

The evaluation of information resources is a very complex process best carried out by subject specialists whose judgements are likely to involve detailed and complex mental processes. It is necessary to draw out and formalise the tacit knowledge which is currently used so that the selection process becomes more transparent, consistent and accountable, and itself is subject to a process of continual improvement.

This research was driven by a conviction of the need to formalise the selection process in order to assist LIS professionals in the selection and evaluation of material available via the Internet. The central role of human judgement is recognised, and that selection is intuitive and shaped by existing knowledge and experience. However, it is also recognised that there is a role for guidelines to assist LIS professionals in selection and evaluation. By determining a wide range of criteria which are applicable to different information sources, it is assumed that librarians and other information professionals will be able to use the criteria in conjunction with their own knowledge and experience. Those reviewers who commented on the subconscious nature of evaluation conceded that the criteria offered a useful starting point, highlighted issues they had not considered and reminded them of other issues. Thus, the criteria assisted in source evaluation by acting as a guide and a prompt to their existing or latent knowledge.
Finally, one reviewer commented on the difficulties associated with implementing and using many of the criteria described in the tool, such as the length of establishment of a journal or the stringency of the refereeing process. Likewise, creating an 'overall impression' is problematic because LIS professionals would perhaps not have the time to use material extensively in order to create an impression and, as one reviewer suggested, such a conclusion might be drawn following consideration of a combination of the other criteria. Therefore, a further consideration in the criteria which are used will be the time available to the evaluator.

5.4 Implications of the results

This section considers the wider implications of the results arising from the research. The criteria are compared to those derived from other studies described in the literature. The validity of the results are then assessed by appraising the methods used to develop them. The generalisability of the results and possible approaches to testing the Evaluation Criteria Document are considered.

5.4.1 Comparison of the criteria

The literature review (Chapter 2) provides an extensive discussion of the different types of criteria available to the profession. The purpose of this section is to compare existing criteria with those identified in this study, and to consider any reasons for the variations which might exist.

A range of criteria relating to the selection and evaluation of sources in a paper-based format have been discussed, and some significant similarities can be identified. For example, as early as 1904, Kroeger suggests an examination of the coverage, authority and any special features of a reference work, and refers the evaluator to the title page, preface and introduction to identify purpose. Likewise, Higgins (1984) and Katz (1992) cover similar criteria, including the need to identify any unique features of a work and to consider the basis of the information. The most obvious difference between paper-based and Internet sources would seem to be in their format. However, in relation to reference works, both Higgins and Katz note the need to obtain information easily, the importance
of ease of use, the need for clarity in the presentation and arrangement of a source, as well as the relevance of any illustrations and their location in relation to the text.

There is an immense amount of literature dealing with criteria for the evaluation of bibliographical and other electronic databases. Again, numerous similarities can be identified. For example, both Large (1989) and Basch (1990a) refer to aspects such as coverage, authority, accuracy, currency, uniqueness, retrieval facilities and user support. However, there is one notable difference. During the 1990s, there has been an increasing concern with database quality, particularly the accuracy of database indexing. However, indexing effectiveness was referred to only once during the course of the interviews. Reasons for this might include a difference in perspective as LIS professionals are generally conducting a search on behalf of a third party and are therefore more concerned with ensuring retrieval of all the potentially relevant records. Alternatively, end-users may use databases less and are less likely to be knowledgeable of their development and structure, and therefore, may be unaware of any problems.

When the research commenced, authors were already beginning to modify traditional criteria for the selection and evaluation of information available via the Internet, and an increasing number of such criteria have been developed during the course of the research. LIS professionals such as Hinchliffe (1995), Smith (1997b), and Brandt (1996) have been prolific in their commentaries on source evaluation and many similarities may be identified with the criteria they propose. Likewise, many of the eLib subject-based gateway services have produced documents on the selection and evaluation of sources for inclusion in their services and again, similarities are identifiable (see for example, the OMNI guidelines for resource evaluation (1997), or Evaluating Internet resources for SOSIG (1998)). However, not all of the criteria are similar to those defined here. For example, the criteria proposed by McLachlan (1996) focus on accessibility, presentation and arrangement and ignore aspects relating to the accuracy, authority or purpose of a source.

Hofman and Worsfold (1997) have endeavoured to collate the criteria described in the literature, as well as those currently used by the eLib subject-based gateway services. Thus, the material offers a useful means of comparing the types of criteria proposed by LIS professionals with those developed here. The criteria are divided into 'scope', 'content', 'form', 'process' and 'collection management', and it is easy to identify
similarities. For example, ‘content’ includes coverage, currency, authority and accuracy, and ‘form’ includes ease of navigation, user support, appropriate use of the technology and aesthetics. However, ‘form’ also covers the use of recognised standards, and ‘process’ relates to system and site integrity. These issues were not mentioned in the interviews, possibly because they are not of concern to end-users, and as a result are not included in the Evaluation Criteria Document. ‘Scope’ relates to an assessment of the intended audience, cost and subject area in comparison to the user’s needs, and ‘collection management’ examines the relationship of a source with the service being developed. Identifying the user’s needs is not defined as an independent stage in the Evaluation Criteria Document, but rather a factor which should be considered throughout source evaluation. In addition, collection development is not addressed as the Document is intended for a wider audience than developers of subject-based gateway services.

It is possible to identify numerous minor variations in the individual questions proposed for source evaluation. For example, Hofman and Worsfold suggest an assessment of the ‘substantiveness’ of a source, and questions include:

- Does the resource contain more than contact details?
- If the resource consists of a collection of links, is there substantial annotation or value-added information?

This research has highlighted the importance of the context of information seeking to the criteria used. Reasons for using the Internet include the location of contact details or to find further sources on a subject area of interest. Consequently, where a source simply provides contact information or a collection of links, it might be considered a quality source under certain circumstances because it meets the needs of the user concerned. However, in other situations, users may require more information and therefore, the Evaluation Criteria Document recommends questions relating to whether the information is provided at an appropriate level of detail for the user concerned, and whether the source is unique in terms of its content or format.

Further differences lie in the lack of explanatory information on source evaluation and the lack of detail on the relationships among the different criteria in the Hofman and Worsfold document. In addition, there is no distinction between the different types of sources available via the Internet and how those different sources might be assessed. An
explanation for these differences lies in the methods used to develop the evaluation criteria. Hofman and Worsfold collected and amalgamated existing criteria, while the Evaluation Criteria Document was developed by examining the information seeking behaviour of end-users of the Internet. Therefore factors relating to the process of source assessment were identified and used to add depth to the criteria. Furthermore, this research indicated different ways of using and assessing different source types, and therefore a source specific approach was adopted.

Numerous other groups have produced criteria for assessing the quality of information available via the Internet, some of which were examined in the literature review. Reservations have already been expressed regarding the popular reviewing services and it is now possible to identify significant differences between the criteria used by such sites and those mentioned by the interviewees. For example, Lycos Top 5% mentions the content of a source, but focuses on design and whether a source is ‘fun, inviting and captivating’. Likewise, the Six Senses service is also biased towards an assessment of the presentation and arrangement of information as opposed to its content. The results of this study highlight the importance of content to end-users, and presentation and arrangement were considered secondary in many of the information seeking situations which were described. Furthermore, the lack of an audience focus in many of the popular reviewing sites means the criteria cannot offer a valid indication of quality because any understanding of quality is dependent upon the needs of the user. While the subjectivity of any quality assessment is recognised, the Evaluation Criteria Document was developed by examining the behaviour of a definable group of Internet users and therefore reflects their perceptions of quality. As Rettig (1996) suggests, the criteria used by the popular reviewing services result in little more than an assessment of ‘coolness’ or ‘net appeal’, rather than a realistic indicator of quality.

Codes or standards for the provision of quality health and medical information via the Internet have been developed by three organisations, Medical Matrix (1997), the British Healthcare Internet Association (1996), and the Health on the Net Foundation (1997). Recommendations of these organisations include the need for:

- a clear statement of the authority of information,
- contact information,
- sources to be kept current,
There is an obvious overlap between these guidelines and some of the areas for assessment described in the Evaluation Criteria Document. The above guidelines were developed by a range of medical and health care professionals, and the Evaluation Criteria Document was developed by examining the information seeking behaviour of members of this group. Thus, it is unsurprising that similarities exist, and these similarities serve to validate the respective criteria.

Furthermore, as discussed in Chapter 3, the Health Information Technology Institute at Mitretek Systems have devised criteria for health information available via the Internet (Ambre, et al., 1997). The document, produced by a range of health care professionals including consultants and IT specialists, provides an extensive guide to source evaluation intended for consumers of health information. Again, there are numerous similarities between the proposed criteria, such as assessing the currency and accuracy of information. It is also possible to identify advantages over the Evaluation Criteria Document, notably in relation to the availability of criteria for assessing the evidence basis of information. The research or evidence basis of information was rarely mentioned during the course of the interviews. This might be accounted for because the interviewees did not expect to find high quality information via the Internet but used refereed journal articles where high quality information was required. However, as an increasing volume of research-based information is disseminated via the Internet, there may be a need for additional work into assessing the research quality and evidence basis of Internet-based materials, particularly with increasing moves towards evidence-based practice in health care generally.

However, there are also a number of drawbacks to the Mitretek document. The guidelines do not differentiate between different types of sources available via the Internet, little detail is provided on how users should approach assessment and the available advice is presented as a dense narrative which is written in an academic style and assumes some medical knowledge. For example, where 'evidence-based medicine' is discussed, the concept is not defined and it is assumed the reader understands what is meant by a 'controlled clinical trial' or an 'epidemiological study'. There is an apparent
lack of concern for the readers of the document who are identified as 'the general public'. Although the Evaluation Criteria Document was not implemented and tested, the needs of LIS professionals were considered and their comments indicated the need for extensive explanatory notes and guidelines.

The literature review highlights the lack of research into how end-users select and evaluate information. However, some studies have been conducted and it is possible to draw comparisons. Bichteler and Ward (1989) examined geologists' views of the factors affecting the quality of information sources. The areas identified were the author's reputation, the quality and validity of the data, and the reputation of the journal. Similar issues were identified by Sievert, et al. (1996) when examining the factors beyond relevance which affected clinicians' decisions to read different journal articles. Again, both studies highlight the importance of methodological rigour and research quality in an assessment of information. As already mentioned, the research or evidence basis of information was rarely mentioned during the course of the interviews possibly because the interviewees did not expect to find high quality information via the Internet. Research quality might have been mentioned more frequently had the focus of the study been the use of journal articles, and again, as more sources of this nature are made available via the Internet, research will be required into the development of criteria relating to research quality.

The study conducted by Schamber (1991a and b) was influential in the design and conduct of this research as it was also concerned with the evaluation criteria mentioned by end-users when describing their own information seeking experiences. The criteria are almost identical to the generic evaluation criteria identified here, although slightly different terminology has been used:

<table>
<thead>
<tr>
<th>Presentation Quality</th>
<th>Presentation Arrangement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
<td>Currency and Maintenance</td>
</tr>
<tr>
<td>Reliability</td>
<td>Authority and Reputation</td>
</tr>
<tr>
<td>Verifiability</td>
<td>Comparison to Other Sources</td>
</tr>
<tr>
<td>Geographic Proximity</td>
<td>Purpose (Limitations) and Coverage</td>
</tr>
<tr>
<td>Specificity</td>
<td>Purpose (Intended Audience) and Coverage</td>
</tr>
</tbody>
</table>
Schamber (1991b) also lists the number of times each criterion was mentioned in relation to the different types of sources (television, information system, person, etc.), and the different presentation types (text, interpersonal, multi-media, etc.), and concludes that the 'criteria varied in relative importance depending on the specific aspect (e.g. source) of the situation being evaluated' (Schamber 1991b, p.131).

Undoubtedly, the affinity of the results may be accounted for by the similar methods which were used, as well as the nature of the users and the information sources. Users of weather information were interviewed and issues such as accuracy and currency are also likely to be of concern, as with users of health and medical information. Likewise, a range of multi-media sources were discussed. However, Schamber did not seek to develop a tool for source evaluation and provides limited information about the different issues raised in relation to each criterion. It is therefore difficult to draw any further comparisons between the results, although the comparison thus far underlines the validity of the methods used and the results achieved in both studies.

A project based at the University of Georgia attempted to rate the relative importance of a range of different criteria (Wilkinson, 1997). The criteria were identified through a review of the literature and by examining those used by different gateway services, and were then ranked by respondents to an electronic questionnaire. The criteria are listed under the headings:

- site access and usability,
- resource identification and documentation,
- author identification,
- authority of author,
- information structure and design,
- relevance and scope of content,
- validity of content,
accuracy and balance of content,
navigation within document,
quality of the links, and
aesthetic and affective aspects.

The ten highest ranking criteria were:

- is there a good organisational scheme?
- is the design so complex that it detracts from the content?
- is the information sufficiently current to meet the user's needs?
- are there any obvious errors or misleading omissions in the document?
- are the links relevant and appropriate to the document?
- what is the author's name?
- what is the author's professional or institutional affiliation?
- does the author or the sponsor of the site have a vested or a commercial interest in the topic?
- are the links evaluated in any way prior to inclusion?
- are the links clearly visible and understandable? (Oliver, 1997).

The above ratings do not appear to reflect the results of this study. In particular, the top ranking items are biased towards an assessment of the presentation and arrangement of information, whereas the interviewees regularly underlined the importance of content. Certain problems can be identified in the conduct of the University of Georgia study which may account for these differences. In particular, the questionnaire was available via the Internet and there is a lack of information regarding who participated and rated the criteria. Furthermore, the study reports do not mention whether participants could suggest new criteria or reject existing criteria, implying the criteria were biased towards the existing views of the researchers (see for example, Oliver, 1997; Wilkinson, 1997).

As mentioned earlier, the reviewers expressed an interest in weighting the different criteria according to their perceived importance but such an approach was not adopted in the Evaluation Criteria Document. While drawbacks are recognised in the methods used at Georgia, there may be scope to adapt them and investigate ranking the relative importance of the criteria described in the Evaluation Criteria Document.
5.4.2 Validity of the results

The research design used to develop the evaluation criteria is described and justified in Chapter 3. This section considers the validity of the results by examining the methodological implications associated with their development.

According to Patton (1990, p.461), the credibility of a qualitative study is dependent upon three issues:

- rigorous techniques and methods for gathering high quality data that is carefully analysed with attention to issues of validity, reliability and triangulation;
- the credibility of the researcher, which is dependent on training, experience, track record and presentation of self; and
- philosophical belief in the phenomenological paradigm, that is, a fundamental appreciation of naturalistic enquiry, qualitative methods, inductive analysis and holistic thinking.

The methods and techniques used were selected to ensure the collection of high quality data which would enable accurate analysis and representation of the results. The motivating factor in the design of the study was the applicability of the methods to the research area, and ultimately, the methods and techniques were successful in achieving their purpose. The open-ended interviewing techniques were successful in seeking understanding of an area about which little was known. The interviewees were able to describe in their own words their perceptions, attitudes and feelings towards the information available via the Internet and how they assessed the quality of that information. Transcription of the entire dialogue from the first interviews enabled analysis of the users’ comments regarding their own experiences, and the theory regarding source assessment emerged directly from the data. The second stage of interviewing was effective in validating the initial findings, as well as in developing the evaluation criteria and the theory regarding information quality assessment. Finally, the open-ended questionnaire was also effective in collecting data regarding the attitudes and perceptions of LIS professionals towards the Evaluation Criteria Document.

Validity can refer to 'a valid account', which is 'one which can be defended as sound because it is well-grounded conceptually and empirically' (Dey 1990, p.253). Schamber (1991a, p.95) argued that the strongest claim for validity in her study was 'that the data
were elicited directly from users describing their own information seeking and use situations', whereas many other investigations are conducted under artificial test situations. Furthermore, Schamber used 'naturalistic and relatively unobtrusive methods ... to collect and analyse users' criteria', as respondents could select their own example of information seeking and describe the example in their own words. Likewise, the validity of the criteria developed from this research is based upon their development through examining users' own descriptions of their information seeking experiences. The respondents used natural language to describe authentic examples where the Internet had been used to look for information.

Dey (1990) discusses the use of numbers to analyse meaning in order to indicate validity. In this study, numbers have been used to identify which interviewees mentioned the different evaluative comments in relation to each source. The purpose of the study was to observe and describe, rather than to predict the likelihood of future events, and the numbers were not intended to rate the relative value of each criterion. However, the frequency counts serve to validate the criteria by indicating the number of interviewees who mentioned each issue in relation to each source type.

Reliability refers to 'consistency through repetition ... others using the same procedures should be able to produce the same result' (Dey 1990, p.250). The focus of the research was an investigation of the information seeking behaviour of health and medical users of the Internet. It would be almost impossible to repeat the methods used to achieve identical results as both the use of health and medical information, and the nature of the information available via the Internet, are continuously changing. According to Strauss and Corbin (1990, p.250):

> Probably no theory that deals with a social/psychological phenomenon is actually reproducible, insofar as finding new situations or other situations whose conditions exactly match those of the original study, though many major conditions may be similar.

However, comparison with the results from Schamber's study discussed earlier indicates the reliability of the procedures which were adopted in both studies. Similar methods were adopted to investigate the information seeking behaviour of a different group of users in a different environment. Both user groups and environments shared similar characteristics, and similar criteria were derived from the different sets of interviews.
Schamber (1991a, p. 92) describes three methods of ensuring the reliability of data analysis: measuring coding against a standard or norm; measuring the extent to which coding is consistent between more than one analyser; and, measuring whether coding is invariant over time when conducted by one coder. Only the third suggestion is applicable to the methods of data analysis used here. However, the necessary time was not available during the research to re-analyse the data at a later stage and verify the results. Instead, the results of the analysis were constantly compared with the original interview transcripts in order to ensure an accurate representation of the attitudes and opinions of the interviewees.

The use of methodological triangulation was a consideration in the design and conduct of the criteria development and validation interviews. Methodological triangulation involves using different methods to study the same phenomenon and serves to strengthen the validity of the resulting data. The second set of interviews was conducted using a different interview schedule to examine the information seeking behaviour of a different group of health and medical Internet users, and the resulting data therefore serves to validate the findings of the first interviews. However, as mentioned in Chapter 3, it was recognised that observation of Internet users would complement the data derived from the interviews. As also discussed, resources were not available to video respondents at their convenience, which was also considered intrusive, computing equipment was not available to record users in a less obtrusive manner, and it was felt unlikely that health and medical professionals would be willing or able to devote additional time while the researcher observed them and then interviewed them about their use of the Internet. It is recognised that there are limitations of reliance on interview data alone:

Interviews are a limited source of data because participants and staff can only report their perceptions of and perspectives on what has happened ... Interview data can be greatly affected by the emotional state of the interviewee at the time the interview takes place. Interview data are also subject to recall error, reactivity of the interviewee to the interviewer and self-serving responses (Patton 1990, p. 245).

Furthermore, while triangulation was 'first conceptualised as a strategy for validating results', it is increasingly used as a means for 'further enriching and completing knowledge' (Flick 1998, p. 230). In the context of this study, observation of Internet
users might have enriched the data by validating individuals comments' on their use of Internet-based resources. Therefore, the extent of triangulation was limited, and although the interview data was validated using a different interview method, this data could have been further enriched had observation been a conceivable option.

In the earlier quotation, Patton (1990, p.461) secondly lists consideration of 'the credibility of the researcher, which is dependent on training, experience, track record and presentation of self' when assessing the credibility of a qualitative study. A PhD, by its very nature, is a research training process and consequently, the researcher lacked any practical experience at the outset. However, an ESRC (Economic and Social Research Council) accredited training course was undertaken during the first three months of the study which introduced a wide range of research methods available to social scientists. Participants were required to undertake work relating to, for example, the differences between and the relative values of quantitative and qualitative methods, analysis of statistical data, legal and ethical issues associated with research, and the philosophical foundations of research in the social sciences. An extensive review of the literature was also conducted to ensure consideration of a wide range of methods and techniques, and the literature was examined to study any advice regarding the design, conduct and analysis of questionnaires and interviews.

The lack of experience of the researcher was a drawback in certain regards. For example, the ESRC research training course lasted three months and the volume of work was time-consuming, thereby impeding the early progress of the study. Moreover, some problems have already been highlighted in Chapter 3 relating to the conduct of the first interviews, namely the tight time scales and the lack of effective piloting, which might be accounted for by a lack of experience. However, the training course was a valuable learning experience, and the various stages of data collection and analysis, particularly the pilot interviews, enabled the researcher to develop skills and gain experience which was built upon during the research. Any problems were therefore resolved in the second interviews. Another significant problem mentioned in Chapter 3 was the time required to transcribe the first interviews due in part to the poor quality of the tape-recordings. While this was a technical problem which cannot necessarily be accounted for by a lack of experience, the time required to transcribe interviews was better understood and therefore the second interviews were not transcribed verbatim.
Patton (1990, p.461) also refers to the 'presentation of self' by the researcher, and earlier in his work, suggests the credibility of a researcher is ensured through a stance of neutrality:

The investigator does not set out to prove a particular perspective or manipulate the data to arrive at predisposed truths. The neutral investigator enters the arena with no axe to grind, no theory to prove and no predetermined results to support. Rather, the investigator's commitment is to understand the world as it is, to be true to complexities and multiple perspectives as they emerge and to be balanced in reporting both confirming and disconfirming evidence (p.50).

The qualitative approach to data collection aimed to ensure that pre-existing theories and beliefs were not imposed upon the study. The inductive approach to analysis in particular aimed to prevent preconceived attitudes or opinions affecting the results, and to ensure that the theory regarding source assessment emerged directly from the data. In the conduct of the interviews, the researcher maintained a stance of neutrality to enable the interviewees to freely express their attitudes and opinions. Likewise, an open-ended questionnaire was used to collect data concerning the attitudes and perceptions of LIS professionals towards the Evaluation Criteria Document. Indeed, the pilot schedules for the second interviews did not enable the respondents to express their attitudes and opinions fully, and the schedules were amended accordingly.

Again, in the earlier quotation, Patton thirdly identifies a need for a philosophical belief in the phenomenological paradigm and a fundamental appreciation of naturalistic enquiry, qualitative methods, inductive analysis and holistic thinking. As already discussed, a qualitative and naturalistic approach using inductive analysis techniques was adopted to enable research into an area about which little was understood and to ensure the accuracy of the results. Furthermore, a holistic perspective was taken which viewed Internet users as individuals working within a context. In particular, a user-centred approach to investigating information seeking behaviour was adopted to develop criteria by examining individuals' views regarding their own information seeking experiences. Furthermore, the research was based upon an understanding and appreciation of subjectivity, both in the use of information and in the assessment of its quality. The research design was shaped by a scepticism regarding universal laws or generalisations relating to human behaviour, and an appreciation of the inability to describe or categorise people in quantitative terms.
A grounded theory approach was also adopted in the study to ensure the development of an accurate, valid and applicable theory regarding source assessment. Through using a grounded theory approach, the results are grounded in the data and therefore form an accurate and reliable reflection of end-user perspectives on source assessment. In assessing a grounded theory study, Strauss and Corbin (1990, pp.249-258) also refer to the validity, reliability and credibility of the data and the need to judge the quality of the research process. The authors also suggest judgements relate to the empirical grounding of the data, including whether concepts are grounded in the data through coding, how linkages are drawn between related concepts, and whether categories and sub-categories are linked. The methodology chapter provides an extensive and detailed discussion of the use of grounded theory techniques for analysing the interview results which enabled the concepts, categories and relationships to emerge from the data, and therefore, to be grounded in the data.

Strauss and Corbin (1990) also refer to the need to ensure theoretical saturation. Theoretical saturation is achieved when no new or relevant data emerge, the category development is dense, or the relationships between the categories are well-defined and validated (Strauss and Corbin 1990). The study attempted to account for as much of the relevant behaviour as possible within the area. In particular, the second stage of interviewing was conducted to develop the theory, and the opinions of LIS professionals were sought to ensure representation of their views regarding the results. However, one of the problems faced by the study was that it attempted to examine the cognitive processes involved in information quality assessment. A large amount of valuable data was elicited regarding the interviewees’ thoughts and opinions about the sources they accessed and used via the Internet. It was possible to identify a wide range of issues affecting perceptions of source quality and to consider the relationships between the issues. However, a question must remain regarding the tacit knowledge which could not be elicited and the value judgements made by individuals which were not expressed during the interviews. Furthermore, some source types and issues were discussed in detail, while others such as FAQ files, FTP archives and CAS, were only discussed by a limited number of individuals. It is therefore difficult to draw conclusions regarding theoretical saturation.
5.4.3 Generalisability of the results

The Evaluation Criteria Document was developed by examining the information seeking behaviour of health and medical users of the Internet based in an academic environment. As discussed in Chapter 3, a qualitative approach was adopted to examine their behaviour because it was relevant to the central question of the study and there had been little research on which to base any predefined answer categories necessary for quantitative research. However, one of the drawbacks of the methods used, and of qualitative techniques generally, is that the results are limited to the context of the study. Quantitative studies utilise random sampling techniques, large samples and standardised methods to enable an assessment of the extent to which results are representative of the wider population from which the sample has been drawn. Conversely, qualitative researchers "usually study a single setting or a small number of individuals or sites using theoretical or purposeful sampling rather than probability sampling" (Maxwell 1996, p.96). The aim is to produce "a wealth of detailed information about a much smaller number of people and cases" but "the potential for generalisability is reduced" (Patton 1990, p.14).

However, commentators advocate that it is possible to generalise from the results of qualitative studies. Whilst quantitative researchers are concerned with predicting the applicability of results to a wider population, qualitative researchers focus on understanding the likelihood of results being relevant elsewhere. Patton (1990, p.489) defines this as extrapolation:

Extrapolations are modest speculations on the likely applicability of findings to other situations under similar but not identical conditions. Extrapolations are logical, thoughtful and problem-orientated, rather than statistical or probabilistic.

Likewise, Strauss and Corbin (1998, p.169) argue that a grounded theorist 'can claim predictability' in the 'limited sense that if elsewhere approximately similar conditions obtain, then approximately similar conditions should occur'. Therefore, it is possible to suggest that under similar conditions, the results arising from this research would be applicable. In other words, the Evaluation Criteria Document is not only relevant to the respondents involved in this study and to the sources which they discussed, but it is also likely to be applicable to the assessment of other health and medical information sources.
available via the Internet which are of interest to users based in an academic or a research environment. Furthermore, Strauss and Corbin (1990, p.251) maintain that 'the more systematic and widespread the theoretical sampling, the more conditions and variations that will be discovered and built into the theory', and therefore, 'the greater its generalisability'. The second set of interviews was undertaken to develop the theory of information quality assessment by identifying gaps in the theory and collecting data to fill those gaps. Theoretical sampling techniques were used to ensure theory development, and by implication, the potential for generalisability within the specified population is increased.

According to Maxwell (1996), there are certain features of a theory which lend plausibility to any generalisations. These include the respondents' own assessment of generalisability, the similarity of dynamics and constraints to other situations, the presumed depth and universality of the phenomenon studied, and corroboration with other studies. As already discussed, the results arising from this research were similar to those from Schamber's (1991a). Certain similarities have already been identified between the two study populations and their information environments, namely the need for accurate and current information, as well as the use of multi-media sources. This suggests that the Evaluation Criteria Document is applicable, not only to health and medical professionals, but also to other groups who might be interested in information sources which share similar characteristics to those described by the respondents.

Moreover, simply reading through the Evaluation Criteria Document suggests that the results of the research are more widely applicable than sources of interest to health and medical professionals. Indeed, as mentioned in Chapter 4, one of the reviewers commented:

The inclusion of genetic sites makes [the tool] very specific to medical resources. If this was excluded it could be applied to any subject service.

Maxwell (1996, p.97) believes that qualitative studies may have 'face generalisability'. This refers to situations where 'there is no obvious reason not to believe the results apply more generally'. It is arguable that the Evaluation Criteria Document has 'face generalisability', and to a certain extent, this has been confirmed by additional work which succeeded completion of the tool.
During the course of the research, the author was approached to write a book on selection and evaluation strategies for Internet-based sources (Cooke, in press). The book was neither intended solely for use by LIS professionals, nor was it intended for assessing health and medical materials of interest to users located in academic or research environments. Two of the chapters were based almost entirely on the Evaluation Criteria Document (‘Assessing the quality of an information source’ was based on the generic criteria, and ‘Assessing particular types of sources’ on the source specific criteria), and the scarcity of necessary revisions indicates the wider applicability of the criteria. Those changes which were made were minimal and generally stylistic. For example, the section on electronic journals was renamed, ‘Electronic journals and magazines’, and any issues peculiar to an assessment of academic journals were included in a sub-section. Similarly, any criteria specific to bibliographical databases were subsumed into the broader section on ‘Databases’, and ‘Molecular biology resources’ was removed because it was not considered relevant to disciplines other than medicine. Furthermore, examples were drawn from a wide range of domains, both academic and non-academic, in order to illustrate the application of the criteria. These included a subject-based site about Vincent van Gogh, a discussion list on post-modernism and Christianity, a FAQ file on Star Trek, and a multi-media site containing images of cats aimed at children. The criteria were generally applicable and only minor amendments were necessary.

It is therefore possible to speculate on the wider applicability of the results arising from this study. However, the research was restricted to a particular group of users and it can only be claimed, on the evidence of the research conducted to date, that the tool is applicable to academic users of health and medical Internet-based sources. No conclusions can be drawn about the applicability of the Evaluation Criteria Document without examining the information seeking behaviour of other groups of Internet users or implementing and testing the effectiveness of the tool in other situations or contexts. Other groups for comparison might be those involved in clinical practice, such as doctors in hospitals or general practice, or nurses and midwives. Additional groups include students of health care and medicine, health managers, those working in the range of professions allied to health care, as well as consumers of health information. The scope of the research could be broadened further by examining the information seeking behaviour of the almost infinite number of other groups outside the disciplines listed.
Furthermore, as already mentioned, both the use of health and medical information (and the use of information generally), and the nature of the information available via the Internet, are continually changing. It is therefore difficult to justify the likely generalisability of the results beyond the immediate time in which the study was undertaken. As quoted earlier, Strauss and Corbin (1990, p.250) advocate that 'probably no theory ... is actually reproducible' due to the difficulties of 'finding new situations or other situations whose conditions exactly match those of the original study'.

Furthermore:

All interpretations, whether or not they have the features or status of a theory, are temporally limited ... they are always provisional, they are never established forever; their very nature allows for endless elaboration and partial negation (qualifications) ... theories are limited in time ... constantly becoming outdated (Strauss and Corbin 1998, p.171).

Consequently, the Evaluation Criteria Document will require development as the technology for providing information via the Internet, as well as the nature of the information itself, continues to change and develop in order to ensure its continued applicability and relevance.

5.4.4 Testing the Evaluation Criteria Document

As discussed above, the validity of the results arising from this research is justified on the basis of the sound methodological approach. This is supported by the earlier comparison of the criteria with others discussed in the literature which used similar research methods. However, as discussed in Chapter 3, no conclusions can be drawn regarding the effectiveness of the tool in filtering information due to the lack of its implementation and testing. It was felt that while one of the original objectives of the research had been to implement and test the tool, there were problems with the data arising from the first interviews which meant additional research into information seeking behaviour was necessary to ensure a sound research basis for the tool. Consequently, the evaluation tool was developed almost entirely by examining the behaviour of end-users and there is little evidence, other than the opinions of the reviewers, to suggest that the tool will be of value or use to LIS professionals. The reviewers were individually approached because of their interest in information quality,
thereby ensuring that they were knowledgeable about the process of quality assessment and enabling them to comment on the likely value and usefulness of the tool. However, while they felt that the tool would be valuable and useful, they were not representative of the LIS community. Moreover, simply commenting on the likely usefulness of a tool obviously does not provide a sound basis for drawing conclusions about its effectiveness. Further research is therefore required to evaluate the effectiveness of the Evaluation Criteria Document in filtering information available via the Internet.

There is a dearth of work which can be drawn upon for guidance in implementing and testing evaluation criteria. This has been highlighted by Jadad and Gagliardi (1998) in their review of instruments used to rate health and medical information available via the WWW. The authors were concerned with establishing the degree of validity of different instruments, and found that none of the existing tools had been subject to any rigorous testing. Furthermore, neither the criteria which arose from the review conducted by Hofman and Worsfold (1997), nor the criteria developed by the Health Information Technology Institute at Mitretek Systems (Ambre, et al., 1997), have been satisfactorily implemented and tested, despite being among the most important sets of criteria which have been developed during the past five years for evaluating Internet-based sources.

Hofman and Worsfold (1997) outline their testing procedure. This involved distributing the criteria to four subject-based gateway services and asking the participants to 'work through the list ... and mark down the criteria that they found relevant for use in their service'. Only one criterion was not used by any services and no criteria were removed. The test results 'corroborated the idea that different services use different selection criteria', and demonstrated that 'the list could be a useful tool', but provides no evidence of its effectiveness in filtering information. The document containing the criteria was also reviewed by two experts in the field using essentially the same approach as was adopted in the review of the Evaluation Criteria Document. Furthermore, the criteria developed by Hofman and Worsfold have been developed into the Internet Detective, an instrument which is designed to enable users to learn about evaluating Internet-based sources of information. Again, testing of this tool was limited; a group of students assessed the Internet Detective using the Internet Detective criteria and the evaluation resulted in a qualitative review of the tool, again with no insight into its effectiveness (Worsfold and Hiom, 1998).
The Health Information Technology Institute has recently produced a document in addition to the *White Paper* which proposes a stakeholder approach to implementing and testing (Ambre, *et al.*, 1998). The authors define four stakeholder groups (consumers, health care providers, LIS professionals and WWW site developers), and outline a proposed implementation plan. Firstly, each group will identify which aspects of the criteria are important to their group. The creation of a database of test sites is then proposed. The tools will be used to evaluate these sites by the different groups and the 'results will be analysed and issues identified and discussed'. The aims include to assess the effectiveness of the tools and to examine how differences in the tools and their audiences impact upon the outcome. However, while it is clear how the proposed project will assess which aspects of evaluation are appropriate to each target group, there is a lack of detail about the testing process and in particular how the results will be analysed to assess the effectiveness of the tool.

As mentioned, the Evaluation Criteria Document was developed almost entirely by examining end-users' attitudes towards health and medical information available via the Internet, but the document itself is intended for use by LIS professionals. While little can be drawn from the above studies about testing *per se*, they do offer some insight into how the Evaluation Criteria Document could be implemented to assess its relevance and usefulness to the LIS community, as well as its usability. Implementation could involve use of the instrument by a sample of LIS professionals to assess:

- the relevance of the document, and the criteria it contains, to their needs;
- the ease of using the document as a whole; and
- the ease of using and understanding the evaluation criteria.

Furthermore, some of the reviewers' comments related to a different format for the tool, such as a hypertext document which could include links to examples of information sources. This perhaps implies the need for a 'toolkit' format. The implementation of the Evaluation Criteria Document might usefully include an investigation, not only of its usability in its current form, but also consideration of the most appropriate format and the potential value and usefulness of a toolkit. The implementation could involve a much larger and more varied sample than the review which has already been undertaken, therefore providing additional data. However, this still would be insufficient to draw any conclusions about the effectiveness of the tool in filtering information.
When attempting to establish the validity of the different tools which they examined, Jadad and Gagliardi (1998) were interested in whether an assessment of inter-observer reliability had been undertaken; i.e. an assessment of whether different individuals using a rating instrument would draw the same conclusions about the same documents. One project has attempted to undertake such a study. Charnock, et al. (1999) have developed an instrument for judging the quality of written consumer health information. The instrument, DISCERN, contains questions about features and characteristics of written information, such as whether information is current and accurate, and users rate the information from one to five according to each feature or characteristic. DISCERN was distributed to twenty-eight individuals with a test collection of documents. The participants were asked to rate the documents using the tool and statistical analysis was undertaken to establish the levels of agreement between the different participants. The authors were subsequently able to draw conclusions about the reliability and validity of DISCERN in judging the quality of information because there were acceptable levels of agreement between different people about the same source. They conclude:

The methodology used to develop DISCERN has enabled us to identify an agreed set of standards for the content of written information on consumer choices which can be consistently understood and applied by a wide range of users (Charnock, et al., 1999).

The methodology adopted to test DISCERN is irrelevant to the testing of the Evaluation Criteria Document because it relies on the quantitative rating of information sources which can then be compared. As discussed, the Evaluation Criteria Document currently results in a qualitative assessment. However, as discussed earlier in the chapter, there is evidence in the literature and from the comments made by the reviewers to suggest a need for research into the development of 'objective' measures for assessing information quality. Some approaches to the development of a rating system were proposed and the need for implementation and testing was highlighted. Any future research in this domain could draw upon the methods adopted by Charnock, et al. (1999) to assess whether any resultant ratings provide a meaningful and an 'objective' measure of information quality.

Charnock, et al. (1999) also distributed a questionnaire with their instrument to assess its usefulness, but again, this would be of little additional value to the review process.
which has already been undertaken here. Charnock and Shepperd (unpublished) are also currently considering developing DISCERN into a tool for rating Internet-based consumer health information, and they propose a survey of users’ views. Once more, the survey is unlikely to elicit data on the effectiveness of the tool as it is concerned with attitudes about the likely relevance and usefulness of the tool.

As mentioned in Chapter 2, Kuller, et al. (1993) conducted a comparison of the selection decisions made by librarians and medical physicians when examining search results from Medline. The study aimed to assess:

- the similarities between physicians’ and librarians’ selections;
- the decision-making criteria used by librarians and physicians in the selection process; and
- the utility of articles selected by librarians compared to those selected by physicians.

Searches conducted on Medline over a given period were reviewed by both a librarian and the physician who requested the search. Each individual assessed which articles they felt were relevant, and indicated on a form their reasons for selecting the references. The reasons were defined as objective criteria (e.g. MeSH descriptors, document length) or cognitive criteria (e.g. clinical applicability, educational value), and the participants were requested to indicate whether each criterion was of major, some or no relevance. The selected articles were then given to the physician who evaluated their utility to the original request for information.

The study provides a valuable insight into how the Evaluation Criteria Document could be tested. A sample of library and health care professionals could be enlisted to use the Evaluation Criteria Document when searching the Internet, and to complete a similar form to identify which criteria are used in filtering materials, and how important each of the criteria are considered to be in relation to specific materials. This would provide insight into the decision-making criteria used by librarians compared to health care professionals. More importantly, by adopting a similar approach to Kuller, et al., the materials selected by librarians could be compared to those selected by health care professionals, and the health care professionals requesting the information could assess the value and usefulness of any selected materials to their information need. This is an interesting area of assessment because one aim of developing the tool was to enable LIS
professionals to filter materials on behalf of end-users. As Kuller, et al. (1993, p.39) argue, 'it is this factor - the librarian rather than the physician choosing the article - that must be examined in order to provide data on the effectiveness of quality filtering'. Moreover, although not explicitly discussed by Kuller, et al., the methods also assess inter-observer reliability when using the tool because any significant differences in the materials selected by different participants would suggest that the tool is not valid.

In addition to assessing inter-observer reliability, Jadad and Gagliardi (1998) also recommend assessing the effect of any rating instruments on health care decision making and resource utilisation. While there is a volume of research which relates to the impact of information on clinical and other decision-making processes, there is a lack of material which evaluates any attempts to improve the decision-making process. However, it might be possible to undertake a study whereby one group is enlisted to search the Internet and to evaluate the materials they find using the Evaluation Criteria Document. Their experiences could be compared with a control group who are required to search the Internet and to evaluate materials without using the tool. This could establish the extent to which the tool facilitates the processes involved in filtering material. Moreover, the participants from the two groups could identify which issues they consider when evaluating any materials, as with the Kuller study. The decision-making processes could then be compared to assess, for example, whether users of the tool are more critical or whether they base their decisions on different selection criteria.

A related study might involve enlisting participants to identify materials of interest to them, and to evaluate those materials, again noting the issues which are considered during assessment. The same participants could then conduct a similar search for information using the Evaluation Criteria Document, once again noting the issues which are considered when examining materials. The differences in their decision-making processes could then be compared to assess whether the Evaluation Criteria Document has any impact upon their decision-making or use of resources.

The above discussion highlights a range of different approaches for the possible implementation and testing of the Evaluation Criteria Document, perhaps suggesting the need for a multi-faceted study. Firstly, the document could be used by LIS professionals to assess its relevance, usefulness and usability, as well as possible alternative formats. Secondly, the tool could be used simultaneously by library and health care professionals when searching for information. The materials which are retrieved and the criteria which
are used could be compared, and the likely utility of the filtered materials evaluated by the original requester of the information, in order to assess the effectiveness of the tool. Lastly, two studies could be undertaken to assess the impact of the tool on decision-making and resource utilisation. The first might be a comparison between the evaluations undertaken by two groups, one using the tool and one not using it, and the second, a comparison of the evaluations undertaken by a group, firstly not using the tool, and then using it.

As discussed under 'generalisability of the results', there is little evidence (other than the face generalisability of the Evaluation Criteria Document) that it is more broadly applicable than academic users of health and medical information sources. Implementing and testing the tool could involve LIS professionals and/or end-users from additional areas, such as those involved in clinical practice or other areas of health care provision in order to establish the likely value and usefulness of the tool to their information needs. Similarly, the tool is likely to be more widely applicable and users could be involved in its implementation and testing from the almost infinite range of subject areas outside health care and medicine.

### 5.5 Summary

This chapter has attempted to draw together the main findings of the research into a grounded theory of information quality assessment. Central to the theory are a range of generic issues which are generally applicable to the assessment of information sources available via the Internet. In addition, there are a number of issues which are peculiar to the assessment of different types of sources identified during analysis. However, quality assessment is not a straightforward process as a wide range of inter-related factors affect users' perceptions of quality, and differing factors are of increased importance depending upon the needs of the user and the nature of the source used. An evaluation tool is proposed, the Evaluation Criteria Document (Appendix C), based upon the results described in Chapter 4 and tabulated in Appendix B, as well as the theory of information quality assessment. The tool is intended as a guide to assist LIS professionals in assessing source quality. The full range of quality assessment issues are covered in the document, but ultimately the criteria used will depend upon the needs of the user and the
nature of the source, as well as the existing knowledge and expertise of the evaluator and the time and resources available to them.

The brief comparison of the criteria available in the literature with the Evaluation Criteria Document highlights notable similarities and differences. The criteria proposed by LIS professionals have tended to focus on information available via the WWW and ignore the variety of source types available via the Internet. Furthermore, the existing criteria lack any explanatory information on the process of source evaluation. The differences can be attributed to the development of the criteria, namely a lack of research into the information seeking behaviour of Internet users or into how quality is assessed. However, the study conducted by Schamber (1991b) resulted in similar criteria, suggesting the validity of both the methods used and the resulting criteria arising from both studies. Criteria developed by health care and medical professionals among others underline the need to assess research quality or the evidence basis of information. These issues were rarely mentioned by the interviewees, possibly because they felt high quality information was not disseminated via the Internet.

The methods used were effective in studying the information seeking behaviour of end-users of the Internet. In particular, the interviewees were able to describe in their own words their perceptions, attitudes and feelings towards the information available via the Internet and how they assessed the quality of that information. Inductive analysis enabled the development of a grounded theory regarding source assessment and criteria were derived from users’ descriptions of their attitudes and experiences. The second stage of interviewing was effective in validating the initial findings, as well as in developing the evaluation criteria and the theory regarding information quality assessment. The open-ended questionnaire was successful in collecting data regarding the attitudes and perceptions of LIS professionals towards the likely value of the proposed evaluation tool. However, there was no implementation and testing of the tool, evidence to support its value and usefulness is limited, and no conclusions can be drawn regarding its effectiveness in filtering materials.

The use of qualitative methods means that the results of the study are restricted to the context of the research. However, it is possible to make modest speculations about the likely applicability of the results to other health and medical users based in an academic environment, as well as to other groups interested in information sources which are
likely to share similar characteristics. Furthermore, the Evaluation Criteria Document has 'face generalisability' as simply examining it and using it to evaluate materials from other disciplines indicates that is more broadly applicable. However, these are speculations and research is required into source assessment by other groups in order to assess the extent to which these speculations are valid. Furthermore, the technology for providing information via the Internet, as well as the nature of the information itself, is continuously changing and additional research will be required to ensure the continued applicability and relevance of the Evaluation Criteria Document.

The lack of implementation and testing of the tool, and the limitations of the review process, mean that there is no evidence to suggest that the tool is effective in filtering resources which have been retrieved via the Internet by LIS professionals. Further research is therefore required to evaluate its effectiveness and a range of possible approaches are suggested. Firstly, the document could be used by LIS professionals to assess its relevance, usefulness and usability, as well as any possible alternative formats. Secondly, the tool could be used simultaneously by library and health care professionals when searching for information. The materials which are retrieved and the criteria which are used could be compared, and the likely utility of the filtered materials evaluated by the original requester of the information, in order to assess the effectiveness of the tool. Lastly, two studies could be undertaken to assess the impact of the tool on decision-making and resource utilisation. The first might be a comparison between the evaluations undertaken by two groups, one using the tool and one not using it, and the second, a comparison of the evaluations undertaken by a group, firstly not using the tool, and then using it. Additional implementing and testing could involve LIS professionals and/or end-users from other areas of health and medicine, as well as users from the almost infinite number of different disciplines, in order to corroborate the wider applicability of the tool.
Chapter 6

Conclusions and Recommendations
6.1 Purpose of the chapter

The purpose of this chapter is to summarise the major conclusions of the thesis. The research questions are used to present the conclusions of the study as a whole, and conclusions are drawn regarding the methodological approach which was adopted to address those questions. The chapter also provides recommendations for use of the proposed evaluation tool and for future research based upon the findings of the thesis.

6.2 Conclusions: the development of a tool for assessing the quality of Internet-based information sources

The overall aim of the research was to determine whether it was possible to develop a tool or technique to assist librarians and other information professionals in the selection and evaluation of Internet-based information sources. Various problems and issues were identified at the outset of the research which are listed in Chapter 1, along with four objectives designed to address the questions and achieve the overall aim. Following the review of the literature, these questions were refined slightly into the research questions discussed in Chapter 3. Conclusions about the study as a whole are drawn by examining the research questions.

6.2.1 What is ‘information quality’?

An explicit definition of information quality has been avoided in the LIS literature to date. However, in management terms, quality is understood to refer to ‘the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs’ (BSI, 1995). The BSI definition of quality is appropriate to an understanding of information quality generally. According to this definition, there can be no definitive statement of quality because its nature will depend upon the needs of the individual concerned. However, there are identifiable characteristics which will affect the extent to which information meets the needs of a user and make it of more or less quality within a
particular context or situation. The results of the interviews confirm the applicability of
the BSI definition. Different issues were mentioned by different interviewees which
affected their perceptions of information quality, and the issues mentioned depended
upon the needs of the user and the nature of the source used.

6.2.2 What is the most appropriate technique for assessing the
quality of Internet-based information sources for use by
LIS professionals?

Following an extensive review of the literature, the use of evaluation criteria was
considered the most appropriate approach to the selection and evaluation of information
sources available via the Internet for use by LIS professionals. Evaluation criteria enable
the identification of the different factors or characteristics which might affect the quality
of an information source and therefore can be used to guide LIS professionals when
assessing quality on behalf of a third party.

6.2.3 Is information quality an issue to Internet users?

Information quality was an issue to the users of health and medical information based in
an academic environment who were interviewed regarding their use of the Internet for
work-related information seeking. In summary, the Internet was not considered a source
of high quality information or essential for work-related information seeking because
the information had not been through a process of peer review, such as editing or
refereeing. Where the interviewees required high quality information, they used refereed
journal articles. However, the interviewees discussed a wide range of factors which
affected their perceptions of quality, and these related, not only to the quality of the
information they used, but also the source itself and the service provided by those
responsible for a source.
6.2.4 How do users of the Internet assess the quality of the sources they access and use?

It is not possible to identify a straightforward procedure for assessing source quality. A range of different factors were mentioned by the interview respondents which affected their perceptions of source quality, and the issues mentioned depended upon their individual needs, as well as the nature of the source used. Quality assessment is dependent upon both contextual factors (the information seeking situation) as well as subjective factors (the attitudes and opinions of the individual concerned). Moreover, quality assessment is a complex process which is affected by a wide range of interrelated factors which are of varying importance depending upon the needs of the user.

6.2.5 Is it possible to identify criteria from users' assessments of the sources they access and use?

It was possible to elicit users' opinions regarding the sources they accessed and used by adopting open-ended interviewing techniques to discuss an example where the Internet had been used to look for work-related information. The interviewees commented on their experiences of browsing for information, why they initially accessed some sources, why they used some sources regularly, their criticisms of and how they might improve the sources they used, and how the sources they accessed compared with others. A wide range of factors or criteria could be identified from the interviewees' comments which affected their perceptions of source quality. These are summarised in Tables 10-24 and 36-48 in Appendix B.

6.2.6 Is it possible to identify criteria from users' assessments which apply across a range of different source types available via the Internet?

It is possible to identify a range of issues which affect the quality, or users' perceptions of the quality, of a range of different types of information sources available via the Internet. These issues related to the following aspects of the sources:
- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Furthermore, different issues were mentioned which were peculiar to different types of sources available via the Internet, and particular issues were of increased importance in relation to these different source types. While it is recognised that there is a wider range of source types than those listed, the following were identified from the interviewees' comments:

- bibliographical databases,
- CAL materials,
- Current Awareness Services,
- databases and databanks,
- electronic journals,
- FTP archives,
- FAQ files,
- image-based information sources,
- molecular biology resources,
- organisational WWW sites,
- personal Home Pages,
- search facilities,
- subject-based WWW sites, and
- Usenet Newsgroups and discussion groups.
6.2.7 Can user assessments be interpreted in order to develop a tool or technique for use by LIS professionals in assessing the quality of Internet-based sources?

The users' assessments were inductively analysed to identify the full range of issues mentioned in relation to the different source types. These are discussed in Chapter 4 and summarised in the results tables (Appendix B). In addition, the results were analysed to develop a grounded theory of information quality assessment which is presented in Chapter 5. These results and the theory of information quality assessment were developed into a tool, the Evaluation Criteria Document (Appendix C), which is designed to guide librarians and information professionals in the selection and evaluation of Internet-based information sources.

6.2.8 Does the tool or technique provide an effective filter for selecting and evaluating information available via the Internet?

The Evaluation Criteria Document was not implemented and tested. Therefore, it is impossible to conclude that it provides an effective filter when selecting and evaluating information available via the Internet. However, adherence to the principles of grounded theory and the use of a qualitative and user-centred approach to data collection resulted in a document which accurately reflects the attitudes of academics working in health and medicine towards the information available via the Internet. Furthermore, a second set of interviews was conducted using a different interviewing technique to validate and develop the findings, and the reaction of the LIS community to an earlier draft suggests that it will be useful when selecting and evaluating sources of information available via the Internet. A comparison with the criteria discussed in the literature also serves to validate the criteria as many similarities were identified.
6.3 Conclusions regarding the methodology

This section summarises the conclusions about the methodological approach used in the study. The research design was influenced by the following trends: the shift from a systems-orientation to a user-orientation in the design, development and evaluation of information systems; the use of qualitative methods to understand and explore human behaviour; and the use of grounded theory as a research strategy concerned with theory development not theory testing and validation.

6.3.1 A user-centred approach

A user-centred approach was adopted to investigate users' attitudes and opinions towards the quality of information available via the Internet in order to develop evaluation criteria. The approach was successful in determining the factors end-users felt were of concern in assessing the quality of sources which had been retrieved via the Internet and in understanding the process of quality assessment. The user-centred approach consequently resulted in a document which contains different criteria for different types of resources and detailed explanations about the process of source assessment. In comparison, the criteria described in the literature had been developed on an ad-hoc basis without consideration of users' perceptions of information quality, and lacked explanatory information or a resource specific approach. However, while the Evaluation Criteria Document describes the factors affecting users' perceptions of information source quality, ultimately it is intended for use by LIS professionals. A drawback of the research conducted to date is that the tool was not implemented and tested, there is only limited evidence to suggest it will be valuable and useful to LIS professionals, and none to establish its effectiveness when used by LIS professionals to filter materials.

6.3.2 A qualitative approach

The central questions of the study and the lack of pre-existing research into the area required a qualitative approach to data collection and analysis in order to enable exploration and understanding of an area about which little was known. The qualitative
approach was successful in exploring the information seeking and information use behaviour of Internet users. The validity of the results arising from the study is based on the use of open-ended interviewing techniques which enabled users to describe in their own words their attitudes and perceptions towards the information available via the Internet. In addition, users were describing authentic examples of information seeking and verbatim transcription of the first interviews enabled content analysis of users' comments regarding their own experiences. Use of a different interview technique for the second interviews validated the results through methodological triangulation, and enabled additional exploration of the issues associated with the quality of a wider range of source types.

However, there were drawbacks to using a qualitative approach generally and to the specific methods which were used. The use of qualitative techniques means that the results of the research are limited to academic users of health and medical Internet-based sources, although face generalisability and corroboration with the results of another study indicates the wider applicability of the Evaluation Criteria Document. Other limitations have been noted in the extent of methodological triangulation as observations of Internet users might have enriched and further validated the interview data. The reliability checks were also limited; although comparison with Schamber's (1991a) study suggests the methods were reliable, and constant comparison with the interview transcripts confirmed the reliability of the results, additional checks might have included an assessment of the consistency of coding. Another drawback was the time required to transcribe and analyse the interviews which impeded the progress of the study.

6.3.3 A grounded theory approach

Limitations of existing criteria necessitated theory development as an aim of the research rather than theory testing and validation, and grounded theory techniques were used to ensure the development of an accurate, reliable and valid theory of source assessment. Maximum variety in the initial sample and an open-ended interview technique enabled initial exploration of perceptions of the quality of sources available via the Internet. The data from the first interviews was analysed to begin developing the theory of quality assessment. Gaps were identified and a second set of interviews was
undertaken using theoretical sampling techniques to develop the theory. The use of inductive analysis enabled the theory of quality assessment and the criteria to emerge from the data and they therefore provide an accurate portrayal of the interviewees’ perceptions of the quality of the sources they retrieved from the Internet.

However, one of the problems faced by the study was ensuring theoretical saturation. The research attempted to examine the cognitive processes involved in information quality assessment and it is difficult to assess whether any tacit knowledge or value judgements were not expressed during the interviews. Furthermore, while some source types and issues were discussed in detail, others were discussed by a limited number of individuals and the validity of this data must be questionable. In addition, while using a grounded theory approach was advantageous and the results are a solid basis for future research, the need for theoretical development meant that there was no testing of the effectiveness of the criteria in assessing source quality.

6.4 Recommendations for the implementation and use of the Evaluation Criteria Document

The following recommendations relate to the implementation and use of the Evaluation Criteria Document (Appendix C) which was developed as a result of this research.

6.4.1 The role of the document

Librarians and information professionals are recommended to use the Evaluation Criteria Document as a guide to selecting and evaluating information sources available via the Internet. The tool was developed by examining the information seeking behaviour of health and medical users of the Internet based in an academic environment and is therefore biased towards the evaluation of sources of interest to this audience. However the document is likely to be more widely applicable.
6.4.2 Use of the document

Readers should begin by examining the generic ‘Evaluation Criteria’ in order to become familiar with source assessment. Users should then decide what type of information source they wish to evaluate. In many cases, this will be immediately obvious, but users may wish to examine the definitions of the different types, either in the ‘Glossary’ or in the ‘Source Specific Criteria’ section. Once the evaluator has decided which source type they want to evaluate, they should examine the detailed notes relating to the ‘Source Specific Criteria’, which includes pointers to any appropriate generic criteria.

The ‘Evaluation Checklists’ are intended as the major working tool of the document as each checklist provides a comprehensive set of questions to be asked in relation to each type of information source. Users who are familiar with evaluation may find they can begin immediately with the checklists, while others will find it beneficial to refer to the detailed explanatory notes.

6.4.3 Criteria selection

The Evaluation Criteria Document is intended as a guide, and therefore, it is recommended that evaluators select the appropriate criteria from the extensive range that are provided, and implement them bearing in mind:

- the needs of the user or user group concerned,
- the nature of the source being evaluated,
- the existing knowledge and experience of the evaluator, and
- the time and resources available to the evaluator.
6.5 Recommendations for future research

The following are recommendations for future research based upon the findings of this study.

6.5.1 Implementing and testing the effectiveness of the Evaluation Criteria Document

This study was primarily concerned with identifying the potential for the development of a tool for assessing source quality and no implementation or testing was undertaken. Further research is therefore required to evaluate the effectiveness of the Evaluation Criteria Document in filtering information which has been retrieved via the Internet. There are a range of different approaches which might be adopted. Firstly, the document could be used by LIS professionals to assess its relevance, usefulness and usability. Secondly, the tool could be used simultaneously by library and health care professionals when searching for information. The materials which are retrieved and the criteria which are used could be compared, and the likely utility of the filtered materials evaluated by the original requester of the information, in order to assess the effectiveness of the tool. Lastly, two studies could be undertaken to assess the impact of the tool on decision-making and resource utilisation. The first might be a comparison between the evaluations undertaken by two groups, one using the tool and one not using it, and the second, a comparison of the evaluations undertaken by a group, firstly not using the tool, and then using it.

6.5.2 Broadening the scope of the evaluation criteria

The Evaluation Criteria Document was developed by examining the information seeking behaviour of health and medical users of the Internet based in an academic environment and the use of qualitative methods means that the results of the study are restricted to this context. While it is possible to make modest speculations about the likely applicability of the results to other users, research is required to assess the extent to which these speculations are valid. Other groups for comparison might be those
involved in clinical practice, such as doctors in hospitals or general practice, or nurses and midwives. Additional groups include students of health care and medicine, health managers, those working in the range of professions allied to health care, as well as consumers of health information. The scope of the research could be broadened further by examining the information seeking behaviour of the almost infinite number of other groups outside the disciplines listed. Any implementing and testing might also involve LIS professionals and/or end-users from these additional areas.

While the research identified a range of evaluation criteria relating to the different source types, not all of the source types or the criteria were discussed in the same amount of detail. There is also a need to broaden the scope of the criteria by ensuring consideration of the full range of source types available via the Internet and considering any assessment issues which were not explored fully.

6.5.3 Developing an ‘Evaluation Toolkit’

The research resulted in the development of a tool designed to assist in the selection and evaluation of information sources by LIS professionals. However, the comments provided by the reviewers implied the need for a ‘toolkit’, such as a hypertext document with links to examples of sources. The implementation and testing of the Evaluation Criteria Document might usefully include an investigation into the most appropriate format it should take, including the potential value and usefulness of a toolkit.

6.5.4 Ranking the relative importance of the criteria

There is evidence both from the literature and the reviewers’ comments to suggest that evaluators are concerned with the relative importance of different criteria and with developing an ‘objective’ means of assessing source quality. Research is required to assess:

- why some criteria were mentioned by some users and not others,
- why some criteria were mentioned in relation to some sources and not others, and
- users’ perceptions of the relative importance of the different criteria generally and in relation to specific source types.
The results of this could then be used to assign numerical values to different evaluation criteria, enabling the numerical rating of information sources. This would then require a process of implementation and testing to assess whether the resultant ratings provide a meaningful and an 'objective' measure of information quality. The methods described by Charnock, et al. (1999) provide insight into how this could be achieved.

6.5.5 Guidelines for assessing research quality and the evidence basis of information

When comparing the criteria available in the literature with the results of this study, there was a notable difference between those developed by LIS professionals and those proposed by health care and medical professionals, namely a focus on research quality and the evidence basis of information by the latter. Research quality and the evidence basis to any information was rarely mentioned by the interviewees, possibly because the interviewees felt that the Internet did not provide access to high quality information. As an increasing volume of research-based information is disseminated via the Internet, there is a need to consider approaches to assessing the research quality and evidence basis of the available information, particularly with increasing moves towards evidence-based practice in health care generally.

6.5.6 End-user assessment of information quality

There is a need to address the problems faced by end-users in identifying and assessing the quality of the information available via the Internet. The results of the research illustrate the value of the Internet and the impact of networking technologies on those involved in health care and medicine. However, the results also highlight a number of problems associated with use of the Internet for accessing information, including a lack of confidence regarding information searching and quality assessment skills. Furthermore, the reviewers identified the need for a tool for use by end-users. The tool as it stands already reflects end-users' attitudes towards information quality. Additional implementation and testing is required to investigate the most appropriate format a tool
should take for use by health care and medical users, and to investigate the training and implementation issues associated with any such development.

6.5.7 Ongoing development of the Evaluation Criteria Document

The Evaluation Criteria Document will require continuous development. The technology for providing information via the Internet, as well as the nature of the information itself, is continuously changing and developing. New source types will invariably continue to be introduced, including within health and medicine, and the information is being used in an increasing variety of ways and by a wider range of users. Consequently, the issues covered in the document will require revision to ensure their continued applicability and relevance.

6.6 Summary

This chapter has summarised the conclusions of the thesis. Ultimately, the aim of the study was achieved as a tool was developed to assist LIS professionals in the selection and evaluation of information sources available via the Internet. However, while the tool provides an accurate reflection of end-users' perceptions of information quality, it has not been implemented and tested to ensure its effectiveness in filtering information. Moreover, although it is possible to estimate the likely applicability of the tool to other groups, the use of qualitative techniques means that it is restricted to health care and medical users of the Internet based in an academic environment. These speculations could be validated and the scope of the research broadened by examining the information seeking behaviour of a much wider range of users than the group studied here.
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Appendix A

Data collection and analysis tools
The following is the questionnaire which was distributed to identify potential interviewees for the information seeking and use interviews.

Use of the Internet for medical information

If you are able to participate in an interview, please complete this form and return it to [contact name] in the library by [date] at the latest. Thank-you.

1. Which of the following do you use in your work? Please tick as appropriate.

   - E-mail [ ]
   - Usenet News [ ]
   - FTP (file transfer) [ ]
   - Gopher [ ]
   - World-Wide Web (Netscape, Mosaic, Lynx) [ ]

2. How often do you use these tools? Please tick as appropriate.

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<th>Daily</th>
<th>Weekly</th>
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<td>World-Wide Web</td>
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[ ] I would be willing to participate in an interview during [dates] Please tick

[personal details]

Thank you for taking the time to complete this form.
The following is the interview schedule which was used for the information seeking and use interviews.

[Introduction]

1. Context

To begin with, I would like to discuss your use of the Internet generally, and then move on to discuss a specific instance where you decided to use, or might use, the Internet to look for information.

1.1 What facilities or tools available over the Internet do you use?

REFER TO FILTERING QUESTIONNAIRE

- e-mail? World-Wide Web? FTP? Gopher?
- do you look at any Usenet Newsgroups?

1.2 Are you involved in any discussion groups?

1.3 About how long have you been using the Internet for?

- e-mail? other tools?

1.4 How regularly would you say you access the Internet?

REFER TO FILTERING QUESTIONNAIRE

- e-mail: daily? a couple of times a week? less often?
- other tools: daily? a couple of times a week? less often?

1.5 What do you use the Internet for generally?

- work? recreation? examples?

1.6 From where do you access the Internet?

- work? home? the library?

1.7 Do you have your pre-interview form with you?

YES: GO TO Q1.8

NO: Perhaps you may be able to think of a recent instance where you decided to use the Internet to look for information in your work OR perhaps you might be able to think of an instance where you might use the Internet to look for information? For example, for teaching purposes, a research
project, a publication, or for your personal continuing education.

1.8 Could you tell me a little bit more about the example where you used/might use the Internet to look for information?

- why did you/might you need information on this particular occasion?
- what was the/might be the subject area or topic that you were interested in?

1.9 What was the/might the information (be) for?

- teaching, a research project, a publication, personal continuing education?
- for use in your work? for use by someone else?

1.10 What were you/might you be hoping to find on this particular occasion?

- were you looking for a specific fact? a document?
- did you have a specific source in mind or were you just browsing? personal curiosity?

1.11 How did you go about trying to find the information?

- what facilities or tools did you/might you use?
- did you/might you use any search tools or just browse? search terms?
- did you/might you just use the Internet or did you/might you look at any printed sources/other electronic sources for the same information?

WITHOUT A FORM:

We shall now do a quick search of the Internet in order try and obtain some information.

USE Q1.8-1.11 TO EXPAND AND DO THE SEARCH. N.B. SEARCH UNTIL 3 + SOURCES ARE LISTED.

GO TO Q1.13

1.12 Have you got the location details of some sources listed?

YES: IF 3+ SOURCES LISTED, GO TO Q1.13

NO/-3 SOURCES LISTED:

- do you have any (other) sources in mind which you might/which you did consult or use?
- are there any sources which you access regularly?
- are you subscribed to any discussion groups? Perhaps we could discuss the group as an example?

A source might be any site or document which you might consider a potential 'source of information'. For example, a specific WWW site or a single WWW page, a particular document which is available via FTP, a database, a single item retrieved from a database, an individual e-mail message which you have been sent or a whole discussion group in which you are involved.
1.13 Did you find/ would you have found the information you were looking for on this occasion?

- did you find /have you found what you were looking for?
- was the/is the information complete or partial?

1.14 Was the/might the Internet (be) the first place you look(ed) for information?

1.15 Did you/might you look elsewhere for information after using the Internet?

- a reference book? a colleague?
- to find the same information, more information, or to confirm what you have already found?

1.16 Why did you/might you use the Internet rather than, say go to the library to look for information on this occasion?

- did you/might you have a specific source in mind?
- was a/might a source (be) recommended to you?
- personal curiosity?

2. Source evaluation

Now I would like to take some examples of information sources from your pre-interview form/the search results and discuss them each in turn in more detail. The questions about each source are intended to determine which sources you might examine in response to a particular information need and why you choose to access and use some sources and not others. Hopefully, we will have time to examine 3 sources in detail.

SELECT FIRST/SECOND/THIRD SOURCE.

We have access to the Internet available, so please feel free to access the source if you wish to refer to it at any time.

QUESTIONS 2.1- 2.11 ARE TO BE REPEATED FOR 3 SOURCES

2.1 Was this/might this be the first source you looked at on this occasion?

- did you look elsewhere before looking at this source for the information you required?
- elsewhere on the Internet or elsewhere (a colleague, the library, a librarian, etc.)?

2.2 Why did you approach this source?

- can you explain what factors might affect/did affect your decision to access this source?
- what made you think this source would have the information that you wanted?
- were there any characteristics of the source which affected your decision to access it?
2.3 Do you/might you find the information you were looking for in this source?

- was the/might the information (be) complete?
- did you/might you partially find what you were looking for?

2.4 Was/is the information appropriate?

- cover the appropriate subject area?
- in the appropriate level of detail?
- pitched at the appropriate level?
- in an appropriate format?
- written in an appropriate style?

PROMPTS FOR ANY CRITERIA MENTIONED:

- how would you assess the ....... of this source? e.g. relevance?

2.5 Did the/might the information have an impact on your knowledge?

- did the source refresh your memory?
- was any of the information new?
- did the source substantiate/confirm what you already knew?

2.6 Did it/does it seem easy or difficult to get information from this source?

- why did you/might you feel this way?

PROMPTS FOR ANY CRITERIA MENTIONED:

- how would you assess the ....... of this source? e.g. clarity?

2.7 Did you/might you use the information contained in this source?

- did the source solve a problem? answer a question? help make a decision?
- did you/might you use the information in your work? e.g. did you cite the information in a publication? use the results in your work?
- did you/might you pass the information on to someone else?
- did you/might you make a note of the source for future reference? print the information out for future reference? bookmark the site?

2.8 Can you explain what factors would affect/might affect your decision to use/not use the information contained in this source?

- were there/might there be any characteristics of the source which affected your decision to use/not use the information contained in this source?

PROMPTS FOR ANY CRITERIA MENTIONED:

- how would you assess the ....... of this source? e.g. clarity?
2.9 Did you/might you rely on the information contained in this source? For example, in terms of its factual accuracy?
   - would you be confident or have faith in the information contained in this source?

2.10 Can you explain what factors would affect/might affect your decision to rely or not rely on this information?
   - were there/might there be any characteristics of the source which affected your decision to rely/not rely on the information contained in this source?
   - under what circumstances might you/did you (not) rely on this information?

PROMPTS FOR ANY CRITERIA MENTIONED:
   - how would you assess the ... of this source? e.g. accuracy, currency, relevance?

2.11 Did you/might you access any other sources after accessing this source (looking for the same information)?
   - did you go on and look elsewhere for the same information?
   - elsewhere on the Internet or elsewhere (a colleague, the library, a librarian, etc.)?

QUESTIONS 2.1-2.11 ARE TO BE REPEATED FOR 3 SOURCES (where possible)

2.12 In this instance, what would an ideal source of information have been? Or, how would you improve the sources you examined?
   - what would it contain?
   - what would it look like?
   - what features would it have?
   - what would it provide access to?

3. Information quality

I would now like to move away from the specific sources which we have been looking at and talk more generally about your use of information. The following questions are intended to explore your attitudes and perceptions about 'information quality'. Please try and answer the questions, but if you find these are issues on which you really do not have an opinion, then please feel free to say so.

To begin, I want to throw you in at the deep end by asking:

3.1 What factors do you feel affect the quality of an information source?
   - how would you differentiate a high quality source from a low quality source of information?
   - what factors do you feel affect your perceptions of the quality of a source of information?
3.2 Do you feel these factors apply to all types of information?

- do you feel these factors apply equally to information available via the Internet as to printed sources?
- to an e-mail as to a WWW site?

3.3 Do you feel these factors affect whether or not you decide to use information?

- printed information? a WWW document? an e-mail?

3.4 Do you feel these factors affect whether or not you rely on information?

- printed information? a WWW document? an e-mail?

3.5 When you look at printed information, say in the format of a journal article, do you:

- look at the author?
- look at the author’s affiliation or the originating institution?
- look at the date of the material?
- consider how long the journal has been available?
- consider the presentation of the information?
- look to see whether material has been refereed?

3.6 When you look at a World-Wide Web site do you:

- look at the author?
- look at the author’s affiliation or the originating institution?
- look at the date of the material?
- consider how long the source or site has been available?
- consider the presentation of the information?
- look to see whether material has been reviewed?

3.7 When you look at an e-mail from a discussion group or a Usenet Newsgroup, do you:

**USERS OF DISCUSSION GROUPS/USENET ONLY**

- look at the author?
- look at the author’s affiliation or the originating institution?
- look to see if it is moderated?

4. Personal information

4.1 Lastly it would be helpful if you could tell me a little about your role here and the work that you are involved in so that I can put the questions I have already asked into context.
5. Conclusion

Thank-you for your time and input. I think we have covered everything which I had hoped to cover.

5.1 Did you want to add anything or are there any questions which you would like to ask?
The following is a sample transcript from the information seeking and use interviews which is provided for illustrative purposes. The transcript is from the first interview, and has been selected for no reason other than convenience. The interviewer’s comments and questions are in bold.

[Introduction]

You have filled in this form so I have a bit of an idea about how much you use the Internet already. Basically, you use everything that I listed there apart from the Gopher?

Yes.

About how long would you say that you have been using the Internet for?

I would say for about a year, only just about a year, I would say.

And that includes e-mail?

Yes. Oh, the e-mail’s only been within the last three or four months. I used Netscape, for instance, about a year ago. Well, perhaps two years ago. For the last two years, I’ve been using BIDS, I don’t know whether that comes under, which is the Bath Information System, so I’ve used that certainly for the last two years, but I’ve never gone onto the Internet proper, sort of Netscape and surfing round until the last year, and then e-mail is only within the last few months, about three or four months.

How regularly would you say you access the Internet?

The e-mail daily. Not necessarily just for work purposes, because I’ve got friends all over the university and things like that. I would use, I go to the World-Wide Web via Netscape, virtually daily, I would say. And the Newsgroups, I use them sort of weekly, but again that’s not always for scientific things, that’s for other things.

OK, what I was going to ask you then was what do you use the Internet for. So you use it for...

Yeah. E-mail, for a mixture, sort of fifty percent work, fifty percent not work. The network, again, probably seventy-five percent for work, twenty-five percent not for work. What else was there? The Newsgroups, more not for work, more for social things. I’m not sure what the regulations are, how strict or how tight it is for using the Internet for things other than work, but a lot of it goes on, a lot of people, to be honest about it... Probably half of it is work related, probably half of it isn’t.

From where do you access the Internet?

I’ve got a computer terminal, an Apple Macintosh on my desk.

And that’s where you access it from?

Yeah, actually in the laboratory.

And you’ve brought your pre-interview form with you?

Yeah.

So you managed to fill that in OK?

Yeah, sure. That’s just one example. We get project students in the lab, and we get sort of four a-
year. They’re, two of them are medical students and I don’t have a medical background so their projects tend to be medical related, or clinical related, so it’s quite useful to get information in that way for myself and for them to start projects off, rather than having to come to the library and plough through text books. I’ve put a few sites on there that I’ve used.

This is a specific example?
That’s just one specific example, yeah.

So can you....
Yeah. Certainly. Our medical students are doing a project related to Amyloidoses which are quite a complicated group of diseases. I wanted to get some background information for them, including giving them some references to go away and sort of get rid of them and so I actually just used some of the bookmarks that I’ve already got on my Netscape. One of them is the Online Mendelian Inheritance in Man which is quite a large database where you can access it just by a keyword. So in that case I’d just use Amyloid and pull out lots of different sites there. Another one is a protein database browser which again you can access via text so I can put in Amyloid and pull out a protein sequence and that sort of thing. And both of the first two link into Medline which allows me to get references for them. And again BIDS which allows me to search via keywords very simply. And to trace all sorts of information. That’s probably the most useful of these actually. The problem with, one of the problems I find with the OMIM is that it gets out of date. There is information there that is wrong as well. Because there’s only one person, anyone can put the information on, it’s not refereed or it’s not checked in anyway. So you have to be a little bit careful. Things go out of date as well. Some things may be two, a couple of years out of date. But it’s quite a good starting place to get information. And you can search for a disease by title, that sort of thing, and it links everything together, that’s useful, it ties different diseases together.

So what were you actually hoping to find? Were you looking for....?
I suppose at the end of the day, background information, but more importantly would be to get titles of papers, references that I could then give to the medical students who could then come to the library, read the papers and then from looking at the abstracts, the appendices, get more references and create information to write an introduction for a project. So it was getting information for themselves. I don’t have the information so I find out through reading the introductions that they write.

Did you find the information that you were looking for on this occasion?
Yeah. You can find, it tends to, the way it works is it tends to be a, you sort of go round in circles. Once you get one or two references, then you can look at the references in those papers and then you go from place to place and you eventually get to the place you’re looking for. I suppose when you set out, you don’t actually know what you’re looking for. You’re looking for a good review in a reputable journal but it’s knowing where to start isn’t easy. You can arrive there through different routes I suppose.

So this was kind of like a starting point really?
Yeah. It was giving them something to get... Although, if you said to them go to the library and find out about Amyloids, they might go to an old text book and then plough through things that are from the 1960s/1970s, so I wanted something that was reasonably up to date. And perhaps then you could work backwards and find the, get to the historical eventually rather than going from the historical and coming up to date.

And was the Internet the first place that you looked for information?
Yeah, it was. It’s on my desk so it generally is the first place that I look.
And then the students would then go away and look elsewhere for information?
Yeah. That’s right.

You wouldn’t follow it up yourself?
No I wouldn’t. I wouldn’t have the time to do that. In that case the medical students, they create an introduction which then I read and I learn from that myself.

You mentioned that you have the terminal there on your desk. Is that the main reason why you used the Internet?
It’s very convenient and it doesn’t take an awful lot of work, I suppose. It’s something you can justify, just sitting around playing with a computer and filling the time I suppose. Although it’s very convenient. It’s easy. It is, it’s physically easier than walking downstairs as well. And it has got the information you want, so yeah.

[Introduction to source evaluation]

To start with the top one, as that’s probably the easiest, the Online Mendelian Inheritance in Man. Was this the first source that you looked at on this particular occasion?
Yes. The reason I, for example, would choose the two sites that I’ve listed there are because they’re in the bookmarks on my computer. So rather than go and find something out, I’ve used them previously. I wouldn’t really know what I was looking for or where to find it. I mean, I knew that this had sufficient information, it’s probably not perfect, there probably are better places to look, but again, for reasons, that was the first place that I would go to. Something like that. Perhaps, probably the first place would be BIDS, the Bath data services, because you can search, as I say, by a single keyword in a title or even a keyword or a title word and it’s, that’s up to date, updated every week or twice a week, so that would generally be my first choice. Even to get information on a subject, just going by a research paper so I could then find a recent research paper, read that and then perhaps find a review or a book or something that was referred to in that paper. So that would be, I would say BIDS would certainly be my first choice. And the other two are bookmarks. I’ve something like twenty-five bookmarks or so in the computer. Not all of them are mine. Other people have put them there. But there must be an awful lot of information which I haven’t accessed. Again, it’s just what’s there. What’s available.

Did you get the information that you were looking for from the first source that you looked at?
I got some information, but again it’s open-ended so I’m not looking for a specific answer to a specific question. I’m generally looking for a bit of broad background information. So, yeah, I certainly got some information from it, yeah.

And would you say that information was appropriate to what you were looking for?
Yeah. It was aimed at the right level. Yeah, it was a good starting place, definitely.

What do you mean by aimed at the right level?
It wasn’t, it was scientific, but it wasn’t pitched at, it wasn’t too high a level, it wasn’t too complicated or anything like that. So, it was sort of a mixture between layman’s and sort of scientific. So it was understandable for second or third year medical students who needed the information. It was quite readable for anybody. For example, I know of examples where people have got information from this, from this Online Mendelian database to take home for their partners or friends who have asked about a certain disease or something like that. So it is pretty understandable, in that respect.
Would you say that the information had an impact on your knowledge? So, was any of it new to you?
Yeah, I would say so, yeah. There was a good mixture, there was bits, background that I’ve learned, sort of student, that sort of thing, which reminded me of things and then there was, other things, it gets quite genetic as well, this first site, talking about the Mendelian one, so there is lots of genetics and inheritance things that I didn’t know about. So yeah, it had an impact, yes.

Would you say that it seemed easy or difficult to get information from this source?
It was very easy.

And that’s because you can just put in the terms that you want?
Yeah. It’s done by keyword. Most of the places that I use are like that. Very, very user-friendly. I would choose, I suppose I am choosing things that are easy to use. Yeah. That’s why I favour them and use them again and again, yeah. Very straight forward.

Did you use the information from that source? So, did you pass on the information to the students?
Yeah. The information was given to the students and they will have used it, perhaps not directly, but used it again as a starting point to find other information. Yeah. So it was used.

Can you explain why you used that information? Was it because you felt it was appropriate?
Because that was the information I had at hand. I went, for example, to the sites, for example, and got sufficient information. I didn’t require anymore, so that was enough for me. It wasn’t in preference to anything else, it was just what was available and it was sufficient. In that case, that was why it was used.

Would you say that you would rely on it as a source of information?
No, I wouldn’t personally rely on it, because as you get older, or you start to realise that you don’t believe everything that you read. I would, general information I would read it to educate myself, but I wouldn’t completely believe everything that I read there. I wouldn’t completely rely on it. I would check it in other places, if I was.... Yeah, I would certainly go and look elsewhere if there was something of particular interest, I would follow it up.

And can you explain why that is?
Just from a feeling, just through looking at sites that I do know about. I’ve seen things that aren’t correct or things that are out-of-date or things by authors who you don’t particularly believe, or don’t, not particularly interested in their work or they don’t have a particularly good reputation. So anybody could put their information up there. And as you get more used to the system, you know who to believe, who’s good or who’s dodgy, that sort of thing. So you build up your own prejudices, I suppose.

And you’d rely on your own personal knowledge, or would you actually go and check the information?
In some cases, I would rely on my own knowledge. I wouldn’t use the information from certain people, certain groups, for example, and that’s prejudices that I’ve built up over the last six or seven years. Which again, I don’t think is uncommon, to get a feel for what’s correct. I’m not saying the information is wrong or blatantly made up or anything like that, but certain people can put more emphasis on things, than I believe is correct, or others believe, is correct. So I suppose someone who is less experienced may, might believe everything they read, and that could be a little bit dangerous. But I think people in my position have developed their prejudices sufficient to know what they’re doing. So you can look at the name of an author and that’s enough to know, no, I’m not going to read that, it’s not worth it. It’s not important to me. Without sounding
So you then went on and accessed other sources after accessing this one?
Yeah.

I’ll now go back and ask these questions again. So the second one [looking at sheet] is...
It’s a protein database browser. That’s run by the European, one of the European science foundations, so it’s not really an information, it’s more of a large database of protein sequences and protein structures. There’s lots of different programmes, there’s lots of links as well to other databases and other tools for protein analysis. So in that case, that’s, the sequences, the information in there is all published information, it’s all refereed. It’s a lot more believable. But again, it’s not so much text. It’s not so much written information about diseases, for example, or clinical conditions. It’s data, it’s more data access. But you can assume that most of the data on there is OK. It’s pretty useful, yeah. But you would need to get the information from the first place, for example, or from the BIDS, to then know what you were looking for in the protein database browser. So you would need names of proteins, yeah, specific proteins to get information on, which you would get from the broader sources.

So is that what you did? You got the name of the protein?
Yeah. That’s right. So then I could pull out the sequences and then that had links into Medline. So, for example, in the protein database browser, it would have, it gives you a sequence for a protein, and then it gives you, say three or four references which refer to the work, it would maybe show you the paper in which the protein sequence was published. So it has authors names in as well so you can trace them, you can get addresses if you want to write to people. That sort of thing. And it has links to other tools which allow you to analyse protein structure, protein function. All sorts of, there’s lots and lots and lots of links in there. So that’s very useful in alignment checks and sequence, structure predications and all things like that. That’s a pretty good site actually.

And this was a site that you knew about?
Yeah. That’s a site that I use very regularly. Because it also links in, it allows you to do database searches with protein sequences. The blitz and the blast searches and things like that, where you can just type in protein sequences and it does, it checks all the sequences in the database, and does alignments and things like that. So I would use that, I use that site definitely weekly. It’s very, very useful.

Again, did you find the information that you were looking for in that source?
Yeah. Yeah. If the information isn’t there, then it means the information doesn’t exist with that source. It’s pretty comprehensive, whereas in the first case, if the information isn’t there, it doesn’t necessarily mean that it doesn’t exist. That’s the difference. It’s just maybe not updated, or not complete, or that sort of thing. Whereas the other one, the protein database browser, is, as I say, it’s run by Europe, I think its the EMBU, the European Molecular Biological Unit, something like that, and that is very, very complete and very efficient as well.

Again, was the information appropriate?
Yes. Certainly. In that case, I was looking for specific information. I knew it would be there, and I found it as well, no problems.

Would you say the information had an impact on your knowledge? So, it was new to you?
Yeah. Yeah. It is all data, so it’s things that you couldn’t know. It’s probably not knowledge, because it’s not the sort of thing you could learn. But it’s the sort of thing, you could get a sequence and you would put it in a file and keep it and perhaps refer back to it, and use it. So, yeah, it had an impact.
And is it easy or difficult to get information...
Again, very simple. Very simple, yes.

It was very easy to search?
Yes. It's sort of fifty percent of it is menus. Just going round in circles finding menus. But yeah, it is. And you could use it, you could go into it, having never used it and be up and running within a couple of minutes. You don't need any specialist knowledge at all.

And you used the information on this occasion?
Yeah. Specifically. Definitely, I used the information.

So that was again to pass it on to the medical students?
Yeah. That's right, yeah.

I think perhaps you've covered some of this already, but why did you use that particular source?
It's so good. I've used it before. It's very, very user-friendly and very comprehensive as well. I've got no complaints with it at all.

And you would rely on it as a source of information?
Yeah. Virtually one hundred percent, yeah.

And is that because of who produces it, you mentioned who produces it?
Yeah, that's right. Yeah, definitely.

And that's an organisation that you're...?
Yes, it is, it's a very large organisation, but you can't get the information there if it's not correct. That's probably, it's all refereed information in that case. So all the people, it's checked by two or three people first before it's deposited.

You accessed BIDS after accessing that source?
In this particular case, it would probably be a mixture of the two. I would go to BIDS and get some information, maybe get some general information and then use the Protein Database Browser, or even the OMIM. So it wouldn't necessarily be an order. You could go from one to another. I don't suppose in that case the order would be particularly important. BIDS you can access at any time. Again that is so, so easy to use. Not just for this example, I use that all the time to get information. Generally, I would go looking for specific papers. But it's quite easy. You could do a search, for example, by keyword, and then combine it with, just looking for reviews. So you could just pull out specific papers that are in, that are review articles which are the sort of documents that are thirty or forty pages with five hundred references in, that sort of thing. So you can do lots of things with BIDS, it's pretty....

So again, you used BIDS because you've used it before?
Yeah. I don't think I could function without BIDS. Definitely not.

Did you find what you wanted from BIDS on this occasion?
Yeah. I always do. Again, if it's not in BIDS, it's not published. It's all comprehensive. It does everything that's published.

And the information was appropriate?
Yeah. Definitely. Certainly, without BIDS, I couldn't function. I don't think a lot of us could. It would mean coming back to the library again. I suppose we used to do that. A couple of years...
ago. But once you’ve got used to using it, I don’t think I’d remember how to plough through all the science citation indexes and things like that. I can remember, it wasn’t a year ago, two years ago, I was sat reading current contents every week. And that would take you an hour a week or something to check. Whereas I can log onto BIDS and check in two minutes.

And you’ve just had access from your office for a year?
Yeah, for a couple of years for BIDS, I think I said.

And again the information was appropriate to what you wanted?
Yes, it was.

Did you find any new information? Did it have an impact on your knowledge?
Yeah. It’s updated weekly so I always find new information from it, every week. Definitely.

Did you find it easy or difficult to get information from BIDS?
Very easy. Again, I suspect perhaps I choose sites that are easy to use. I didn’t really realise that until now. So if I find a site that’s good and simple then I probably add it to my bookmarks and use it in the future. So that’s probably what’s happening. Or perhaps all the sites are easy as well, I don’t know. I’ve never had any particular problems getting information from sites. I’ve occasionally, things send you round in circles, you just go from menu to menu to menu and you just find yourself back at the start and you haven’t actually gone anywhere. But as I say, generally the information is pretty good on the Internet. It’s certainly very user-friendly, very easy to use.

Did you use the information that you got from BIDS?
Yeah. I did, and I always do.

And would you rely on BIDS as a source of information?
Yeah.

Can you explain...?
It’s really just a comprehensive list of all papers published, including abstracts and things like that, or research papers. So again, they’ve been through the refereeing process, again you can apply your own prejudices and just use the papers that you’re interested in, or papers that you particularly, and authors, that you particularly respect or believe. So, BIDS is a comprehensive information source, and then once you apply your own prejudices to it, it’s, it just narrows things down. It allows you to make the choices for yourself. It just says, here’s the information, now you choose what you want to, to get more information on, in that respect.

On this particular occasion, did you access any other sources?
No. I don’t think I did actually. That was sufficient. Because BIDS would give me a list of sort of fifty scientific references to give to them, the OMIM, the Online Mendelian Inheritance would give me a print-out of perhaps four or five pages of background and the protein database browser would give us half a dozen or a dozen or so protein sequences with links again to references into Medline, that sort of thing. So that would be sufficient information for me.

Can you say, in this particular instance, what would an ideal source of information have been?
I suppose an ideal source of information, it would be, on the network, it would be like a recent, it would have the information of a recent text book. But with the, written as a sort of scientific paper, so it would be fully referenced, it would have a list of references at the end that are relevant. It would be within the past year and a half, perhaps the past two years. But it would be written in the style of a decent text book, that sort of thing. I think there are things like that.
coming online at the moment, but I haven’t actually managed to get onto them yet.

So you are looking for something that gives you a concise summary?
Yeah.

But with pointers to more information?
Yeah. That’s right. Exactly.

[Introduction to information quality]

What factors do you feel affect the quality of an information source?
I suppose it’s repeating things I’ve said. Quality is reflected by the person who produced the information. If someone, a particular author, has put their name to it. Obviously the people who are putting the information together. You may be more inclined to believe a name that you’ve heard before, one of the large corporations, that sort of thing, or a large organisation. Quality of information. I suppose also the way it’s presented as well. If something looks slick and it runs quickly and it’s not too, there’s only, there’s not rubbish there, then that reflects and you feel that. Yeah, so that would summarise it basically.

So when you’re talking about the author, would you rely on your own personal knowledge of the author or would you perhaps go away and check to see what else that author’s written?
Yeah, if I didn’t know the person then I would, BIDS would be an ideal, I keep going back to it, would be an ideal place to do a search by surname and look at the journals they’ve published in, that sort of thing, look for reputable journals that sort of thing. I suppose you’re talking, probably talking about more specific, rather than, I suspect you’re talking about information that hasn’t got an author’s name to it, rather than a piece of information which I can go to and read. Sort of anonymous in that respect.

Well, either.
Yeah, in that case, I would rely on the name of, probably, whoever was producing the information or who’s looking after the information. That sort of thing, and how well it was presented as well.

What do you mean by presentation? The way it would look on the screen?
Yeah, physically, how well it’s, whether there’s typographical errors. How, just how well it’s presented, just how it looks physically, aesthetically, how it looks.

Do you feel that these factors apply to all types of information? Do you feel they apply equally to a site that you’d look at on the World-Wide Web as to a journal article?
I think subconsciously, I probably do actually, yeah. If you feel that something is well put together, and it looks as though someone’s spent time preparing it, then yeah, that has an impact on me, yeah.

Does that apply equally to the author? Would you look at the author of a Web site or a page on the Web as you would a journal article?
Yeah. I think I would. Yeah. Again, it’s sort of prejudices I think. Some of which are probably correct and some of which aren’t, but they develop for whatever reasons. It’s difficult I suppose.

Do you feel these factors affect whether or not you decide to use information?
I suspect they affect whether or not you would use information again, or frequently. So, yeah, it does have an affect, yeah. If you felt that something was shoddy and you found mistakes in it, then it would perhaps put you off using it again in the future, yeah.
And again, would it affect whether or not you would rely on information? Yeah. You might still use it, but in the back of your mind, or in my mind it might create doubts or questions.

Now, talking specifically about printed information, say in the format of a journal article, you mentioned that you look at the author, didn’t you? Yeah.

Would you look at the author’s affiliation or the originating institution? Yeah, certainly, definitely.

And why would that be? Again, from prejudices you build up from certain institutions, for example. What was the question again?

Why would you look at the author’s affiliation or the originating institution? Probably just through being cynical, I suppose. Through prejudices that are built up from reading, or from other people, or, I can’t really explain why. It’s quite difficult.

Would you say that you have experiences of what particular institutions are like or the work they produce? Yeah, that’s it, yeah. But again, you must be careful with, a lot of your conceptions, aren’t always correct, or my conceptions, aren’t always correct. It's a difficult one this. Can I leave that for a while? I have to be careful what I say!

Would you look at the date of the material? Yeah. Certainly. It would have to be up to date. I wouldn’t discard something because it was old because certain fields don’t move particularly quickly, but it’s important to know, in some fields, it's important to be updated every week. I mean, some things are correct at the time and then they are superseded and out-dated.

So would you be interested ....? Yeah, it is very important, yeah. And a specific date, rather than just a year. I mean even a month. Date to the exact month, yeah. That’s important.

Would you consider how long a particular journal has been available? Would you have a different opinion of a very new journal as opposed to a long standing one? Yeah. I think most people have that feeling, that you probably wouldn’t even look at a few of the new journals. I don’t know how they get established, or how long it would take to get established, but there are specific examples of new journals that have come out, and people I work with think, ‘Oh well, I don’t believe it’, or ‘it’s no good’. I wouldn’t subscribe to a new journal until its proved itself. Definitely.

Do you consider the presentation of the information in a journal? You mentioned that on the screen you would expect the information to look good? 
Yeah. Yeah.

Would that apply to a journal article equally? Yeah it would. It tends to be that the journals of higher impact, that are more important, are probably better presented, or maybe not that, but the journals of lower impact, or those that aren’t so important, aren’t as well presented, and it sort of shows. The pictures aren’t of as high quality and the photos don’t need to be of as high quality. So that yeah, definitely, yes, I would say.
Would you look to see whether a journal is refereed?

Yeah. It doesn’t mean if it isn’t refereed, I wouldn’t read it. I wouldn’t, it doesn’t necessarily mean I wouldn’t believe it, but it’s definitely, that would be considered, yeah.

And why is that?

Because it’s easy to get information published if it’s not refereed. I mean it’s easy to get refereed information published, even if it’s not correct, and I’m sure that a good, a large amount, I don’t know what the percentage, may be ten, twenty percent, up to fifty percent, maybe not fifty percent, but a substantial percentage of information available, of medical information, probably is incorrect. Not through people intentionally trying to deceive, but interpretations are wrong, it’s quite easy to interpret results in one way and it is incorrect. So refereeing, it increases your confidence in the information. But again, I wouldn’t believe everything I read that’s refereed.

So now talking about a document say that you found say on the World-Wide Web, you mentioned that you would look at the author; you don’t have to answer this, but again, would you look at the author’s affiliation?

Yeah. By affiliation, do you mean...

The institution that they work for?

Yeah. I mean, specifically, in my case, it’s more what research group are they in? Perhaps. Who are the people who are leading the group? Even what university are they in or what department? So some departments have better reputations than others. Some research groups have better reputations. Information from some countries is more believable than others. Yeah.

Would you look at the date of material?

Yeah, definitely.

And that’s for the same reasons....?

Yeah. Identical reasons to before.

Would you consider how long a particular source or document has been available, or the site, on the World-Wide Web?

The thing, I suppose the difference with the Web is that it’s quite new. So, whereas you know a reputable journal because they’ve been around for a while and people talk about them all the time, the number of people originally using the network, or the World-Wide Web, is a lot less. Certainly in our institution. So it’s still early days, you’re still making your own decisions as to what’s useful, and what’s right or what’s important. I wouldn’t be put off going to new sites in the same way that I’d be put off going to new journals. No. In fact, I’d probably be more keen to look at new sites, at new information. I know some of the, for example, the Journal of Biological Chemistry has gone online, or some of the current opinions journals have just gone online, within the last six months or so, and I started using those straight away. I’m always keen to look for new things. So I think it’s a bit different in this case. Yeah.

And you’ve mentioned already that you would consider the presentation of the information?

Yeah.

And that would affect whether or not you would go back to a site?

Yeah. I wouldn’t, if I felt it was genuinely good information, then presentation wouldn’t stop me using it. But it can be quite annoying. Especially with the load on the network. Our computers don’t run particularly quickly because we’re going through the University’s server. So you don’t really want to be messing around and having, for example, it’s annoying to have large logos.
large pictures, that are printed on every page, which takes forever to download things. You can
deselect it, but, I suppose there’s a tendency to put brightly coloured and large things like that in
for the sake of it. And if you’re after information, you don’t really want that. You’re already
there. It’s not going to sell it to you I don’t think.

Would you look to see whether material has been peer reviewed or refereed on the Web?
Probably not. I don’t, I’d maybe look to see if it was, but again, since it’s early days, a lot of the
stuff isn’t. And you have to accept that. I would look, yeah, if it was, if the information was
easily available, I’d be curious. But for us, it’s certainly very early days on the network, we’re
still finding our feet, I think.

Are you involved in any discussion groups?
I’m not. I’m aware of them. I probably would be interested in getting involved, yeah, but I
haven’t actually taken the plunge yet, no. There are several that would apply, that would be of
interest to me, and I’ve seen other people using them, but, it’s not intimidating, but it’s a bit, you
have to know what you’re talking about, sort of laying yourself open to the world, isn’t it? People
know a lot more than you, so...

And you get fifty messages a day?!
Exactly, yeah.

Lastly, could you just tell me a little bit about what you do here, just so I can have an idea
of the context...?
Yeah. Certainly. I’m a post-doctoral researcher. So, I’ve just finished my PhD a couple of years
ago. I work in the Department of Biochemistry and I’m part of a research group which researches
Alzheimer’s disease, and diseases of the elderly, or degenerative diseases. So I work full-time on
a medical research project, supervising a PhD student, and we have various people who come
through the laboratory. We have, as I said, we have two medical students a year who come for
about four or five months, we have science students, sort of biochemistry students, who have
come for about three months as well. So we’re all concerned with medical research. Yeah, that
would basically summarise it.

So you did your PhD here?
Yeah, that’s right.

Was there anything else you wanted to add, or any questions you had?
The only thing I would add, I don’t know, is that we have problems using the Internet because
it’s just so slow. I don’t know whether that reflects, as I say, our server, or things beyond the
University, but at certain times of the day, it’s completely unusable. If you try sort of around
lunch time, it just drives you round the bend. Sometimes. Just to download small amounts of
information. I suppose it reflects the computer, I’m just using an LC2 which is, but it’s not even
that, even on a Power PC, it’s just annoyingly slow. I’d be concerned that it’s going to get worse
as well. I don’t know what, what’s going to happen, or what will happen or what can happen, but
that is sufficient to put people off using it, I think. It’s, you sort of, enough to make you have to
come in at eight o’clock in the morning to do it, or do it at six o’clock, that sort of thing, which
isn’t ideal.

And when you really want to do it is a lunch time, isn’t it?
Yeah, exactly. You need to do it when you need it. Because you can’t get, sort of, for example, I
did, the other week, I was using, doing database searches and I did one at about a quarter to nine,
and submitted the search and the information comes back via e-mail and by the time I’d opened
up my e-mail, the results had come back. And I did the same, that was about quarter to nine, I did
the same about twelve o’clock and it took about three and a half, four hours to come back. So it’s
reflecting more people using the service, I suppose, but it’s....

It’s frustrating?
It is. Yeah. Because there’s so much, there’s so much to use and you feel as though you can’t use it. Being sold a bit short. The other thing is it is hard to, to find new information, new information sites, unless you go out and look for them yourself. So there isn’t really a system of, it’s fair enough saying there’s this new database, there’s this new thing coming on to the network, but unless you get into a search engine like Yahoo! or whatever, and then know again what you’re looking for, you just, there’s lots of things that would be of use to you, but you can’t use. So perhaps people could be targeted. I know some of the journals now have little sections with new sites saying ‘this is useful, this is useful’, but again, it’s just the tip of the iceberg....

And it becomes overwhelming as well, because you see so many announcements like that? Yeah, that’s right. I don’t know what the best way of communicating the information about information would be to people. But that’s also a bit of a problem as well. Because generally, it’s, at the moment, it’s word of mouth. People say, ‘Oh, have you tried this? It’s pretty good’. I mean, that’s OK. But it isn’t ideal.

That’s how it works with you? Sort of people...?
Yeah. I think it does. ‘Have you tried this site? It’s quite useful’. Or, ‘I’ve just come across this’. You can come across things just by accident or just by mistake. So, a lot of people haven’t got the time to sit down and go looking for things. Again, you don’t really know what’s out there, so they don’t know what they’re looking for. They know there is stuff is out there. I know there must be alternatives to this there [pre-interview form examples] that are excellent, but....

Do you use OMNI at all, the OMNI database? Have you heard of OMNI?
I’ve heard of OMNI, but I don’t think I use it, no. Again, most people are learning the Internet themselves. There’s no formal teaching or anything like that. So, it’s picking bits up from other people. There isn’t, there’s an awful lot of people who don’t use it as well, just because they’re intimidated by it, or they don’t know, they think they don’t know what they’re doing. So, although we’re all, we’ve all got e-mail addresses and we’ve all got access to computers, I think there’s an awful lot of people who don’t use it, no. But everyone else who uses it is virtually self-taught. Although there isn’t a lot to learn. Once you get going, it might be of use to have a sort of formal teaching session or something, to say where you can do this, this and this if you want to. Or some co-ordinating. But for someone, I suppose it would be difficult for someone creating a new site to get the message across to people, to say what’s available.

[tape turning]
I would say at the moment, it’s a bit of a mess and it’s just information everywhere. It’s like having a desk with papers all over it.....

And you just stick your hand in?
Yeah, and just grab a bit. And generally it’s OK. But then there’s probably bits over there that are of use as well.

This is why people finds sites that they know how to use and stick with them?
Exactly. Yeah. They’re all, I suspect that virtually all sites are very usable. But you just get a couple that you like and that’s sufficient to get the information. And I think probably that’s what happens. So you’re missing out on the better sites, I would imagine.
The following is a sample category of analysis. Anything spoken by the interviewer is in bold and the interviewee number is in square brackets after each comment. The category for organisational home pages has been selected for illustrative purposes.

- It’s appropriate but the specific piece of information wasn’t actually there [2]
- It’s one of those pages that’s, that’s very graphical. It uses Java scripts so it’s very, very pleasing to the eye, and very easy to manoeuvre around. So it’s, there are pages where information can be presented in a rather dull and drab and incoherent way. But this one is very easy [2]
- very graphical and user-friendly [2]
- it’s a professional company. I know the people there. It wouldn’t be of any advantage for them to put information which wasn’t entirely accurate on there. I think you do accept certain professional standards which would mean that I have got no reason to doubt that the information is accurate. So, I would trust it [2]
- funnily enough I did actually find the most bizarre site which was actually a centre for atomic tourism, I think they called it. Sounds as though it was a bit of a prank at first but it wasn’t. It actually provided a lot of information on various sites, on how to get to places. So it did actually prove to be very useful [3]
- there was a Home Page for the Bureau of Atomic Tourism, which sounded somewhat bizarre, but on looking into it, it was a list of all the world-wide museums and sites in connection with the world nuclear energy programme and of the atomic bombings, which I did find quite useful. And I think I would go back to there because being a sort of, a medical physicist interested in those areas, you think, ‘if ever I was in those countries, there might be something that I might try and just sort of look at’. For example, I’d be very interested in going to Los Alamos in Mexico, which was the site of the first atomic detonations and there is a museum site there, and this has got all the information that you want. When I went to Hiroshima, it provided sort of useful guides as to what to expect and where to go and look to see things and it was actually quite informative. I think that was, that was actually quite interesting. An unexpected find, if you like [3]
- It just came up on my search, you see, you know, I just, just go down the pages of various things and it just came up on one of the searches as you’re going through all the points of contact and it came up with all the sites [3]
- that was a chance finding. I wasn’t expecting to find that information. I mean it was personally relevant, but also it was of academic interest and as I say, it was something that I would use and I would go back to there if I was planning a trip to those sites [3]
- it was so easy to just, simply having found the site, to just retrieve the information and just download and print it out. It was very simple [3]
- you could search it by site, that’s right, and then just index the actual site that you were interested in [3]
- I think you’re not quite sure as to the authentification of these sites, the information that goes down there. I mean, anybody can write down anything in there, can’t they, that they want to do. I think that’s one of the, the perhaps, the problems of it. Particularly as it was something that I’ve never heard of before. If it was a large institution or academic or commercial
I knew of and it was a page of theirs, then I would obviously be quite confident in what I have. If it’s a source which I just don’t know anything about, or say a less respectable institution or site, then I think you have to treat it with a little bit of scepticism [3]

- I suppose more organisations now are relying, or not relying perhaps, but are realising the benefits of having Home Pages because it attracts the international attention or audience more, which means that they do, some organisations do quite a good job of presenting these Home Pages. In fact, we in the Department are trying to sort of get our own pages up and running because we’ve got a few Postgraduate courses in which we hope to attract overseas students and things. So, you know, for the same sorts of reasons, I think that some of these Home Pages are quite good [4]

- I do get a lot of the MRC literature, the sort of flyers that they send out with proposals and projects and what not. But this was much more extensive and it had it all classified and categorised, you know, into sort of various, into different, you know, different sort of levels, different categories [4]

- the more I sort of delved through, the more links, I got to new layers [4]

- It was easy to find your way round. It had very, very good links and lots of them [4]

- you would have to rely on that [the factual accuracy of the information]. You know, who writes, I mean, there isn’t any, there isn’t a sort of a cause of interpretation of this, of the information that is provided. It’s just all factual information about grants and scholarships and fellowships and all that kind of stuff. You know, I would sort of, in that sort of case, I would imagine that it was all fairly accurate, you know [4]

- There might be sort of bias on my part, accepting everything that the MRC says, but because you know their stance, their sort of reputability, I suppose I would accept the accuracy of it. You wouldn’t have any reason not to really [4]

- Can you say what an ideal information source would have been for that particular instance where you needed information? Yes. Just to find out an appropriate award for a PhD studentship and the address and the contact, for the contact person within the MRC [4]

- they just seemed to have listings in different categories which were all linked together. So if you find that you’re browsing through one category, for example, overseas fellowships, now, they might have a few pages on that, and you might think, you know, this isn’t any good and there’s a link, at the bottom, there’s going to be five or six links into other areas, and you can tell exactly by the link which, it was either a button or a thumbnail, I’m not sure, but you could, from the page that you were on, if you knew that it was the wrong page, you could easily get into the right one from the way that they had it set-up, constructed [4]

- I didn’t look at them [university pages for daughter] in any great detail. But I scanned through them to look at the range of opportunity, the course requirements in some cases and how she could apply [5]

- I think it’s very important that things that are done by an institution should be well thought out before they’re presented because that’s actually a reflection on the institution [6]

- things that are put out by the universities in general, should be well thought out so that they are factual and correct. Things that are put out by individuals, you have to have doubts about [6]

- that was great because it gave me an e-mail and a point of contact, although it didn’t actually give me, because I suppose it’s difficult to keep up to date, the e-mail numbers of the names of the actual people in the institute. It gave me names of Heads of Department and it gave me an e-mail name for the Webmaster but that was all. It didn’t give me, you know, all the details-dates, but then it did give you a way of getting hold of it [9]

- there is a Net site for confocal microscope users group, for information and help, and they’ve
used that and found it excellent, and then actually found names and contacts to get in touch
with people by e-mail, to get advice personally on specific questions. So that was great and
they used it as a discussion group and they then said, ‘Oh, you can get hold of this information
in this way’ [9]

- The information was very good on what the institute did and on each different section within
the institute, and what they did, and what was also very, very useful because I don’t speak any
other foreign languages was that the Web site was in both German and English and you had
the option to choose which language you wanted to view the information in. And I actually
went through the German information as well in case there was something that they’d only
translated into English but hadn’t bothered, and the whole lot was translated through into
English, and so that was excellent. But what I found was missing, although there was lots of
information on what they did, and lots of information on the institute’s policy and what they
were aiming to achieve as an institute as a whole, there wasn’t that information in terms of a
name and a point of contact to then go and get, for example, papers that have been published
by the institute. It wasn’t as useful in terms of a directory in that sense. And again, the names
of the people who were working in different sections weren’t there. But that may be because
their personnel changes quite a lot and it would be inefficient to do that. But the Heads of
Departments names were there, but they didn’t put telephone and fax numbers on [9]

- they didn’t even have an e-mail address. The only e-mail address that was there was the
Webmaster’s e-mail address. So, if I’d wanted to fax them, I couldn’t, or telephone them, I
couldn’t. So that was quite awkward. I then had to go through the Webmaster, who I suppose,
whose job isn’t really to act as a switchboard. But they were very nice and they did, and e-
mailed me back from their person who is responsible for the IT part of the Institute, with the e-
mail name of one of the people I was looking for. But a telephone number or a fax number
would have been very useful to include, as well as a full address, and it didn’t actually do that
[9]

- There was no sort of way of contacting them, other than writing and that’s actually too slow
nowadays [9]

- The actual information that had come out I would then take as red and just use it, yes, in the
same way as I would use an abstract that had come up on Medline for example. It’s factual
information. I wouldn’t, I would assume that it was sound, and that it was factual, although it’s
probably a bad assumption actually thinking about it, but I would assume that if it was
information that was coming from an institute about their policy and about work going on in
their department, I would assume that it was up to date and factually correct. In terms of
information that came from more unknown sources, in terms of maybe if it was coming from
an individual, if it was coming from, I don’t know, something other than a government
institute or a recognised body, like a society for example, then I would automatically say,
‘Well, that’s their personal opinion’, and I would go away and put together different opinions
to try and see whether there was a consensus. But I wouldn’t assume, yeah, I would assume
that if it had come from an institute that it would be absolutely down the line and OK. Maybe
wrongly! [9]

- We have a system on the network within the University where you can get hold of e-mail
numbers and names and department addresses and telephone numbers for all the staff members
at the University. Now, that sort of a directory, like a telephone directory, but more than, you
know, with the address and fax number and e-mail number on, would be very useful to have
and would have been a useful additional page on the end of their Web site. But that was
missing, and having looked at other Web sites in terms of looking at the European
Commission, that was also missing. There weren’t points of contact, there weren’t information
officer contact details to actually go in and talk to a person. And not knowing enough about the
Internet and the Web, I didn’t know whether there were people behind symbols that I could get
in touch with because I wasn’t actually - you know you have to put your e-mail address in for
them to be able to know that it's you that's talking to them, so that they can contact you? - I haven't been trained on how to do that. So I was using it purely as a blind person and they wouldn't have been able to contact me and I wouldn't have been able to contact them through that system. I know you can do that, but I don't know how! [9]

I went straight and just typed in European Commission as a search term and got their home page: 'Hi! We are the European Commission', and then it actually said, 'If you want information on publications and information on different Director Generals that make up the EC', and as you go through, there is information there, but again, if I'd wanted to talk to a person, the points of personal contact aren't there but the information on publications did tell me the name of the journal, how often it was published, how big it was, and which one I would need for my particular subject area. So that answered my question. It told me where to go and look in the library for the information I needed. So from that point of view, it was very useful. From the point of view of having somebody to go and ask questions about what was written in the journal to qualify the points, that wasn't there. So they weren't actually giving me the information as a member of the public or as a professional to go and query points in their legislation [9]

the whole thing was written in English, I don't know whether it was written in English because I was accessing it from an English Web site or not [9]

it was all in English which was very helpful but the other thing was when I rang the Commission, was the person in charge going to be able to speak English? That sort of information would again have been very valuable, as a government body, to try and get that sort of information from them [9]

it was quite difficult to find that sort of information. Half was there, but the personal contact again was missing [9]

It gave me the name of the journal I wanted and then it broke the journal down and told me which sections, because they're all lettered, so I need to look in section L for the sort of things I was looking for. And also it told me how often it was published, so I then had an idea of the bulk of information I was going to have to plough through, and it also told me that each Directive was given a number so that I knew that if I could just find the number of the Directive, it would then make it easier to search for because each issue has got an index by Directive number [9]

Easy to get in terms of thought process, but difficult in terms of time and effort, because it's so, so slow [9]

I wouldn't question whether it was inaccurate or had been messed with, or, you know, what they say, I would expect to be factually correct, and up to date, more to the point [9]

if they're not up to date, then really it's of no use to me because I'm writing a report that's going to be used to influence new legislation, so it's got to be up to date, and also, if it's not factually correct, then there's no point in me bothering to go and look at it. I might as well actually go and look at the hard copy, paper version, which again I would assume to be as factually correct as what I've seen on the World-Wide Web [9]

it's a formal institute and what they're saying, I'm assuming to be factually correct [9]

In terms of the question of the name of the journal and where it was and which sections I needed, it was fine, and I think it actually gave the name of the department who were responsible for producing it [9]

In terms of finding out more general information as to where I could get help with interpretation of the legislation, it was really quite vague because it was a very, very general page [9]
If I knew of a person, an information officer, who was able to speak English, I would ring, I would have rung that person up because the cost of telephone call is arbitrary. The quality of the information that I would get if I could get it from first hand, from somebody in the European Commission, I would prefer to do that rather than base it on just one government expert's opinion because I'm preparing a document that's got to relate to all the different countries. So if I can get a first hand source of information without national bias, and that actually is better for the work that I'm trying to do.

I've got a friend up in Dundee who's effectively got his own home page and there's a photograph of him and it tells you what room number he's in and his phone number and his fax number and his research interests and how many times he brushes his teeth almost. But another friend in Southampton, you really have to hunt through the information and eventually you will get his e-mail address. And that's it. There's nothing else about him. And the same information for this place is somewhere in between. It says quite a lot of things like room numbers and stuff like that but not a lot else. So that sort of thing, I suppose, is variable, but that's partly I think because some of these sites have been established for longer and therefore they've evolved to be better, just because someone has got the time to do it, I suppose.

if you went to a University site, I was trying to find something out about somebody in Newcastle and I just couldn't find what I was looking for because the front end of the information was so poor, whereas there are other ones where you can immediately find your way round because they make it easier for you. It's partly because I didn't have enough information about this person in Newcastle, but I think I had equally little information at some other places and found it. So I did think there, although it's the same with other sorts of information, sometimes you can find you're way round ..

if I've got a specific question about one of the commercial folks who have got a personal Web site then I would go directly to their Web site. Something like that, and take it from there.

for instance there is a very large organisation in America who make or who breed mice with cancer abnormalities. So, I access their site to see what mice there are and availability of them because we work with mice.

it obviously gave you all the options to browse that catalogue and everything.

the Home Page of the catalogue collection was very clear. So, I mean, it was just a simple matter of clicking on the relevant icons to take you to the next, to the right page. And that was very easy.

Again, would you say you would rely on this source? For example, in terms of the accuracy of the information? Yes, yes, because, I think, I mean it's a catalogue so it's just simply documenting what they have in sort of stock or what they have to give. So I think you know, that's fine, you know.

our Home Page because I usually use that also as a starting point because I also have, I've looked up sometimes sites for the mouse, an encyclopaedia, mouse genome encyclopaedia, something like that, you know, but I just to get to it through our Home Page. It's quite nice and very well organised. It's very easy to get from there to where you want. I also use our Home Page when I want to look up electronic journals and so on. I just go from there.

the kind of organisation that our Home Page has is just quite useful, because it covers in a way, I guess, the major areas of biology that people are interested in and then it gives you, like, kind of, links to big places, and then you can use from there, to go to other ones, small ones and so on. So, it's quite good in that way. I wouldn't ask for anything much more complicated.

over the World-Wide Web, [the librarian] has a Web page, a home page for the Institute and it's very, extraordinarily useful because it actually has lots of sites which, like Nature has a site and sites where if your searching for local information, we have all sorts of things, and one of
the things we have is sequence information [19]

- one of those sites was a home page of someone in Canada [19]
- he had a very nice home page in as much that he had publications and references and a page on what he was interested in [19]
- it was a rather unusual place. It was Nova Scotia University in Canada. It’s not a particularly well-established university, so it was quite interesting [19]
- I think it was updated fairly recently, I don’t know when [19]
- It didn’t appear to be old, to have old data anyway, old information [19]
- I think the general style suggested it was within the last year or so, perhaps even in the last few weeks [19]
- if it’s someone’s home page, then, I mean, I don’t care who’s put it up. Well, I mean, it depends on what you mean. I mean, the Home Page of the EBI, then of course I care that it’s the EBI that’s put it up. But then I wouldn’t have bothered going to it if I hadn’t known that it was the EBI [20]

I have occasionally gone to Web sites, with, you know, people who I know have done some fairly, fairly interesting work in whatever area that they’re looking at. But often a lot of the time, it’s, the Web page is just a picture of the person and describes what department they working in and where they’re working. There’s no real information [22]

- I have tried that approach, just going straight to a, say a particular university’s home page, then trying to go through the departmental listing, but often you come back to exactly the same page! [22]
- It’s often nice to see, a lot of the sites have all these, ‘These sites are under construction’ or ‘frequently updated’, so it’s nice to see, they often list the date it was last modified, so it saves, if you know when, about the last time you looked if it’s been modified since then, it can be useful, yes, instead of just trawling through the same old information [22]
- I find with a lot of them, they’re just general interest information rather than anything particularly deep or with any real information inside. A lot of it is just a waste of, a waste of my time [22]
- sometimes, if they have a good page with links to others sites on there, I use that just to see if it has any links that I’ve not visited, or something along those lines [22]
- most of it is people’s own ramblings really! But sometimes, on some of the news, on the Usenet Newsgroups, occasionally somebody will mention that they’ve put a paper ... which was fairly useful, although a lot of the pages were in the wrong order! But that is useful, when it is part of a real thing, it’s like a real publication, rather than an electronic publication [22]

There was the one document which is the World Health Organisation guidelines on counselling. It is a specific document, but I was disappointed to find out that it’s actually a book, and all they gave on the Internet was a brief, they described the book, and told where you can order it, and how much it costs, so I stopped there! [23]

- while I was there, I then realised there was lots of other information here, and I printed out some stuff. So these are basically stuff that some universities have produced [23]
- I was looking for the guidelines and it was sufficient for me to know that they exist and when they’re being printed and when I realised it was 1990, I thought, well, that’s a bit old anyway. So in a way, that solved my question. I didn’t actually, I wasn’t particularly interested in buying the book [23]
First of all it was a little bit out of date, and then it's, secondly it's a book, and I then asked my employer whether she, whether we would actually already have the book, and she said no, but do you realise it's out of date, and she wasn't keen on purchasing the book because, I mean, in the world of HIV/AIDS six years is basically out of date [23]

it was still helpful in my particular MPhil project outline because I refer to the guidelines, and I make the point that the guidelines don't take into account the recent issues of HIV testing in pregnancy because the guidelines were produced in a time when HIV was still mainly an issue for, or most people talked about HIV testing and counselling in STD clinics or Gynae clinics, but it's only since a couple of years that HIV testing is increasingly incorporated into routine ante-natal, routine ante-natal care. So those guidelines wouldn't have anything on the ante-natal care. But I didn't know that until I saw that it was 1990. [23]

it's part of a series of reports they've produced. I mean the price, it's Swiss francs, it's seven francs, or eleven, about five pounds. I would have purchased it if it was more up to date. But I didn't think it was worth it [23]

I printed out a few pages on the World Health Organisation reports they've produced, particularly in relation to HIV, and I think this is useful because, although the guidelines are old, it was good to know that they've produced so many other reports [23]

it was interesting to find out what they, they refer to books [23]

That really depends on which document. Let's say this World Health Organisation, then I would assume that whatever is there should be correct because that's their work. I mean, it's not subjective. It's objective. They're involved in, they're reporting on a study they've carried out, or of some programme in third world countries. So I assume that that's factual knowledge. It's what they're doing [23]

the CDC is, it is considered the office in the United States where people look for that information [24]

that is the Department in the States that routinely records all infectious diseases and data for the surveillance stage of infectious diseases. So I knew that was where I wanted to try first because if anyone was going to have the information, they would be the most likely to have the information. So that's why I went there [24]

they were going to have the updated figures on there but it wasn't on there at the time because it was something they needed developed, and so the rest of the stuff, the actual, actually the data file with the figures wasn't accessible [24]

if I tried now, they might actually have the data, the information there but they didn't at the time [24]

I think it said 'AIDS Figures' or something like that so I clicked on it and it said 'this information is not yet available' [24]

it was very big and in fact, I'm the sort of person who prefers to have something that I could guarantee I am going to find everything I wanted, and in a system like that which is so huge, because you are always jumping from one bit to another, you're never quite sure whether you've missed something on the way. And so if anything, that might have been a disadvantage because there was just so much. Not so much for surveillance, but it has happened if you're looking for something else, I would have gone off on one sort of trail and never got back to where I started and possibly missed something vital. I think that's because of sort of the size of it [24]

this is what I wanted, what I've found here, and at the time, I couldn't get that information [24]

did I find it easy to use? I mean, yes because they're all so similar that it doesn't matter which thing you're using, generally you do the same with every one. So I can sort of pick up this very
it depends on the person entering the information. But I guess, I mean that bearing in mind that this is a government department, the information is going to be as accurate as any published source, as a publication from their Department. So yes, I would rely on it.

maybe it was a different Home Page. I mean, if it was something that wasn’t an official one, and it was, because there were quite a few Home Pages on there for AIDS which are perhaps patients or you know, groups of patients who have set up their own Home Pages to convey information. And maybe then in that sense I wouldn’t trust that information as much, but because this was a government, official page, then yes I would rely on it.

the CDC is actually part of the NIH and there was a link to it. I mean, again it’s a government department.

it was quite clear and it was easy to use.

generally I don’t find that I have too many problems [using sites]

It was likely to have that information.

this is male members by category, that’s still AIDS cases rather than HIV positive cases. And so it’s not telling you quite the same thing.

in terms of making it better, it wouldn’t really have helped [because the information was not available]. I suppose it would have helped if there had been pages in that information explaining that. So there would have been ...? Yes. If there had been something about HIV surveillance, and I’d clicked on it and for haemophilia, it would have said, ‘This information isn’t available’ and suggest you contact the numbers or other pages that you might go to or something, or other people that you might contact, or something. So that was all really. Because of course when I got through to this and I found that the information wasn’t there, then I didn’t know where to go to, from here, that’s when I had to go to an external source.

The most thing I use is a particular site on the Web, for Telemedicine. It’s sort of in a way information exchange on the Web.

There’s this place called the Telemedicine Information Exchange which is quite a well-organised site, and we’ve got an entry in there, our projects got an entry which is, which was wrong, so I just logged in most recently to check that and make the corrections and e-mail them the corrections.

they keep a bibliography of journals there including the articles, or some abstracts anyway.

we’re also about to buy some new teleconferencing equipment and I used their index of manufacturers and equipment to see if there’s anything useful I could get out of that.

I can’t remember now if it was from searching around and it just came out or it was someone suggested it to me.

They post information on active Telemedicine evaluation projects, so we have something on that.

the Telemedicine Information Exchange keeps a list of equipment on suppliers and so forth, and you can go into that for more detail and that may well send you back to IBM or Olivetti or Picture-tel or something.

Would you say that the information from the Telemedicine site is appropriate to you? Yes. That’s why I go there.

It's developing, you know, it's quite a new site. It's improving all the time. So there's more and more of the publications are there in full, you know, and so, you know, it improves. And it's very well-linked and organised, you know. There are several databases, there's the
bibliography, there's a list of companies and financial information, and it works well [25]

• it was fairly simple, and easy to use. Yes. Simple and well organised [25]

• The bibliographies are straight copies from the sources so that's pretty reliable. The information on the projects I guess gets out of date, as ours did, and the company details, I suppose they rely on the companies to keep that up to date. So, you know, you find something like this and you want to check it out, so you go to the original source. Simple as that. I'd say it's reliable. You'd just find out another way, yes, you'd follow it up. [25]

• The company stuff, it tends to, a lot of it is very American. So there wasn't much detail on British suppliers [25]

• It was very American [25]

• What would an ideal source of information have been like for this example? Have more European stuff on there, for this sort of thing. By putting ourselves on it, I'm hoping it will encourage, and the Aberystwyth project I mentioned are also on it, you know, it will encourage more European institutes to be there. They may as well be in the same place, so it needs us to initiate it, I think. Since it's there. It's quite well-organised, it's well resourced, you can quickly update it. You know, it had been changed the next day once I'd e-mailed them. So it's probably up to this site [the respondent's institution] on the Internet, I think to take the initiative [25]

• it's a society which is an off-shoot of the American Liver Study Society, and it's a part of it where pathologists tend to concentrate. And it's a page that they have where they tell you about when the next conference is, when the next, what dates they are, and they, they circulate cases which you can review on your own in preparation for the discussion which takes place at the conference. And I must say I find it, really it's that sort of experience which puts me off exploring the Web further is the extreme slowness of down-loading pictures. You download a picture and it takes half an hour. Essentially, one doesn't have the time to do that, to get into that sort of thing [27]

• the time, the date of the conference, the timetable, and the data, which as I said, are posted on that page [27]

• they circulate, in histo-pathology, you're looking at tissue sections, you know, a visual sort of discipline, which requires pictures, so they send round the pictures of what the disease looks like to the different people that are planning to talk on that subject [27].

• the speed of it was a pain, or sorry, the lack of it [27]

• This one is molecular haematology in, at Cambridge, which is a bit of text about who works there and what field they're in, and how the research is going. Nothing of any, no real meat at all [28]

• it's a sort of a graduate biosciences thing, and if I remember correctly it's got links to things like journals, and, I just think it's just going to be a good linker really. I don't think it's going to provide any real information itself. But it's certainly, he's obviously, this chap or whoever has done it has built an enormous amount, it looks, it looks pretty good, and also there are lots and lots of useful links so that is something I would go back to [28]
A5: Criteria development and validation interviews

Information seeking questionnaire

The following is the questionnaire which was distributed in order to identify potential respondents for the criteria development and validation interviews.

Use of the Internet for medical information

1. In the past twelve months, have you used the Internet to do any of the following in connection with your work? Please tick where yes.
   [ ] Looked for background information for a research project, to update your own knowledge or for a specific publication or presentation
   [ ] Downloaded computer software using FTP, Gopher or the WWW
   [ ] Posted a query to a Usenet Newsgroup or Discussion Group
   [ ] Looked for funding information
   [ ] Used a bibliographic database to carry out a literature search
   [ ] Searched a gene sequence database/databank
   [ ] Looked for a specific fact about a person or an institution (e.g. an address)
   [ ] Looked for material to supplement your own teaching material (e.g. text-book style material, computer-assisted learning materials, images)
   [ ] Read or consulted an electronic journal

2. Are there other examples where you have used the Internet recently to look for information in connection with your work? Please specify.

3. If you have not used the Internet recently for your work, are there any reasons why? Please specify.

4. Are you willing/able to participate in a short interview session (maximum 20 minutes) to discuss your use/non-use of the Internet in your work? Please tick as appropriate.
   [ ] YES  [ ] NO (please go to question 7)

5. When would you prefer to be interviewed? Please place a '1' next to your first choice, a '2' for your second choice and a '3' for your third choice.
   [Dates]

6. Where would you prefer to be interviewed? Please tick as appropriate.
   [ ] in the library  [ ] in my own office/lab

7. Personal details

Please return this questionnaire to [Librarian's Name] at [Address] by [Date] at the latest. Thank-you.


### A6: Criteria development and validation interviews

#### Sample pilot interview schedule

The following is an example of the schedules used for the pilots of the criteria development and validation interviews. The schedule for text-based information sources has been used for illustrative purposes.

[Introduction]

#### 1. Background

1. **What is your job title/role within this organisation?**

2. **What is your main subject area of interest?**

3. **Do you use any of the following tools? Please specify whether or not you use them, you used to use them but no longer do, or if you don’t know what they are.**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Use</th>
<th>Don’t Use</th>
<th>Don’t Know</th>
<th>Did But No Longer</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>World-Wide Web</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>Usenet News</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>FTP (file transfer)</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
</tbody>
</table>

4. **Do you access these tools daily, weekly, monthly or less than monthly?**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Less Than Monthly</th>
<th>Not Used</th>
</tr>
</thead>
<tbody>
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<td>e-mail</td>
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<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>World-Wide Web</td>
<td>[]</td>
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<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>Usenet News</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
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<td>FTP (file transfer)</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
</tbody>
</table>

5. **Are you subscribed to any online discussion groups?**

<table>
<thead>
<tr>
<th>Subscription</th>
<th>Use</th>
<th>Don’t Know</th>
<th>Was, But Unsubscribed</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>[]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>no</td>
<td>[]</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
6. How long ago did you start using these tools?

<table>
<thead>
<tr>
<th>Tool</th>
<th>&lt; 1 year</th>
<th>1 - 2 years</th>
<th>+ 2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>World-Wide Web</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Usenet News</td>
<td>[ ]</td>
<td>[ ]</td>
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</tr>
<tr>
<td>FTP</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>discussion groups</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

7. From which of the following do you have access available to the Internet?

<table>
<thead>
<tr>
<th>Location</th>
<th>yes</th>
<th>no</th>
<th>don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>home</td>
<td>[ ]</td>
<td></td>
<td>[ ]</td>
</tr>
<tr>
<td>work - desk/office/lab (own computer)</td>
<td>[ ]</td>
<td></td>
<td>[ ]</td>
</tr>
<tr>
<td>work - desk/office/lab (shared PC)</td>
<td>[ ]</td>
<td></td>
<td>[ ]</td>
</tr>
<tr>
<td>library</td>
<td>[ ]</td>
<td></td>
<td>[ ]</td>
</tr>
<tr>
<td>public access computer room</td>
<td>[ ]</td>
<td></td>
<td>[ ]</td>
</tr>
<tr>
<td>other:</td>
<td>[ ]</td>
<td></td>
<td>[ ]</td>
</tr>
</tbody>
</table>

8. From where do you usually access the Internet?

2. Category clarification

As stated in the letter that was sent to you, during this interview, I am particularly interested in your use of the Internet to look for [category].

9. Could you tell me a bit more about your use of the Internet to do this? Perhaps you can think of a particular example?

10. What types of materials (e.g. sites or sources) might you be looking for?

[ ] computer-assisted learning materials
[ ] discussion groups/Usenet Newsgroups
[ ] software via FTP, Gopher or WWW
[ ] electronic journals/journal articles
[ ] genetic databases/databanks
[ ] images
[ ] home pages
[ ] full-text materials
[ ] databases
[ ] bibliographical databases
3. Full-text resources

11. Do you use the Internet to look for information for any of the following reasons? Please indicate whether you feel these factors affect your use always, sometimes, rarely or never.

- to browse for material on a subject or by an author [always] [s. times] [rarely] [never]
- to look for a specific item (e.g. a site someone has recommended) [always] [s. times] [rarely] [never]
- because you have used a particular site before [always] [s. times] [rarely] [never]
- to look for information in an alternative format to printed material [always] [s. times] [rarely] [never]
- because the Internet is available [always] [s. times] [rarely] [never]
- because the Internet is a convenient way of accessing information [always] [s. times] [rarely] [never]
- because the Internet is a fast way of accessing information [always] [s. times] [rarely] [never]
- because the information on the Internet is current [always] [s. times] [rarely] [never]
- because the information is not otherwise available locally [always] [s. times] [rarely] [never]
- because the Internet is a cheap way of getting information [always] [s. times] [rarely] [never]
- the Internet is a ‘new’ and ‘trendy’ way of accessing information [always] [s. times] [rarely] [never]

12. Do you use the Internet to look for information for any other reasons that you can think of? Please indicate whether these factors affect your use always, sometimes or rarely.

13. Do any of the following factors or characteristics affect the information that you access and use? Please indicate whether these factors are important, necessary but not important, unimportant or you have no opinion.

**General**
- your overall impression [always] [s. times] [rarely] [never]
- intended purpose [always] [s. times] [rarely] [never]
- professional appearance [always] [s. times] [rarely] [never]
- factual accuracy of the information [always] [s. times] [rarely] [never]
- no typographical errors [always] [s. times] [rarely] [never]
- whether the information has been refereed [always] [s. times] [rarely] [never]

**Subjects covered**
- particular subjects covered [always] [s. times] [rarely] [never]
- range of subjects covered [always] [s. times] [rarely] [never]
- amount of detail subjects are covered in [always] [s. times] [rarely] [never]
- target audience of the material [always] [s. times] [rarely] [never]
- original work (as opposed to reporting opinions) [always] [s. times] [rarely] [never]
- pointers to further information [always] [s. times] [rarely] [never]
14. Are there any other factors or characteristics you can think of which affect the information that you access and use? Please indicate whether you feel these factors or characteristics are important, necessary but not important or unimportant.
15. Do you have any comments or questions, or is there anything else you would like to add about information available via the Internet, or your use of the Internet generally?

4. Comments on the interview schedule

16. This particular interview is part of a pilot study which is intended to test and evaluate the interview schedule itself.

I would find it helpful if you could offer any comments on the schedule:

- how do you feel about the interview?
- did you understand the questions?
- did you find any of the questions particularly confusing or difficult to answer?
- did you think any of the questions could be worded better?
- did you find the order which the questions were in confusing?
- did you understand the issues I was asking about?
- was the information you received prior to the interview clear and unambiguous?
A7: Criteria development and validation interviews
Sample final interview schedule

The following is an example of the schedules used for the criteria development and validation interviews. The schedule for text-based information sources has been used for illustrative purposes.

[Introduction]

1. Background information

What I would like to do first of all is to get some basic background information about your research interests and use of the Internet generally.

1. What is your job title/role within this organisation?
2. What is your main subject area of interest?
3. Do you use any of the following tools? Please specify whether or not you use them, you used to use them but no longer do, or if you don’t know what they are.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Use</th>
<th>Don’t Use</th>
<th>Don’t Know</th>
<th>No Longer Use</th>
</tr>
</thead>
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</tr>
<tr>
<td>World Wide Web</td>
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<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>Usenet News</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>FTP (file transfer)</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
</tbody>
</table>

4. Do you access these tools daily, weekly, monthly or less than monthly?

<table>
<thead>
<tr>
<th>Tool</th>
<th>Daily</th>
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<td>[]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
<td>[]</td>
</tr>
</tbody>
</table>

5. Are you subscribed to any online discussion groups?

<table>
<thead>
<tr>
<th>Subscription</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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</table>

[334]
6. How long ago did you start using these tools?

<table>
<thead>
<tr>
<th>Tool</th>
<th>&lt; 1 year</th>
<th>1 - 2 years</th>
<th>+ 2 years</th>
<th>never used</th>
</tr>
</thead>
<tbody>
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<td>e-mail</td>
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<td>[ ]</td>
<td>[ ]</td>
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<tr>
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<tr>
<td>Gopher</td>
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<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>discussion groups</td>
<td>[ ]</td>
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</tbody>
</table>

7. From where do you usually access the Internet?

<table>
<thead>
<tr>
<th>Location</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>home</td>
<td>[ ]</td>
</tr>
<tr>
<td>library</td>
<td>[ ]</td>
</tr>
<tr>
<td>work: - desk/office/lab (own computer)</td>
<td>[ ]</td>
</tr>
<tr>
<td>- desk/office/lab (shared PC)</td>
<td>[ ]</td>
</tr>
<tr>
<td>other:</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

2. General use of the Internet and category clarification

8. Could you tell me a bit about your use of the Internet generally? What sort of things do you use the Internet for in your work?

9. As stated in the letter that was sent to you, during this interview, I am particularly interested in your use of the Internet to:

- look for background information for a research project, to update your own knowledge or for a specific publication or presentation
- download computer software using FTP, Gopher or the World-Wide Web
- post a query to a Usenet Newsgroup or Discussion Group
- look for funding information
- use a bibliographic database to carry out a literature search
- look for genetic information
- look for a specific fact about a person or an institution (e.g. an address)
- look for material to supplement your own teaching material (e.g. text-book style material, computer-assisted learning materials, images)
- read or consulted an electronic journal
- to access commercial information (e.g. to consult suppliers' WWW pages about prices or about scientific equipment)
- to access official information (e.g. the Department of Health Press Releases)

10. Could you tell me a bit more about your use of the Internet to do this? Perhaps you can think of a particular example?

11. If not mentioned: what types of materials (e.g. sites or sources) would you use?

- CAL materials
- images
- discussion groups/Usenet
- home pages
- sites of software
- databases
- electronic journals
- electronic journal articles
- bibliographical databases
- genetic sites and services
- full-text information
12. Why might you use the Internet to do this, rather than going anywhere else?

3. Text based information

I would now like to take a specific example of a source of information and talk about it in more detail.

13. Is there a specific source of information which you accessed? Perhaps you could pick one to talk about in more detail?

14. Why did you (initially) access and use that specific source of information? Did you already know about the source? Were there any characteristics of the source which affected your decision to access and use it?

15. Is the source original or unique in anyway? In terms of its content? In terms of its features and facilities?

16. Is the source appropriate to you in terms of the subject area covered? In terms of the intended audience of the information? In terms of the level of detail of the information?

17. Do you feel the source covers the subject area comprehensively? Are all aspects of the area covered that you would expect to be covered? Are there any pointers to further information (hypertext links, references)?

18. Would you describe this as a reputable and authoritative source of information?

19. Would you describe the authors/research group/institution as reputable and authoritative?

20. Is any information available to contact the author of the information? Is there an e-mail facility to contact the page author?

21. Is the information in the source up-to-date? Is there any indication that the information has been up-dated? Is there any indication that the information will be up-dated (again)?

22. Is the information in the source accurate? Is the information biased in any way? Is the information based on research findings? Is there any evidence of quality control of the information (editing, refereeing)?

23. Is the source well-organised? Is the information clearly laid out on the screen? Are there any facilities to search the information?

24. Is the source easy to use? Is any help information available?

25. Is the information well-written?

26. Are there any graphics? Are they clear and easy to decipher? Are they used unnecessarily? Are thumbnail images used?
27. Are there any adverts?

28. Does it take a long time for the information to transfer to your screen?

29. Have you attempted to download the information to another file, or to print it out? Was this easy to do?

30. Are there any restrictions to accessing the information? Did you have to pay? Did you have to register? Are there any particular hardware or software requirements?

31. Was the source easy to find?

32. Is the site stable? Has the site been unavailable when you have tried to access it? Is there a mirror site?

33. Is there any indication that the site is ‘under construction’?

34. Would you describe this as a source of quality information?

35. How might you improve the quality of the source?

36. Did you have any other questions or anything else you would like to add, either about your use of the Internet generally, or about your use of information?
A8: Criteria development and validation interviews
Sample interview transcript

The following is a sample transcript from the criteria development and validation interviews. The transcript is taken from the last interview for illustrative purposes.

1. Background information

1. What is your job title/role within this organisation?

Clinical Lecturer and Honorary Senior Registrar in Medical Genetics

2. What is your main subject area of interest?

Medical genetics.

3. Do you use any of the following tools? Please specify whether or not you use them, you used to use them but no longer do, or if you don’t know what they are.

<table>
<thead>
<tr>
<th>Tool</th>
<th>Use</th>
<th>Don't Use</th>
<th>Don't Know</th>
<th>No Longer Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>World Wide Web</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Usenet News</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>FTP</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

4. Do you access these tools daily, weekly, monthly or less than monthly?

<table>
<thead>
<tr>
<th>Tool</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Less than monthly</th>
<th>Not used</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>World Wide Web</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Usenet News</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
</tr>
<tr>
<td>FTP</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
</tr>
</tbody>
</table>

5. Are you subscribed to any online discussion groups?

<table>
<thead>
<tr>
<th>Subscription Status</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>[ ]</td>
<td>don't know what they are</td>
</tr>
<tr>
<td>no</td>
<td>[x]</td>
<td>was, but unsubscribed</td>
</tr>
</tbody>
</table>
6. **How long ago did you start using these tools?**

<table>
<thead>
<tr>
<th>Tool</th>
<th>&lt; 1 year</th>
<th>1 - 2 years</th>
<th>+ 2 years</th>
<th>never used</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-mail</td>
<td>[ ]</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>World-Wide Web</td>
<td>[x]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
</tr>
<tr>
<td>Usenet News</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
</tr>
<tr>
<td>FTP</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
</tr>
<tr>
<td>Gopher</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
</tr>
<tr>
<td>discussion groups</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[ ]</td>
<td>[x]</td>
</tr>
</tbody>
</table>

7. **From where do you usually access the Internet?**

- home                  [ ]
- library               [ ]
- computer room         [ ]
- work
  - desk/office/lab (own computer) [ ]
  - desk/office/lab (shared PC) [x]

The respondent accesses his e-mail from one terminal, and the WWW from another. These are shared computers available in the Department. In addition, he can access the Internet from his parent's house when he visits them.

2. **General use of the Internet and category clarification**

8. **Could you tell me a bit about your use of the Internet generally? What sort of things do you use the Internet for in your work?**

In relation to his day-to-day work, the respondent uses the WWW to access various genetic databases such as OMIM (On-line Mendelian Inheritance in Man), which is a database of genetic conditions. He uses this database in order to look at background information regarding his patients' conditions. In addition, the respondent uses Medline for conducting literature searches in relation to his work. Other sources he uses includes HGMP (Human Genome Mapping Project) and BIDS. For his research, the respondent uses the EST (Express Sequence Tag) databases, which contain approximately half a million entries for genetic sequences. In addition, he uses the GDB (Genome Database), FlyBase and MouseBase, which are again genetic databases. The respondent only uses the WWW when he has something specific which he wants to look for, and therefore how often he accesses it depends on whether he needs some specific information.

9. **As stated in the letter that was sent to you, during this interview, I am particularly interested in your use of the Internet to:**

- [x] look for background information for a research project, to update your own knowledge or for a specific publication or presentation
- [ ] download computer software using FTP, or a Gopher or World-Wide Web browser
- [ ] post a query to a Usenet Newsgroup or Discussion Group
- [ ] look for funding information
- [ ] access a bibliographic database to carry out a literature search
- [ ] look for genetic information
10. Could you tell me a bit more about your use of the Internet to do this? Perhaps you can think of a particular example?

The respondent specialises in hereditary diseases. Approximately once a month he will conduct a Medline search in order to look for references on the subject. He might also search OMIM in order to get some background information, as well as the EST databases. He is interested in establishing the genetic regions involved in the disease and will conduct a GDB search in order to identify the critical regions. He might also use FlyBase and MouseBase for homology searches.

11. What types of materials (e.g. sites or sources) would you use?

- CAL materials
- images
- discussion groups/Usenet
- home pages
- sites of software
- databases
- electronic journals
- electronic journal articles
- bibliographical databases
- genetic sites and services
- full-text information

12. Why might you use the Internet to do this, rather than going anywhere else?

The respondent uses the Internet to access various genetic sites and services because the data is not available elsewhere. A two volume catalogue of the Mendelian Inheritance in Man is available in print but the Internet version (OMIM) is more up to date. The same people provide both sources, but the printed version can be two to three years more out of date than the online version. The respondent did use MIM before OMIM was available. MIM is also available on CD-ROM but again, the Internet is more up to date. In addition, the Internet version is searchable using keywords.

3(j). Genetic sites and services

13. Is there a specific genetic site/service which you accessed? Perhaps you could pick one to talk about in more detail?

OMIM
14. Why did you access and use that genetic site/service? Did you already know about the genetic site/service? Were there any characteristics of the genetic site/service which affected your decision to access and use it?

The respondent found out about OMIM through colleagues in his Department ('word of mouth').

15. Is the genetic site/service original or unique in anyway? In terms of its content? In terms of its features or facilities?

The site is unique in terms of its coverage, particularly in terms of the currency of the information. The respondent felt that it is also unique in terms of its being easy to find information, but felt that the keyword search facilities were commonly available on other sites. He felt that in his experience, all the sites he had used were user-friendly.

16. Is the genetic site/service appropriate to you in terms of the material it covers?

The respondent felt that the site was appropriate for his general, day to day clinical use, more so than other sources. He felt OMIM was 'adequate' for his needs. However, he did not feel OMIM might be appropriate for the research needs of others.

17. Is the genetic site/service comprehensive in its coverage? Are all aspects of the area covered that you would expect to be covered? Are there any pointers to further information (hypertext links, references)?

The respondent described OMIM as 'extremely comprehensive'; if information was not available via OMIM, he would assume it did not exist or had not been described elsewhere.

18. Is the information provided by the site/service sufficient for your needs? In terms of the level of detail?

'Yes.

19. Would you describe this as a reputable and authoritative genetic site/service?

Yes.

20. Would you describe the institution responsible for the genetic site/service as reputable and authoritative?

The respondent would describe the institution, the authors and the editor of the site as authoritative and reputable. He commented that the editor of the site is a highly reputable geneticist. Until recently, a single author was responsible for all of the information in OMIM but now there is an editorial team. The respondent was unsure how much input each individual had but felt the original author still very much had his 'finger in there'.
21. Is any information available to contact the genetic site/service maintainer? Is there an e-mail facility to contact the genetic site/service maintainer?

The respondent thought it may be possible to e-mail comments to authors but he had not attempted to use the feature.

22. Is the genetic site/service kept up to date? Is there any indication of how often or how regularly the genetic site/service is up-dated?

The respondent felt the site was kept up to date. The last update date is displayed which the respondent felt was a useful feature.

23. Is the data provided on the genetic site/service accurate? Is there any evidence of quality control of the data? Are contact details of researchers who submitted the data available? Are links to published references available?

The respondent felt the data provided was accurate, but was unsure whether there was any evidence of quality control of the data. Information regarding which author has written each section is available. There are also links to published references where material was originally published in journals. The respondent felt providing references was very useful as he used OMIM as a starting place and to get background information on an area. He can then follow the references for further information. He felt OMIM provided 'a good overview' of an area and was a 'good starting place' for accessing 'core information'.

24. Is the genetic site/service well-organised? Are the search facilities that are available adequate for your needs? Are the facilities for displaying data adequate for your needs? Is the information clearly laid out on the screen?

The respondent feels that the site is well-organised because it is sub-divided into topics. The sub-divisions are 'appropriate' and 'useful'.

25. Is the genetic site/service easy to use? Is it easy to find the data you are looking for? Is it easy to display your search results? Is any help information available?

The respondent feels the site is easy to use. It is easy to find the data he is looking for and to display search results. Help information is available but the respondent has not used it as he has not needed to. He described the site as 'idiot proof'.

26. Have you attempted to download any information from the genetic site/service to another file, or to print it out? Is this easy to do?

The respondent had not attempted to download or print material as it is very complicated due to the local systems in place. He commented that the local systems are to be replaced in the future and therefore downloading will be easier. Results can be e-mailed from the site but it is difficult to print the e-mails out due to local problems.

27. Does it take a long time to search and display data in the genetic site/service?
The respondent felt the site was very fast.

28. **Are there any restrictions to accessing the genetic site/service? Do you have to pay? Do you have to register? Are there any particular hardware or software requirements?**

The respondent did not think there were any restrictions to accessing the site. He accesses the site via the HGMP site. In addition, he has accessed the site from home and had no problems so thinks there are no restrictions.

29. **Is the genetic site/service easy to find?**

The site is easy to find because there is a link from the HGMP main menu.

30. **Is the genetic site/service stable? Is the genetic site/service ever been unavailable when you have tried to access it? Is there a mirror site?**

The respondent feels the site is stable and it has never been unavailable when he has tried to access it. A mirror site is currently under development but the respondent has never found accessing the site a problem.

31. **Is there any indication that the genetic site/service is ‘under construction’?**

There is no indication that the site is under construction.

32. **Would you describe this as a quality genetic site/service?**

The respondent would describe the site as a quality site for all the reasons already discussed.

33. **How might you improve the quality of the genetic site/service?**

The respondent had no suggestions for improvements and described the site as ‘excellent’.

34. **Did you have any other questions or anything else you would like to add, either about your use of the Internet generally, or about your use of genetic site/services?**

The sources the respondent had been discussing were not available anywhere else other than via the Internet. He has become increasingly reliant on such sources in his work. The resources have increased the efficiency of his work immeasurably. For example, when he was a BSc student, he would go to the library to conduct an Index Medicus search which would take two days. He can now do the same search using Medline and it takes about thirty minutes. Likewise, he never uses MIM, the text version of OMIM, for the same reasons.
The following is the questionnaire which was sent to reviewers participating in the assessment of the first draft of the Evaluation Criteria Document.

**Comments on the Evaluation Criteria Document**

Now is your chance to say your bit. Please comment freely on the different areas below as your comments are intended to improve the evaluation criteria and the various guidelines for their use. Please continue your comments on a separate sheet if necessary.

1. **The value of the Document**  
   Do you think the Document will be helpful, useful and/or valuable when attempting to evaluate a source of information retrieved via the Internet? Please give any reasons for your answer.

2. **The criteria covered**  
   Are there any criteria *not* covered which you think should be covered?  
   Are there any criteria which *are* covered that you think should not be covered?

3. **The resources covered**  
   Are there any resources *not* covered which you think should be covered?  
   Are there any resources which *are* covered that you think should not be covered?

4. **The language and style of writing**  
   Do you think the style of writing used in the Document is too formal, too informal or about right?  
   Do you feel the language is understandable and meaningful?  
   Are there any terms or phrases which you feel are ambiguous or unclear?

5. **The amount of information**  
   Is the volume of information contained in the Document too much, too little or about right?  
   Are the explanatory notes useful? Do they add value to the criteria?  
   Are the quotes lifted from the interviews useful? Do they add value to the criteria?

6. **Layout and organisation**  
   Do you feel the Document is clearly laid out?  
   Do you feel the Document would be easy to use when attempting to evaluate a source of information? For example, is it easy to find your way round the Document?

7. **Any other comments/criticisms/praises?**  
   Is there anything else you would like to add? Please comment freely.

Thanks for taking the time to complete this form. Please return it by [Date] to: [Researcher's name and address].
The following are the comments returned from one of the reviewers, provided for illustrative purposes.

Do you think the Document will be helpful, useful and/or valuable when attempting to evaluate a source of information retrieved via the Internet? Please give any reasons for your answer.

The Document would definitely prove valuable. It's comprehensive but concise. It seems suitable for any level of user and coupled with a basic knowledge of the Internet, is all you'd need to get started and find some really useful information. I think you encourage the right attitude - to experiment a little to find out more about sites, e.g. looking up known information on a database - and you've avoided sounding prescriptive. As the Internet is so messy, this Document which helps users to sort out the good from the bad, would be useful and is definitely needed.

One question though, is this aimed at the end user or information professional, or all Internet users?

Are there any criteria not covered which you think should be covered? Are there any criteria which are covered that you think should not be covered?

Text-based information: Authority

Is it worth asking if the site is official, for organisational pages? I know of one consultant who has set up web pages for his hospital using his home account - I don't know if he's had approval or not and if not, can it be taken seriously?

Text-based information: Currency

Another question might be to ask if the links (if any) are still functioning?

Text-based information: Presentation

Is there a site map or index? Is there a text-based version available (e.g. postgrad librarians in Wales access using Lynx so not able to see graphics).

Electronic Journals

Does this cover freebies such as BMJ or Lancet - if so, is it worth mentioning how they select which articles will be available over the web?

Are there any resources not covered which you think should be covered? Are there any resources which are covered that you think should not be covered?

I can't think of anything you haven't already covered.
Do you think the style of writing used in the Document is too formal, too informal or about right? Do you feel the language is understandable and meaningful? Are there any terms or phrases which you feel are ambiguous or unclear?

The style of writing is good - written in plain English which makes it easy to read. I don’t think the terminology is a problem as anyone reading/using this Document is going to know what is meant by ftp, home pages, etc. I don’t think a glossary would add anything except extra pages! I like the tone - it’s informative but not patronising and straightforward but not superficial.

Is the volume of information contained in the Document too much, too little or about right? Are the explanatory notes useful? Do they add value to the criteria? Are the quotes lifted from the interviews useful? Do they add value to the criteria?

I have to admit it did look formidable when I first saw it but with the layout and style of writing, it’s not hard work at all. It’s useful having a quick reference checklist and a more detailed guide so the Document can be used as a quick reference tool for confirmation or as a guide for a detailed evaluation, depending on the circumstances. I think the explanatory notes are needed as it helps the reader to form an opinion on the value of a resource.

Effectively, you are saving the reader’s time by putting all they really need to know in one document.

The quotes are good but sometimes a little vague - could you maybe include the occupation of the person or would that give away their identity?

Do you feel the Document is clearly laid out? Do you feel the Document would be easy to use when attempting to evaluate a source of information? For example, is it easy to find your way round the Document?

A very well laid out document - it’s a good idea to split into sections according to the type of resource. I’ve seen other checklists aiming to do what you have achieved but they simply list criteria intended for all types of resource and that just doesn’t work. Nice use of space - there’s nothing worse (to me!) than pages of text. It’s easy to use - the detailed and quick “reminder” sections and the cross-references are useful. It’s well-organised which encourages an organised approach to evaluation.

Is there anything else you would like to add? Please comment freely.

I think the Document will be valued in the medical/health information community. There’s certainly a need for an authoritative guide, like this, to evaluating information on the Internet. You’ve managed to put an awful lot of work and research into an easy-to-use, portable, concise and comprehensive guide. Is it going to be published???
Appendix B

Results tables
## Appendix B1: Filtering questionnaire

### Table 1: Responses to questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Queen’s Medical Centre</th>
<th>National Institute for Medical Research</th>
<th>Royal Free Hospital School of Medicine</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires distributed</td>
<td>450</td>
<td>200</td>
<td>630</td>
<td>1280</td>
</tr>
<tr>
<td>Questionnaires returned (and percentage of total distributed)</td>
<td>39 (8.7%)</td>
<td>7 (3.5%)</td>
<td>53 (8.4%)</td>
<td>99 (8%)</td>
</tr>
<tr>
<td>Total agreeing to an interview (and percentage of total distributed)</td>
<td>23 (5.1%)</td>
<td>6 (3%)</td>
<td>15 (2.4%)</td>
<td>44 (3%)</td>
</tr>
<tr>
<td>Questionnaire respondents interviewed</td>
<td>10</td>
<td>5</td>
<td>6</td>
<td>21</td>
</tr>
<tr>
<td>Respondents individually approached</td>
<td>0</td>
<td>5</td>
<td>4</td>
<td>9</td>
</tr>
</tbody>
</table>

### Table 2: Levels of use of the Internet

<table>
<thead>
<tr>
<th></th>
<th>Daily (and percentage of total returned)</th>
<th>Weekly (and percentage returned)</th>
<th>Monthly (and percentage returned)</th>
<th>Less than monthly (and percentage returned)</th>
<th>Not used (and percentage returned)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>74.5 (75%)</td>
<td>11.5 (12%)</td>
<td>2 (2%)</td>
<td>3 (3%)</td>
<td>8 (8%)</td>
</tr>
<tr>
<td>Usenet</td>
<td>7 (7%)</td>
<td>8 (8%)</td>
<td>1 (1%)</td>
<td>2 (2%)</td>
<td>82 (82%)</td>
</tr>
<tr>
<td>FTP</td>
<td>4 (4%)</td>
<td>18.5 (19%)</td>
<td>11.5 (12%)</td>
<td>9 (9%)</td>
<td>56 (56%)</td>
</tr>
<tr>
<td>Gopher</td>
<td>1 (1%)</td>
<td>3 (3%)</td>
<td>7 (7%)</td>
<td>3 (3%)</td>
<td>86 (86%)</td>
</tr>
<tr>
<td>WWW</td>
<td>22 (22%)</td>
<td>33 (33%)</td>
<td>16 (16%)</td>
<td>7 (7%)</td>
<td>21 (21%)</td>
</tr>
</tbody>
</table>
Table 3: Interviewee details

<table>
<thead>
<tr>
<th>Int.</th>
<th>Job title</th>
<th>Subject area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Post-Doctoral Research Fellow</td>
<td>Elderly &amp; degenerative diseases</td>
</tr>
<tr>
<td>2</td>
<td>Post-Doctoral Research Fellow</td>
<td>Psychiatric disease</td>
</tr>
<tr>
<td>3</td>
<td>Reader</td>
<td>Nuclear medicine</td>
</tr>
<tr>
<td>4</td>
<td>Lecturer</td>
<td>Nursing and midwifery</td>
</tr>
<tr>
<td>5</td>
<td>Reader &amp; Honorary Consultant Physician</td>
<td>Heart disease/cardiology</td>
</tr>
<tr>
<td>6</td>
<td>Lecturer</td>
<td>Molecular biology</td>
</tr>
<tr>
<td>7</td>
<td>Lecturer</td>
<td>Nursing and midwifery</td>
</tr>
<tr>
<td>8</td>
<td>Lecturer</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>9</td>
<td>Post-Doctoral Research Assistant</td>
<td>Skin toxicology</td>
</tr>
<tr>
<td>10</td>
<td>Senior Lecturer</td>
<td>Anatomy</td>
</tr>
<tr>
<td>11</td>
<td>Scientist/Group Leader</td>
<td>Genetic sequencing</td>
</tr>
<tr>
<td>12</td>
<td>Staff scientist</td>
<td>Molecular biology</td>
</tr>
<tr>
<td>13</td>
<td>Head of Division/Institute Vet.</td>
<td>Laboratory animal science</td>
</tr>
<tr>
<td>14</td>
<td>PhD Research Student</td>
<td>Embryo development in frogs (molecular)</td>
</tr>
<tr>
<td>15</td>
<td>Scientist</td>
<td>Molecular biology</td>
</tr>
<tr>
<td>16</td>
<td>PhD Research Student</td>
<td>Immunology &amp; molecular biology</td>
</tr>
<tr>
<td>17</td>
<td>Visiting Scientist/Post-Doctoral Researcher</td>
<td>Genetics of embryo development</td>
</tr>
<tr>
<td>18</td>
<td>Scientist/Head of research group</td>
<td>Micro-processes of cell adhesion</td>
</tr>
<tr>
<td>19</td>
<td>Scientist</td>
<td>Mycobacterial research</td>
</tr>
<tr>
<td>20</td>
<td>Staff Scientist</td>
<td>Molecular genetic techniques</td>
</tr>
<tr>
<td>21</td>
<td>Head of Department</td>
<td>Travel medicine and vaccines</td>
</tr>
<tr>
<td>22</td>
<td>PhD Research Student</td>
<td>Protein production, structure &amp; analysis</td>
</tr>
<tr>
<td>23</td>
<td>Research Psychologist</td>
<td>Ante-natal HIV policies &amp; testing</td>
</tr>
<tr>
<td>24</td>
<td>Statistician/Lecturer</td>
<td>HIV &amp; Haemophilia patients</td>
</tr>
<tr>
<td>25</td>
<td>Honorary Lecturer</td>
<td>Teleconferencing in Primary care</td>
</tr>
<tr>
<td>26</td>
<td>Honorary Consultant Paediatrician &amp; Legal advisor</td>
<td>Paediatrics; medical negligence</td>
</tr>
<tr>
<td>27</td>
<td>Consultant Histopathologist</td>
<td>Histopathology</td>
</tr>
<tr>
<td>28</td>
<td>Data manager</td>
<td>Computer support/data management</td>
</tr>
<tr>
<td>29</td>
<td>Reader</td>
<td>Molecular Biology (Viral Hepatitis)</td>
</tr>
<tr>
<td>30</td>
<td>Undergraduate Student</td>
<td>Bachelor of Medicine</td>
</tr>
</tbody>
</table>
Table 4: Tools used and levels of use of the Internet

<table>
<thead>
<tr>
<th></th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Less than monthly</th>
<th>Not used</th>
<th>Used but level not specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>28 (93%)</td>
<td>1 (3%)</td>
<td>0</td>
<td>1 (3%)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Usenet</td>
<td>3 (10%)</td>
<td>4 (13%)</td>
<td>0</td>
<td>0</td>
<td>20 (67%)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>FTP</td>
<td>2 (7%)</td>
<td>6 (20%)</td>
<td>3 (10%)</td>
<td>2 (7%)</td>
<td>14 (35%)</td>
<td>3 (10%)</td>
</tr>
<tr>
<td>Gopher</td>
<td>1 (3%)</td>
<td>1 (3%)</td>
<td>1 (3%)</td>
<td>2 (7%)</td>
<td>23 (77%)</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>WWW</td>
<td>9 (30%)</td>
<td>12 (40%)</td>
<td>4 (13%)</td>
<td>4 (13%)</td>
<td>0</td>
<td>1 (3%)</td>
</tr>
</tbody>
</table>

Table 5: Use of discussion groups

<table>
<thead>
<tr>
<th>Use of discussion groups</th>
<th>Total (percentage of total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently subscribed</td>
<td>13 (43%)</td>
</tr>
<tr>
<td>Not currently subscribed</td>
<td>14 (47%)</td>
</tr>
<tr>
<td>Do not know what they are</td>
<td>0</td>
</tr>
<tr>
<td>Had been subscribed</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>Not specified</td>
<td>1 (3%)</td>
</tr>
</tbody>
</table>

Table 6: Length of use of the Internet and e-mail

<table>
<thead>
<tr>
<th></th>
<th>&lt;1 year</th>
<th>1-2 years incl.</th>
<th>+2 years</th>
<th>Not specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>3 (10%)</td>
<td>14 (47%)</td>
<td>12 (40%)</td>
<td>1 (3%)</td>
</tr>
<tr>
<td>Internet</td>
<td>7 (23%)</td>
<td>14 (47%)</td>
<td>8 (27%)</td>
<td>1 (3%)</td>
</tr>
</tbody>
</table>

Table 7: Place of access to the Internet

<table>
<thead>
<tr>
<th></th>
<th>Yes</th>
<th>No</th>
<th>Not specified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work</td>
<td>27 (90%)</td>
<td>1 (3%)</td>
<td>2 (7%)</td>
</tr>
<tr>
<td>Home</td>
<td>5 (17%)</td>
<td>12 (40%)</td>
<td>13 (43%)</td>
</tr>
</tbody>
</table>
### Table 8: Information seeking situations

<table>
<thead>
<tr>
<th>Information seeking situation</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access electronic journals (e.g. to keep up-to-date, follow up a citation)</td>
<td>2, 3, 6, 22</td>
</tr>
<tr>
<td>Access molecular biology resources (for on-going research)</td>
<td>6, 14, 15, 17, 18, 19, 20, 29</td>
</tr>
<tr>
<td>Background information (for research or presentation)</td>
<td>3, 5, 6, 8, 10, 12, 13, 21, 23, 24, 29, 30</td>
</tr>
<tr>
<td>Commercial information (e.g. cell line availability)</td>
<td>2, 9, 11, 13, 16, 25</td>
</tr>
<tr>
<td>Conference information</td>
<td>5, 27</td>
</tr>
<tr>
<td>Contact information</td>
<td>8, 9, 14</td>
</tr>
<tr>
<td>Creating WWW pages (looking for comparative information)</td>
<td>21, 28</td>
</tr>
<tr>
<td>Downloading software (e.g. software upgrade)</td>
<td>2, 6, 28</td>
</tr>
<tr>
<td>Funding information</td>
<td>4</td>
</tr>
<tr>
<td>Images for publication or presentation</td>
<td>22</td>
</tr>
<tr>
<td>Medico-legal information (e.g. to find the opinions of others)</td>
<td>26</td>
</tr>
<tr>
<td>Official information</td>
<td>9</td>
</tr>
<tr>
<td>Organisational information</td>
<td>23</td>
</tr>
<tr>
<td>Search a bibliographical database (e.g. subject or author search, reference check)</td>
<td>2, 5, 11, 21, 23</td>
</tr>
<tr>
<td>Teaching materials (e.g. background information, references)</td>
<td>1, 7, 8</td>
</tr>
<tr>
<td>Teaching materials (e.g. CAL materials, images)</td>
<td>4, 6, 30</td>
</tr>
<tr>
<td>Technical information</td>
<td>2, 9, 25</td>
</tr>
<tr>
<td>Travel information (e.g. accommodation, places to visit)</td>
<td>3, 5</td>
</tr>
<tr>
<td>Update knowledge or to keep up-to-date</td>
<td>5, 13, 25</td>
</tr>
<tr>
<td>Int.</td>
<td>Source type</td>
</tr>
<tr>
<td>------</td>
<td>------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Bibliographical database</td>
</tr>
<tr>
<td></td>
<td>Molecular biology resource</td>
</tr>
<tr>
<td></td>
<td>Molecular biology resource</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Electronic journal</td>
</tr>
<tr>
<td></td>
<td>Organisational site</td>
</tr>
<tr>
<td></td>
<td>FTP archive</td>
</tr>
<tr>
<td>3</td>
<td>Personal home page</td>
</tr>
<tr>
<td></td>
<td>Organisational site</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Organisational site</td>
</tr>
<tr>
<td></td>
<td>Image based information source</td>
</tr>
<tr>
<td>5</td>
<td>Organisational site</td>
</tr>
<tr>
<td></td>
<td>Subject-based site</td>
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<tr>
<td></td>
<td>Bibliographical database</td>
</tr>
<tr>
<td>6</td>
<td>Molecular biology resource</td>
</tr>
<tr>
<td></td>
<td>CAL materials</td>
</tr>
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</tr>
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<td></td>
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</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Subject-based site</td>
</tr>
<tr>
<td></td>
<td>Subject-based site</td>
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<tr>
<td>8</td>
<td>Bibliographical database</td>
</tr>
<tr>
<td></td>
<td>UseNet/Discussion group</td>
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<tr>
<td></td>
<td>Molecular biology resource</td>
</tr>
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</tr>
<tr>
<td>9</td>
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<td></td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<tr>
<td></td>
<td>Organisational site</td>
</tr>
<tr>
<td>---</td>
<td>-------------------</td>
</tr>
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<td>10</td>
<td>Not specified</td>
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<tr>
<td>11</td>
<td>Catalogue</td>
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<td>12</td>
<td>Molecular biology resource</td>
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<td>13</td>
<td>Usenet/Discussion Group</td>
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<tr>
<td>14</td>
<td>Molecular biology resource</td>
</tr>
<tr>
<td>15</td>
<td>Molecular biology resource</td>
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<td>16</td>
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<td>20</td>
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<td>21</td>
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<td>22</td>
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<td>24</td>
<td>Organisational site Organisational site Organisational site</td>
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<td>26</td>
<td>Usenet/Discussion group Usenet/Discussion group Usenet/Discussion group</td>
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<td>27</td>
<td>Subject-based site Usenet/Discussion group</td>
</tr>
<tr>
<td>28</td>
<td>Personal home page Molecular biology resource Molecular biology resource</td>
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<tr>
<td>29</td>
<td>Usenet/Discussion group Molecular biology resource Organisational site</td>
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<tr>
<td>30</td>
<td>CAL materials CAL materials CAL materials</td>
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<tr>
<td>Criteria heading</td>
<td>Evaluation details</td>
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<tr>
<td>------------------------</td>
<td>---------------------------------------------------------</td>
</tr>
<tr>
<td>Accessibility</td>
<td>Reliability of access</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
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<tr>
<td></td>
<td>Speed of returning search results</td>
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<td>Accuracy</td>
<td>Accuracy of reference details</td>
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<tr>
<td>Authority</td>
<td>Reputation of source</td>
</tr>
<tr>
<td>Comparison</td>
<td>Interface</td>
</tr>
<tr>
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<td>Ease of use</td>
</tr>
<tr>
<td></td>
<td>Frequency of updating</td>
</tr>
<tr>
<td></td>
<td>Coverage</td>
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<td>Coverage</td>
<td>Subjects covered</td>
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<tr>
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<td>Journals covered</td>
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<td>Ability to determine journals covered</td>
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<td>Range of journals covered</td>
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<td>Comprehensiveness of coverage</td>
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<td>Retrospective coverage</td>
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<td>Availability of abstracts</td>
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<td>Number of records with abstracts</td>
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<td>Level of detail in abstracts</td>
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<td>Value/usefulness of information in each record</td>
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<td>Currency</td>
<td>General currency</td>
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<tr>
<td></td>
<td>Frequency of updating</td>
</tr>
<tr>
<td></td>
<td>Time delay between publication and appearance in database</td>
</tr>
<tr>
<td>Ease of use</td>
<td>General ease of use</td>
</tr>
<tr>
<td></td>
<td>Help information</td>
</tr>
<tr>
<td></td>
<td>Ease of navigation</td>
</tr>
<tr>
<td></td>
<td>Ease of searching</td>
</tr>
<tr>
<td></td>
<td>Intuitiveness</td>
</tr>
<tr>
<td></td>
<td>User-friendliness</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of database</td>
</tr>
<tr>
<td>Presentation, layout</td>
<td>Data transportability</td>
</tr>
<tr>
<td>and arrangement</td>
<td></td>
</tr>
<tr>
<td>Search and output</td>
<td>Author search</td>
</tr>
<tr>
<td>facilities</td>
<td>Keyword search</td>
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<tr>
<td></td>
<td>Title search</td>
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<tr>
<td></td>
<td>Limit by publication type</td>
</tr>
<tr>
<td></td>
<td>Limit by date range</td>
</tr>
<tr>
<td></td>
<td>Output facilities (e-mail)</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of indexing</td>
</tr>
<tr>
<td></td>
<td>Browsing facilities</td>
</tr>
</tbody>
</table>
Table 11: Evaluation criteria: CAL materials

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee no.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessibility</strong></td>
<td>Mode of access available</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Subscription required</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Registration required</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Cost</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
<td>6, 30</td>
</tr>
<tr>
<td></td>
<td>Use of thumbnail images to improve access speeds</td>
<td>6</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>General accuracy</td>
<td>6</td>
</tr>
<tr>
<td><strong>Authority</strong></td>
<td>Reputation of institution</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Reliability of originating source of information</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Reviews available</td>
<td>6</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td>Value/usefulness of source</td>
<td>6, 30</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>General coverage</td>
<td>6, 30</td>
</tr>
<tr>
<td></td>
<td>Resources covered (e.g. full-text journals, case notes)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Facilities available (e.g. self-test materials, tutorials)</td>
<td>6, 30</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>6, 30</td>
</tr>
<tr>
<td></td>
<td>Pointers to further information</td>
<td>6, 30</td>
</tr>
<tr>
<td><strong>Currency</strong></td>
<td>General currency</td>
<td>5, 30</td>
</tr>
<tr>
<td></td>
<td>Coverage of recent materials</td>
<td>30</td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td>General ease of use</td>
<td>6, 30</td>
</tr>
<tr>
<td></td>
<td>Ease of navigation</td>
<td>30</td>
</tr>
<tr>
<td><strong>Images</strong></td>
<td>Availability of images</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Necessity of images</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Textual information available</td>
<td>6</td>
</tr>
<tr>
<td><strong>Overall impression</strong></td>
<td>Value/usefulness of source</td>
<td>6, 30</td>
</tr>
<tr>
<td><strong>Presentation, layout and arrangement</strong></td>
<td>Layout and arrangement generally (e.g. ‘good overall design’)</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Appropriate use of technology</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Interactive format</td>
<td>6, 30</td>
</tr>
<tr>
<td></td>
<td>Format enhances learning experience</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Logical organisation</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Professional appearance</td>
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</tr>
<tr>
<td></td>
<td>Aesthetically pleasing</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Volume of text per screen</td>
<td>6</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Intended purpose</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Intended audience</td>
<td>6, 30</td>
</tr>
</tbody>
</table>
Table 12: Evaluation criteria: Current Awareness Services

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Cost</td>
<td>30</td>
</tr>
<tr>
<td>Coverage</td>
<td>Subject area covered</td>
<td>3, 28, 30</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>28, 30</td>
</tr>
<tr>
<td>Comparison</td>
<td>Coverage</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>30</td>
</tr>
<tr>
<td>Currency</td>
<td>General currency</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Frequency of mailings</td>
<td>3</td>
</tr>
<tr>
<td>Purpose of service</td>
<td>General purpose</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Intended audience</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 13: Evaluation criteria: Catalogues

<table>
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<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
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<td>Accuracy</td>
<td>General accuracy</td>
<td>11</td>
</tr>
<tr>
<td>Authority</td>
<td>Institution responsible</td>
<td>11, 16</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Comprehensiveness of coverage</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Originating country</td>
<td>11</td>
</tr>
<tr>
<td>Ease of use</td>
<td>General ease of use</td>
<td>11, 16</td>
</tr>
<tr>
<td></td>
<td>Help information</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Meaningful error messages</td>
<td>11</td>
</tr>
<tr>
<td>Facilities</td>
<td>Facility to order material</td>
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</tr>
<tr>
<td></td>
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<tr>
<td>Presentation, layout</td>
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<td>16</td>
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<tr>
<td>and arrangement</td>
<td>Navigation features</td>
<td>16</td>
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<td>Overall impression</td>
<td>Value/usefulness</td>
<td>16</td>
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<td></td>
<td>Unique source</td>
<td>16</td>
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<tr>
<td>Purpose</td>
<td>General purpose</td>
<td>11, 16</td>
</tr>
<tr>
<td>Search facilities</td>
<td>Availability of search facilities</td>
<td>11, 16</td>
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Table 14: Evaluation criteria: Databases

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### Table 15: Evaluation criteria: Electronic journals

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<td>3, 22</td>
</tr>
<tr>
<td></td>
<td>Additional software required</td>
<td>20</td>
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<tr>
<td></td>
<td>Link available to additional software</td>
<td>20</td>
</tr>
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<td>Accuracy</td>
<td>Refereed</td>
<td>2, 20</td>
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<td>Authority</td>
<td>Genealogy of journal (print equivalent)</td>
<td>2, 6</td>
</tr>
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<td></td>
<td>Length of establishment</td>
<td>6</td>
</tr>
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<td></td>
<td>Reputation of editorial board</td>
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<td>Coverage</td>
<td>Current issue only available</td>
<td>20</td>
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<td>Ease of use</td>
<td>General ease of use</td>
<td>2</td>
</tr>
<tr>
<td>Presentation, layout</td>
<td>General presentation, layout and arrangement</td>
<td>2</td>
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<tr>
<td>and arrangement</td>
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<td>Purpose of site</td>
<td>Experimental site</td>
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### Table 16: Evaluation criteria: FAQs

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<td>23</td>
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<td></td>
<td>Expertise of authors</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>References to published information</td>
<td>23</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>23</td>
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<td>Purpose</td>
<td>General purpose</td>
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### Table 17: Evaluation criteria: FTP Archives

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<td>Accessibility</td>
<td>Availability of mirror site</td>
<td>2</td>
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<td>Speed of access</td>
<td>2</td>
</tr>
<tr>
<td>Authority</td>
<td>Institution responsible for site</td>
<td>2</td>
</tr>
<tr>
<td>Coverage</td>
<td>Pointers to other sites</td>
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<td>Ease of use</td>
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### Table 18: Evaluation criteria: Image-based information sources

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<tr>
<td></td>
<td>Images</td>
<td>4, 22</td>
</tr>
<tr>
<td></td>
<td>Coverage of other sites</td>
<td>4</td>
</tr>
<tr>
<td>Comparison</td>
<td>Subject coverage</td>
<td>4, 22</td>
</tr>
<tr>
<td></td>
<td>Bias (e.g. American terms)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Pointers to images</td>
<td>4, 22</td>
</tr>
<tr>
<td></td>
<td>Explanatory information for images</td>
<td>4</td>
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<tr>
<td></td>
<td>Balance of text with images</td>
<td>4</td>
</tr>
<tr>
<td>Coverage</td>
<td>Subject coverage</td>
<td>4, 22</td>
</tr>
<tr>
<td></td>
<td>Bias (e.g. American terms)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Pointers to images</td>
<td>4, 22</td>
</tr>
<tr>
<td></td>
<td>Explanatory information for images</td>
<td>4</td>
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<tr>
<td></td>
<td>Balance of text with images</td>
<td>4</td>
</tr>
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<td>Ease of use</td>
<td>Ease of navigation</td>
<td>4, 10</td>
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<td>Facilities</td>
<td>Copyright information for images</td>
<td>22</td>
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<tr>
<td>Maintenance</td>
<td>Site under construction</td>
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<tr>
<td>Presentation, layout</td>
<td>General presentation, layout and arrangement (e.g. 'well-organised')</td>
<td>4</td>
</tr>
<tr>
<td>and arrangement</td>
<td>Navigational facilities</td>
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<td></td>
<td>Overall 'quality' of images</td>
<td>4, 22</td>
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<tr>
<td></td>
<td>Clarity of images</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Format of images (e.g. 2D/3D, colour)</td>
<td>4, 22</td>
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<td></td>
<td>Computer storage format of images</td>
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<td>Purpose</td>
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### Table 19: Evaluation criteria: Molecular biology resources

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<td>Registration required</td>
<td>18, 19, 28, 29</td>
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<tr>
<td></td>
<td>Password required</td>
<td>28, 29</td>
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<tr>
<td></td>
<td>Membership required</td>
<td>28</td>
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<tr>
<td></td>
<td>Cost</td>
<td>19, 29</td>
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<tr>
<td></td>
<td>Location</td>
<td>1, 8, 15, 17, 18, 19, 20</td>
</tr>
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<td></td>
<td>Availability of mirror site</td>
<td>18</td>
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<tr>
<td></td>
<td>Location of mirror site</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Modes of access available</td>
<td>29</td>
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<td></td>
<td>Reliability of access has</td>
<td>28</td>
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<td>Speed of access</td>
<td>6, 17, 18, 19, 20, 29</td>
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<td>Accuracy</td>
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<td></td>
<td>Misnaming of genes</td>
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<td></td>
<td>Quality controls for data entry</td>
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<td></td>
<td>Refereeing</td>
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<td>Information published elsewhere</td>
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<td>Reputation of source</td>
<td>14, 15, 17</td>
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<td>Institution responsible</td>
<td>1, 18</td>
<td></td>
</tr>
<tr>
<td>Reputation and expertise of institution</td>
<td>17, 18, 28</td>
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<td>Funding organisation responsible</td>
<td>15, 29</td>
<td></td>
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<td>Researchers responsible for data indicated</td>
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<td>Reputation and expertise of researchers</td>
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<td>References to publications available</td>
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<td>Reputation of country of origin</td>
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<td>Coverage</td>
<td>19, 20, 29</td>
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<td>Currency</td>
<td>19, 20, 29</td>
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<td>Databases available</td>
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<td>Uniqueness of coverage</td>
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<td>Availability of archive</td>
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<td>Pointers to further sites</td>
<td>8, 12, 17, 28</td>
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<td>Currency of pointers</td>
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<td>12, 14, 15, 17, 18, 19</td>
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<td>8, 12, 15, 19</td>
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<td>Training courses</td>
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<td>Ease of searching</td>
<td>1, 12, 15, 19</td>
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<td>Ease of navigation</td>
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<tr>
<td>Easy to use interface</td>
<td>1, 8, 15</td>
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<tr>
<td>Intuitive to use</td>
<td>1, 12, 15, 17, 18</td>
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<td>Suitable for naive users</td>
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<td>User friendliness</td>
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<td>Links into Medline/other databases</td>
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<td>Links to 3D structures</td>
<td>6, 8</td>
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<td>Availability of images</td>
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<td>Links to published papers</td>
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<td><strong>Evaluation details</strong></td>
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<td>Language</td>
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<td>Speed of access</td>
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<td><strong>Accuracy</strong></td>
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<td>Factual accuracy</td>
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<td><strong>Authority</strong></td>
<td>Reputation of author</td>
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<tr>
<td></td>
<td>Reputation of institution</td>
</tr>
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<td></td>
<td>Expertise of site maintainer</td>
</tr>
<tr>
<td></td>
<td>Reputation of source</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td>Ease of use</td>
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<td></td>
<td>Level of detail</td>
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<td>Layout and arrangement</td>
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<td>Coverage</td>
<td>General coverage</td>
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<td>-----------------------------------------------------------------------------------</td>
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<tr>
<td>Subject areas covered</td>
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<td>Breadth of coverage</td>
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<td>Type of information covered (e.g. reviews)</td>
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<td>Objectivity</td>
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<td>Pointers to further information</td>
<td>4, 16, 17, 19, 24, 28</td>
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<td>Coverage of pointers</td>
<td>17, 19</td>
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<td>Selection of pointers</td>
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<td>Value/usefulness of pointers</td>
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<td>Necessity of images</td>
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<tr>
<td>Currency</td>
<td>General currency</td>
</tr>
<tr>
<td>Frequency of updating</td>
<td>5, 13, 29</td>
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<tr>
<td>Ease of use</td>
<td>General ease of use</td>
</tr>
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<td>Intuitiveness</td>
<td>24</td>
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<td>Help information</td>
<td>24</td>
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<tr>
<td>Ease navigation</td>
<td>2, 4, 24</td>
</tr>
<tr>
<td>Facilities</td>
<td>Contact information available</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of content</td>
</tr>
<tr>
<td></td>
<td>Novelty value</td>
</tr>
<tr>
<td>Presentation, layout and arrangement (e.g. ‘well-organised’)</td>
<td>General presentation, layout and arrangement</td>
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<tr>
<td>Aesthetically pleasing</td>
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<td>Clarity</td>
<td>10, 24</td>
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<td>Categorisation of information</td>
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<td>Navigational facilities</td>
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<td>Meaningfulness of links</td>
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<td>Consistency of layout</td>
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<td>Professionalism of appearance</td>
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<td>Simplicity of organisation</td>
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<td>Purpose</td>
<td>General purpose</td>
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<tr>
<td>Specific purpose (e.g. advertising, official information)</td>
<td>2, 3, 4, 9, 16, 24</td>
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<td>Search facilities</td>
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### Table 21: Evaluation criteria: Personal Home Pages

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<td>24, 28</td>
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<td>Coverage</td>
<td>Subject areas covered</td>
<td>19, 28</td>
</tr>
<tr>
<td></td>
<td>Pointers to further information</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Pointers to publications</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Unique coverage</td>
<td>28</td>
</tr>
<tr>
<td>Currency</td>
<td>General currency</td>
<td>19</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of information</td>
<td>3, 19, 28</td>
</tr>
<tr>
<td></td>
<td>Novelty value</td>
<td>3, 19</td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose</td>
<td>28, 14</td>
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### Table 22: Evaluation criteria: Search facilities

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<td>Speed of searching</td>
<td>2, 22</td>
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<tr>
<td>Authority</td>
<td>Reputation of source</td>
<td>23</td>
</tr>
<tr>
<td>Coverage</td>
<td>Subject areas covered</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Type of information covered (e.g. academic)</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Resource types covered (e.g. Usenet)</td>
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</tr>
<tr>
<td></td>
<td>Comprehensiveness</td>
<td>2, 5, 8, 9, 28</td>
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<tr>
<td>Ease of use</td>
<td>General</td>
<td>9, 10, 22, 28</td>
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<td>Help information</td>
<td>28</td>
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<td></td>
<td>Details of search process</td>
<td>5, 9, 10</td>
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<td>Ease of use of search options</td>
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<td>Output</td>
<td>Number of results</td>
<td>22, 28</td>
</tr>
<tr>
<td></td>
<td>Display format (e.g. one at time)</td>
<td>28</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of material covered</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of search results</td>
<td>2, 5, 28</td>
</tr>
<tr>
<td>Presentation, layout</td>
<td>Availability of subject headings</td>
<td>28</td>
</tr>
<tr>
<td>and arrangement</td>
<td>Usefulness of subject categories</td>
<td>6</td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose</td>
<td>9</td>
</tr>
<tr>
<td>Search facilities</td>
<td>Ability to narrow search</td>
<td>4, 28</td>
</tr>
<tr>
<td></td>
<td>Narrow by subject (e.g. medicine)</td>
<td>6, 9, 28</td>
</tr>
<tr>
<td></td>
<td>Narrow by type of information (e.g.</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>educational)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Keyword access</td>
<td>2, 22</td>
</tr>
<tr>
<td></td>
<td>Removal of duplicates</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Boolean Operators</td>
<td>5</td>
</tr>
</tbody>
</table>
### Table 23: Evaluation criteria: Subject-based WWW sites

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessibility</strong></td>
<td>Speed of access</td>
<td>13, 26</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>General accuracy</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Factual accuracy</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Original source of information cited</td>
<td>5, 10</td>
</tr>
<tr>
<td></td>
<td>Publication process (e.g. refereeing)</td>
<td>25</td>
</tr>
<tr>
<td><strong>Authority</strong></td>
<td>Author identified</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Expertise of site maintainer</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Reputation of institution responsible</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Reputation of site/source</td>
<td>22</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td>Ease of use</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Overall value/usefulness</td>
<td>26</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>Subject coverage</td>
<td>5, 7, 10, 13, 17, 22, 23, 24, 25, 27</td>
</tr>
<tr>
<td></td>
<td>Coverage of specific resources (e.g. journal abstracts)</td>
<td>24, 25</td>
</tr>
<tr>
<td></td>
<td>Breadth of coverage</td>
<td>5, 25</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>5, 7, 17, 23, 25</td>
</tr>
<tr>
<td></td>
<td>Comprehensiveness of coverage</td>
<td>13, 22</td>
</tr>
<tr>
<td></td>
<td>Bias (e.g. American terms)</td>
<td>13, 25</td>
</tr>
<tr>
<td></td>
<td>Pointers to further information</td>
<td>5, 10, 13, 22, 25</td>
</tr>
<tr>
<td></td>
<td>Selection of pointers</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Descriptive information on pointers</td>
<td>22</td>
</tr>
<tr>
<td><strong>Currency</strong></td>
<td>General currency</td>
<td>22, 25</td>
</tr>
<tr>
<td></td>
<td>Frequency of updating</td>
<td>10, 25</td>
</tr>
<tr>
<td></td>
<td>Update date available</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Timeliness</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Update facility available</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Information on update policy &amp; process</td>
<td>25</td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td>General ease of use</td>
<td>10, 13, 25, 26</td>
</tr>
<tr>
<td></td>
<td>Ease of navigation</td>
<td>10</td>
</tr>
<tr>
<td><strong>Facilities</strong></td>
<td>Contact information available</td>
<td>5</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Site under construction</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Evidence of improvements</td>
<td>25</td>
</tr>
<tr>
<td><strong>Overall impression</strong></td>
<td>Value/usefulness of content</td>
<td>5, 7, 10, 26</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of site</td>
<td>16, 13, 22</td>
</tr>
<tr>
<td><strong>Presentation, layout and arrangement</strong></td>
<td>General presentation, layout and arrangement (e.g. 'well-organised')</td>
<td>7, 13, 25</td>
</tr>
<tr>
<td></td>
<td>Clarity</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Professionalism of presentation</td>
<td>5, 7, 10</td>
</tr>
<tr>
<td></td>
<td>Useful and logical arrangement of pointers</td>
<td>22</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>General purpose</td>
<td>2, 25, 26, 27</td>
</tr>
<tr>
<td></td>
<td>Specific purpose (e.g. an official source)</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Intended audience</td>
<td>27</td>
</tr>
<tr>
<td><strong>Search facilities</strong></td>
<td>Search facilities available</td>
<td>22</td>
</tr>
<tr>
<td>Criteria heading</td>
<td>Evaluation details</td>
<td>Interviewee No.</td>
</tr>
<tr>
<td>--------------------------</td>
<td>---------------------------------------------------------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Accessibility</strong></td>
<td>Mode of access (Usenet/Discussion Group)</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Volume of traffic</td>
<td>8, 16, 19, 24, 26, 27, 29</td>
</tr>
<tr>
<td><strong>Administration</strong></td>
<td>List administrator</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Administrative messages sent</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>Automatic subscription</td>
<td>29</td>
</tr>
<tr>
<td><strong>Authority</strong></td>
<td>Organisation responsible</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Expertise of person responsible for group</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Expertise of authors of individual messages</td>
<td>2, 16, 22</td>
</tr>
<tr>
<td></td>
<td>Source of information cited</td>
<td>8, 16, 13, 26, 29</td>
</tr>
<tr>
<td></td>
<td>Reputation of group</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Review of group available</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Reliability of individual postings</td>
<td>16, 18</td>
</tr>
<tr>
<td><strong>Comparison</strong></td>
<td>Accuracy of information</td>
<td>2, 8, 18, 29</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>Subject areas covered</td>
<td>2, 8, 16, 18, 19, 24, 26, 29</td>
</tr>
<tr>
<td></td>
<td>Breadth of coverage</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Scope of coverage</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Types of material covered (e.g. sites of interest, meetings information)</td>
<td>8, 13, 22</td>
</tr>
<tr>
<td></td>
<td>Coverage of individual postings</td>
<td>8, 16</td>
</tr>
<tr>
<td></td>
<td>Moderated/unmoderated</td>
<td>13, 16, 27, 29</td>
</tr>
<tr>
<td><strong>Facilities</strong></td>
<td>Availability of archive</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Date coverage of archive</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Search facility for archive</td>
<td>13</td>
</tr>
<tr>
<td><strong>Overall impression</strong></td>
<td>Value/usefulness of group</td>
<td>8, 13, 16, 18, 29</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of postings</td>
<td>27, 29</td>
</tr>
<tr>
<td><strong>Participants</strong></td>
<td>Expertise of participants</td>
<td>8, 13, 26</td>
</tr>
<tr>
<td></td>
<td>Number of participants</td>
<td>13, 16, 26</td>
</tr>
<tr>
<td></td>
<td>Location of participants (e.g. national)</td>
<td>19, 26</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>Specific purpose (e.g. to post ministerial statements)</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>Statement of scope/purpose</td>
<td>24</td>
</tr>
</tbody>
</table>
Appendix B3:

Information seeking questionnaire

Table 25: Responses to questionnaire

<table>
<thead>
<tr>
<th>Information seeking situation</th>
<th>Initial distribution</th>
<th>Follow-up distribution</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Questionnaires distributed</td>
<td>348</td>
<td>247</td>
<td>595</td>
</tr>
<tr>
<td>Questionnaires returned (percentage of questionnaires distributed)</td>
<td>101 (29%)</td>
<td>61 (25%)</td>
<td>162 (27%)</td>
</tr>
<tr>
<td>Agreeing to interview (percentage of questionnaires distributed)</td>
<td>58 (17%)</td>
<td>27 (11%)</td>
<td>85 (14%)</td>
</tr>
</tbody>
</table>

Table 26: Information seeking situations

<table>
<thead>
<tr>
<th>Information seeking situation</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used a bibliographical database to carry out a literature search</td>
<td>85 (52%)</td>
</tr>
<tr>
<td>Looked for background information for a research project, to update knowledge or for a specific publication or presentation</td>
<td>81 (50%)</td>
</tr>
<tr>
<td>Read or consulted an electronic journal</td>
<td>59 (36%)</td>
</tr>
<tr>
<td>None of the above</td>
<td>57 (35%)</td>
</tr>
<tr>
<td>Looked for a specific fact about a person or an institution (e.g. an address)</td>
<td>55 (34%)</td>
</tr>
<tr>
<td>Downloaded computer software using FTP, Gopher or the WWW</td>
<td>50 (31%)</td>
</tr>
<tr>
<td>Looked for material to supplement teaching material (e.g. text-book style material, computer-assisted learning materials, images)</td>
<td>36 (22%)</td>
</tr>
<tr>
<td>Searched a genetic sequence database/databank</td>
<td>27 (17%)</td>
</tr>
<tr>
<td>Looked for funding information</td>
<td>25 (15%)</td>
</tr>
<tr>
<td>Posted a query to a Usenet Newsgroup or Discussion Group</td>
<td>22 (14%)</td>
</tr>
</tbody>
</table>
Table 27: Further situations mentioned

<table>
<thead>
<tr>
<th>Information seeking situation</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial information (e.g. computer information, scientific equipment, information on reagents and prices)</td>
<td>6</td>
</tr>
<tr>
<td>Access to other molecular biology resources</td>
<td>5</td>
</tr>
<tr>
<td>Conference/meeting information (e.g. details of meetings, flight times)</td>
<td>5</td>
</tr>
<tr>
<td>Communication</td>
<td>5</td>
</tr>
<tr>
<td>Following discussion of Usenet Newsgroup/Discussion Group</td>
<td>2</td>
</tr>
<tr>
<td>Information on specific area of work (e.g. the toxicity of walnuts, information on rare blood tests)</td>
<td>2</td>
</tr>
<tr>
<td>Information on courses in other colleges/universities</td>
<td>2</td>
</tr>
<tr>
<td>Patient education information</td>
<td>1</td>
</tr>
<tr>
<td>Job vacancy information</td>
<td>1</td>
</tr>
<tr>
<td>News information</td>
<td>1</td>
</tr>
<tr>
<td>Official information (e.g. Department of Health press releases)</td>
<td>1</td>
</tr>
<tr>
<td>To ‘play’</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 28: Non-use of the Internet

<table>
<thead>
<tr>
<th>Reasons for not using the Internet recently</th>
<th>Number of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of access</td>
<td>29</td>
</tr>
<tr>
<td>Not familiar with using the Internet</td>
<td>28</td>
</tr>
<tr>
<td>Other people conduct information seeking on respondent’s behalf</td>
<td>9</td>
</tr>
<tr>
<td>Lack of time to use the Internet</td>
<td>9</td>
</tr>
<tr>
<td>Lack of time to learn to use the Internet</td>
<td>6</td>
</tr>
<tr>
<td>Other sources of information are adequate for needs</td>
<td>5</td>
</tr>
<tr>
<td>Intention to use the Internet</td>
<td>4</td>
</tr>
<tr>
<td>Speed of access (i.e. the Internet is too slow)</td>
<td>3</td>
</tr>
<tr>
<td>Only use for communication purposes</td>
<td>3</td>
</tr>
<tr>
<td>Other sources of information are more relevant to work</td>
<td>2</td>
</tr>
<tr>
<td>The information available via the Internet is irrelevant</td>
<td>2</td>
</tr>
<tr>
<td>The Internet is of no interest</td>
<td>1</td>
</tr>
</tbody>
</table>
Appendix B4:
Criteria development and validation interviews

Table 29: Interviewee details

<table>
<thead>
<tr>
<th>Int.</th>
<th>Job title</th>
<th>Subject area</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Consultant Surgeon &amp; University Lecturer</td>
<td>Transplantation surgery</td>
</tr>
<tr>
<td>32</td>
<td>Paediatric Researcher</td>
<td>Neo-natal lung disease</td>
</tr>
<tr>
<td>33</td>
<td>Consultant &amp; Director Histopathology Services</td>
<td>Histopathology (lung disease)</td>
</tr>
<tr>
<td>34</td>
<td>Lecturer</td>
<td>Paediatrics</td>
</tr>
<tr>
<td>35</td>
<td>Senior Research Associate</td>
<td>Psychology</td>
</tr>
<tr>
<td>36</td>
<td>Senior Research Associate</td>
<td>Molecular biology</td>
</tr>
<tr>
<td>37</td>
<td>Consultant Audiological Scientist</td>
<td>Audiology (Tinnitus)</td>
</tr>
<tr>
<td>38</td>
<td>Lecturer</td>
<td>Public Health Medicine and Epidemiology</td>
</tr>
<tr>
<td>39</td>
<td>Senior Research Associate</td>
<td>Immunology</td>
</tr>
<tr>
<td>40</td>
<td>Head of Department</td>
<td>Radiotherapy treatment &amp; planning</td>
</tr>
<tr>
<td>41</td>
<td>Consultant Urologist</td>
<td>Andrology</td>
</tr>
<tr>
<td>42</td>
<td>Lecturer</td>
<td>General practice &amp; medical education</td>
</tr>
<tr>
<td>43</td>
<td>Senior Research Associate</td>
<td>Proteins controlling blood pressure</td>
</tr>
<tr>
<td>44</td>
<td>Lecturer &amp; Honorary Consultant</td>
<td>Radiotherapy principles, cancer &amp; sarcomas</td>
</tr>
<tr>
<td>45</td>
<td>Senior Research Fellow</td>
<td>Alzheimer's &amp; Prionprotein Disease</td>
</tr>
<tr>
<td>46</td>
<td>Clinical Lecturer &amp; Consultant</td>
<td>Dermatology (viral disease)</td>
</tr>
<tr>
<td>47</td>
<td>Lecturer</td>
<td>Forensic psychiatry</td>
</tr>
<tr>
<td>48</td>
<td>PG Medical Dean</td>
<td>Medical education</td>
</tr>
<tr>
<td>49</td>
<td>Head of Molecular Genetics Laboratory</td>
<td>Clinical molecular genetics</td>
</tr>
<tr>
<td>50</td>
<td>Director of NICU</td>
<td>Neo-natal intensive care</td>
</tr>
<tr>
<td>51</td>
<td>Clinical Scientific Fellow</td>
<td>Lung cancer/pathology</td>
</tr>
<tr>
<td>52</td>
<td>Director of ICU</td>
<td>Intensive care</td>
</tr>
<tr>
<td>53</td>
<td>Professor of Molecular Parasitology</td>
<td>Genetics</td>
</tr>
<tr>
<td>54</td>
<td>MRC Team Leader</td>
<td>Bone disease &amp; Osteoporosis</td>
</tr>
<tr>
<td>55</td>
<td>Lecturer</td>
<td>Child Psychiatry</td>
</tr>
<tr>
<td>56</td>
<td>Senior Research Associate</td>
<td>Placental growth and function</td>
</tr>
<tr>
<td>57</td>
<td>Director of Medical Illustration</td>
<td>Medical graphics</td>
</tr>
<tr>
<td>58</td>
<td>Consultant Physician</td>
<td>Geriatric medicine</td>
</tr>
<tr>
<td>59</td>
<td>Research Assistant</td>
<td>Alzheimer's &amp; Prion Disease</td>
</tr>
<tr>
<td>60</td>
<td>Senior Research Associate</td>
<td>Molecular virology</td>
</tr>
<tr>
<td>61</td>
<td>Consultant Anaesthetist</td>
<td>Obstetrics anaesthesiology</td>
</tr>
<tr>
<td>62</td>
<td>Senior Research Associate</td>
<td>Molecular biology</td>
</tr>
<tr>
<td>63</td>
<td>Clinical Senior Research Associate</td>
<td>Mental health policy</td>
</tr>
<tr>
<td>64</td>
<td>Clinical Dean/Consultant Neurologist</td>
<td>Neurology &amp; medical education</td>
</tr>
<tr>
<td></td>
<td>Lecturer Obstetrics &amp; Gynaecology</td>
<td>Lecturer Molecular biology</td>
</tr>
<tr>
<td>----</td>
<td>----------------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td></td>
<td></td>
</tr>
<tr>
<td>67</td>
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<td>68</td>
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<td>71</td>
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<td></td>
</tr>
<tr>
<td>72</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 30: Tools used and levels of use of the Internet**

<table>
<thead>
<tr>
<th>Tool</th>
<th>Daily</th>
<th>Weekly</th>
<th>Monthly</th>
<th>Less than monthly</th>
<th>Not used</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>38 (90%)</td>
<td>3 (7%)</td>
<td>0</td>
<td>0</td>
<td>1 (2%)</td>
</tr>
<tr>
<td>Usenet News</td>
<td>2 (5%)</td>
<td>3 (7%)</td>
<td>3 (7%)</td>
<td>1 (2%)</td>
<td>33 (79%)</td>
</tr>
<tr>
<td>FTP</td>
<td>1 (2%)</td>
<td>5 (12%)</td>
<td>8 (19%)</td>
<td>11 (26%)</td>
<td>17 (40%)</td>
</tr>
<tr>
<td>Gopher</td>
<td>0</td>
<td>0</td>
<td>3 (7%)</td>
<td>1 (2%)</td>
<td>38 (90%)</td>
</tr>
<tr>
<td>WWW</td>
<td>12 (29%)</td>
<td>17 (40%)</td>
<td>7 (17%)</td>
<td>4 (10%)</td>
<td>2 (5%)</td>
</tr>
</tbody>
</table>

**Table 31: Use of discussion groups**

<table>
<thead>
<tr>
<th>Use of discussion groups</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currently subscribed</td>
<td>10 (34%)</td>
</tr>
<tr>
<td>Not currently subscribed</td>
<td>29 (69%)</td>
</tr>
<tr>
<td>Don’t know what they are</td>
<td>0</td>
</tr>
<tr>
<td>Had been subscribed</td>
<td>3 (7%)</td>
</tr>
</tbody>
</table>

**Table 32: Length of use of Internet tools**

<table>
<thead>
<tr>
<th>Tool</th>
<th>&lt; year (14%)</th>
<th>1-2 years incl. (29%)</th>
<th>+ 2 years incl. (33%)</th>
<th>Never used (2%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail</td>
<td>6</td>
<td>12</td>
<td>23</td>
<td>1</td>
</tr>
<tr>
<td>WWW</td>
<td>12</td>
<td>14</td>
<td>14</td>
<td>2</td>
</tr>
<tr>
<td>Usenet News</td>
<td>1 (2%)</td>
<td>3 (7%)</td>
<td>6 (14%)</td>
<td>32 (76%)</td>
</tr>
<tr>
<td>FTP</td>
<td>3 (7%)</td>
<td>10 (34%)</td>
<td>12 (29%)</td>
<td>17 (40%)</td>
</tr>
<tr>
<td>Gopher</td>
<td>0</td>
<td>1 (2%)</td>
<td>11 (26%)</td>
<td>30 (71%)</td>
</tr>
<tr>
<td>Discussion Groups</td>
<td>6 (14%)</td>
<td>4 (10%)</td>
<td>3 (7%)</td>
<td>29 (69%)</td>
</tr>
</tbody>
</table>

**Table 33: Usual place of access to the Internet**

<table>
<thead>
<tr>
<th>Place of access</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>12 (29%)</td>
</tr>
<tr>
<td>Work (own terminal)</td>
<td>29 (69%)</td>
</tr>
<tr>
<td>Work (shared terminal)</td>
<td>9 (21%)</td>
</tr>
<tr>
<td>Library</td>
<td>0</td>
</tr>
<tr>
<td>Public access room</td>
<td>1 (2%)</td>
</tr>
</tbody>
</table>
Table 34: Information seeking situations

<table>
<thead>
<tr>
<th>Information seeking situation</th>
<th>Interviewees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access electronic journals</td>
<td>39, 41, 47, 48, 54, 57, 59, 66, 67, 68</td>
</tr>
<tr>
<td>Access molecular biology resources</td>
<td>31, 36, 43, 45, 49, 51, 53, 56, 59, 60, 66, 68, 70, 72</td>
</tr>
<tr>
<td>Background information</td>
<td>31, 40, 46, 50, 63, 69, 70, 72</td>
</tr>
<tr>
<td>Browsing Usenet Newsgroup or Discussion Group</td>
<td>33, 41, 62, 65, 69</td>
</tr>
<tr>
<td>Commercial information</td>
<td>56, 62, 66</td>
</tr>
<tr>
<td>Conference information</td>
<td>42, 57, 63</td>
</tr>
<tr>
<td>Contact information</td>
<td>37, 42, 47, 48, 50, 56, 59, 60, 64</td>
</tr>
<tr>
<td>Downloading software</td>
<td>32, 50, 52, 57, 58, 49, 59, 62, 64, 66</td>
</tr>
<tr>
<td>Funding information</td>
<td>34, 47, 50, 54, 56, 60, 63</td>
</tr>
<tr>
<td>Official information</td>
<td>47</td>
</tr>
<tr>
<td>Organisational information</td>
<td>46, 61, 65</td>
</tr>
<tr>
<td>Patient education information</td>
<td>37</td>
</tr>
<tr>
<td>Search a bibliographical database</td>
<td>31, 33, 35, 41, 42, 44, 45, 49, 50, 52, 55, 56, 58, 59, 61, 62, 63, 65, 67, 68, 70, 72</td>
</tr>
<tr>
<td>Teaching materials (background information, information on other courses)</td>
<td>41, 48, 71</td>
</tr>
<tr>
<td>Teaching materials (e.g. CAL, images)</td>
<td>38, 41, 52, 57, 71</td>
</tr>
<tr>
<td>Technical information</td>
<td>40, 41, 52, 57, 63</td>
</tr>
<tr>
<td>Travel information</td>
<td>60, 69</td>
</tr>
<tr>
<td>Update knowledge or keep up to date</td>
<td>31, 47, 48, 63, 69</td>
</tr>
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</table>

Table 35: Sources used

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<tr>
<th>Int.</th>
<th>Source type</th>
<th>Name</th>
<th>Source type</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Molecular biology resource</td>
<td>OMIM</td>
<td>Bibliographical database</td>
<td>BIDS</td>
</tr>
<tr>
<td>32</td>
<td>FTP archive</td>
<td>Not specified</td>
<td>Usenet Newsgroup/ discussion group</td>
<td>Not specified</td>
</tr>
<tr>
<td>33</td>
<td>Usenet Newsgroup/ discussion group</td>
<td>Transplant Internet Services list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Database</td>
<td>Wisdom</td>
<td>Organisational site</td>
<td>Cambridge University</td>
</tr>
<tr>
<td>35</td>
<td>Bibliographical database</td>
<td>BIDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Molecular biology resource</td>
<td>EBI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Organisational site</td>
<td>Not specified</td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>CAL materials</td>
<td>Not specified</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Electronic Journal</td>
<td>J Immunology</td>
<td>Electronic Journal</td>
<td>Blood Cells</td>
</tr>
<tr>
<td>---</td>
<td>-------------------</td>
<td>-------------</td>
<td>-------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>40</td>
<td>Usenet Newsgroup/Discussion Group</td>
<td>alt.imaging. medical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Image based information source</td>
<td>Zeneca</td>
<td>Usenet Newsgroup/discussion group Bibliographical database</td>
<td>Not specified</td>
</tr>
<tr>
<td>42</td>
<td>Organisational site</td>
<td>Conference home page</td>
<td>Subject based site</td>
<td>Pathfinder</td>
</tr>
<tr>
<td>43</td>
<td>Molecular biology resource</td>
<td>EMBLE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>44</td>
<td>Bibliographical database</td>
<td>Medline</td>
<td>Usenet Newsgroup/discussion group</td>
<td>Not specified</td>
</tr>
<tr>
<td>45</td>
<td>Bibliographical database</td>
<td>BIDS</td>
<td>Molecular biology resource</td>
<td>Swiss-prot</td>
</tr>
<tr>
<td>46</td>
<td>Bibliographical database</td>
<td>Medline</td>
<td></td>
<td></td>
</tr>
<tr>
<td>47</td>
<td>Organisational site</td>
<td>DoH</td>
<td>Subject-based site</td>
<td>UK Clickable Map</td>
</tr>
<tr>
<td>48</td>
<td>Electronic journal</td>
<td>New England J Medicine</td>
<td>Electronic journal</td>
<td>British Medical J</td>
</tr>
<tr>
<td>49</td>
<td>Bibliographical database</td>
<td>BIDS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td>Organisational site</td>
<td>Wellcome Centre</td>
<td>Subject-based site</td>
<td>doc.net</td>
</tr>
<tr>
<td>51</td>
<td>Molecular biology resource</td>
<td>Four discussed and compared (NCBI, HGMP, two not specified)</td>
<td>Usenet Newsgroup/discussion group</td>
<td>Not specified</td>
</tr>
<tr>
<td>52</td>
<td>Image based information source</td>
<td>Diving forum</td>
<td>Usenet Newsgroup/discussion group</td>
<td>Not specified</td>
</tr>
<tr>
<td>53</td>
<td>Molecular biology resource</td>
<td>EBI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>54</td>
<td>CAS</td>
<td>BBSRC Mailing list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>55</td>
<td>Bibliographical databases</td>
<td>BIDS (Embase)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56</td>
<td>Organisational site</td>
<td>Genosis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>#</td>
<td>Description</td>
<td>Database/Resource</td>
<td>Type Details</td>
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<td>-----------------------------------------</td>
<td>-----------------------------------------</td>
<td>------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>57</td>
<td>Electronic Ophthalmic Photography J</td>
<td>Usenet Electronic journal</td>
<td>Not specified</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td>Bibliographical databases</td>
<td>Medline</td>
<td>British Medical J</td>
<td></td>
</tr>
<tr>
<td>59</td>
<td>FTP archive</td>
<td>SunSite</td>
<td>BIDS, Medline, Not specified, Int J Anti-viral News, Medical Matrix, Biomednet, Virology site, Not specified</td>
<td></td>
</tr>
<tr>
<td>60</td>
<td>Molecular biology resource</td>
<td>Marcvector</td>
<td>Biomednet, Fedix, Not specified</td>
<td></td>
</tr>
<tr>
<td>61</td>
<td>Organisational site</td>
<td>Australian Anaesthesiology home page</td>
<td>Australian Anaesthesiology list, Medline</td>
<td></td>
</tr>
<tr>
<td>62</td>
<td>Organisational site</td>
<td>Packard Canberra</td>
<td>Entrez, BIDS, Methods and Reagents list</td>
<td></td>
</tr>
<tr>
<td>63</td>
<td>Usenet Newsgroup/discussion group</td>
<td>National Public Health list</td>
<td>UKOP list</td>
<td></td>
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<tr>
<td>64</td>
<td>Organisational site</td>
<td>Cambridge University</td>
<td>BIDS</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>65</td>
<td>Usenet Newsgroup/ Discussion group</td>
<td>Obstetrics and Gynaecology list</td>
<td></td>
<td></td>
</tr>
<tr>
<td>66</td>
<td>Catalogue</td>
<td>ATCC</td>
<td>Electronic journal Molecular biology resource FTP archive</td>
<td>Science</td>
</tr>
<tr>
<td>67</td>
<td>Electronic journal</td>
<td>J of Biological Chemistry</td>
<td>Bibliographical database</td>
<td>Medline</td>
</tr>
<tr>
<td>68</td>
<td>Molecular biology resource</td>
<td>GenBase</td>
<td>Bibliographical database</td>
<td>BIDS (Embase)</td>
</tr>
<tr>
<td>69</td>
<td>Usenet Newsgroup/ discussion group</td>
<td>All-stat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td>Molecular biology resource</td>
<td>HGMP</td>
<td>Bibliographical database</td>
<td>BIDS</td>
</tr>
<tr>
<td>71</td>
<td>Image-based information source</td>
<td>Visible Human</td>
<td>Electronic journal</td>
<td>British Medical J</td>
</tr>
<tr>
<td>72</td>
<td>Molecular biology resource</td>
<td>OMIM</td>
<td>Molecular biology resource Molecular biology resource Molecular biology resource</td>
<td>Express Sequence Tag database MouseBase FlyBase</td>
</tr>
</tbody>
</table>

**Table 36: Evaluation Criteria: Bibliographical databases**

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Cost</td>
<td>41, 58, 68</td>
</tr>
<tr>
<td></td>
<td>Password required</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
<td>35, 44, 49, 55, 58, 61</td>
</tr>
<tr>
<td></td>
<td>Mode of access (e.g. Telnet)</td>
<td>62</td>
</tr>
<tr>
<td></td>
<td>Reliability of access</td>
<td>58, 62</td>
</tr>
<tr>
<td>Accuracy</td>
<td>General accuracy</td>
<td>44, 45, 58</td>
</tr>
<tr>
<td></td>
<td>Accuracy of reference details</td>
<td>49</td>
</tr>
<tr>
<td>Authority</td>
<td>Original source of abstracts (e.g. authors)</td>
<td>45, 49, 58</td>
</tr>
<tr>
<td></td>
<td>Reputation of source</td>
<td>44, 45, 58</td>
</tr>
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<td></td>
<td>Motivation of service provider</td>
<td>58</td>
</tr>
<tr>
<td>Comparison with other sources</td>
<td>Coverage</td>
<td>45, 55, 64</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>----------</td>
<td>------------</td>
</tr>
<tr>
<td></td>
<td>Comprehensiveness of coverage</td>
<td>45, 55, 59</td>
</tr>
<tr>
<td></td>
<td>Currency</td>
<td>46, 49</td>
</tr>
<tr>
<td></td>
<td>Frequency of updating</td>
<td>46, 55</td>
</tr>
<tr>
<td></td>
<td>Differences with other versions of same database</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Ease of use</td>
<td>35, 55, 64</td>
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<td></td>
<td>Interface</td>
<td>55, 62, 70, 64</td>
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<td></td>
<td>Search facilities</td>
<td>64</td>
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<td></td>
<td>Speed of access</td>
<td>55, 70</td>
</tr>
<tr>
<td></td>
<td>Time delay for appearance in database</td>
<td>45, 67</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>44, 45, 46, 49, 55, 58</td>
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<td>Journals covered</td>
<td>35, 44, 45</td>
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<td></td>
<td>Breadth of coverage</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Comprehensiveness of coverage</td>
<td>35, 44, 45, 46, 55, 59</td>
</tr>
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<td></td>
<td>Retrospective coverage</td>
<td>46</td>
</tr>
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<td>Full articles available</td>
<td>44, 45, 58</td>
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<td>Availability of abstracts</td>
<td>44, 45, 49, 58, 67</td>
</tr>
<tr>
<td></td>
<td>Level of detail in abstracts</td>
<td>45, 46, 49, 58, 67</td>
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<tr>
<td></td>
<td>Value/usefulness of abstracts</td>
<td>46, 49, 58</td>
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<tr>
<td></td>
<td>Abbreviation of abstracts</td>
<td>44, 49</td>
</tr>
<tr>
<td></td>
<td>References from article available</td>
<td>44</td>
</tr>
<tr>
<td>Currency</td>
<td>General currency</td>
<td>35, 44, 45, 46, 49, 55, 58</td>
</tr>
<tr>
<td></td>
<td>Frequency of updating</td>
<td>46, 55</td>
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<tr>
<td></td>
<td>Time delay between publication and appearance in the database</td>
<td>44, 45, 46, 49, 55, 67</td>
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<tr>
<td>Ease of use</td>
<td>General ease of use</td>
<td>45, 61</td>
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<td></td>
<td>Ease of searching</td>
<td>46, 55</td>
</tr>
<tr>
<td></td>
<td>Ease of navigation</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Ease of downloading/printing</td>
<td>55</td>
</tr>
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<td></td>
<td>Intuitiveness</td>
<td>35, 45</td>
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<td></td>
<td>User-friendliness</td>
<td>45, 70</td>
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<td></td>
<td>Help information</td>
<td>45, 46, 49</td>
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<td>Clarity of help information</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Level of detail in help information</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of help information</td>
<td>45, 58</td>
</tr>
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<td>Introductory courses available</td>
<td>35</td>
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<tr>
<td></td>
<td>Telephone helpline</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Response times of helpline</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of user support</td>
<td>45</td>
</tr>
<tr>
<td>Search and output facilities</td>
<td>Author search</td>
<td>35, 49, 44, 46</td>
</tr>
<tr>
<td></td>
<td>Subject searching facilities</td>
<td>35, 44, 58</td>
</tr>
<tr>
<td></td>
<td>Citation search</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Simultaneous keyword searching</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Automatic keyword mapping</td>
<td>44, 46</td>
</tr>
<tr>
<td></td>
<td>Re-run amended search statements</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Re-run searches at later date</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Facilities to narrow search</td>
<td>46, 58</td>
</tr>
<tr>
<td></td>
<td>Limit by date range</td>
<td>45, 58</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of search facilities</td>
<td>35, 45</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of browse facilities</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Output facilities (e.g. print, e-mail)</td>
<td>46, 35</td>
</tr>
<tr>
<td></td>
<td>Limit by number of search results</td>
<td>58</td>
</tr>
<tr>
<td></td>
<td>Different search interfaces</td>
<td>58</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of database</td>
<td>45, 55, 63</td>
</tr>
<tr>
<td>Presentation, layout and arrangement</td>
<td>Clarity of screen layout</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Volume of information on each screen</td>
<td>35</td>
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<tr>
<td></td>
<td>Repetition of steps/short-cuts</td>
<td>45, 55</td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose</td>
<td>35</td>
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Table 37: Evaluation criteria: CAL materials

<table>
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<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Robustness of material</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Permission/application required</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
<td>38</td>
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<tr>
<td>Accuracy</td>
<td>General accuracy</td>
<td>38</td>
</tr>
<tr>
<td>Authority</td>
<td>Institution responsible</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Sponsorship</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Reviews available</td>
<td>38, 57</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Uniqueness of coverage</td>
<td>38</td>
</tr>
<tr>
<td>Facilities</td>
<td>Searchable glossary</td>
<td>38</td>
</tr>
<tr>
<td>Presentation, layout and arrangement</td>
<td>Format (download and use locally)</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Interactive format</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Volume of information per screen</td>
<td>38</td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Intended audience</td>
<td>38</td>
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</table>
### Table 38: Evaluation criteria: Current Awareness Services

<table>
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<th>Criteria heading</th>
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</tr>
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<tbody>
<tr>
<td>Accessibility</td>
<td>Registration required</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Proof of eligibility required</td>
<td>54</td>
</tr>
<tr>
<td>Accuracy</td>
<td>Accuracy of mailings</td>
<td>54</td>
</tr>
<tr>
<td>Authority</td>
<td>Organisation responsible</td>
<td>54</td>
</tr>
<tr>
<td>Comparison</td>
<td>Currency</td>
<td>54</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>54, 60</td>
</tr>
<tr>
<td></td>
<td>Breadth of coverage</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Scope of coverage</td>
<td>54, 60</td>
</tr>
<tr>
<td>Currency</td>
<td>General currency (e.g. information arrives before funding deadlines)</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Frequency of distribution</td>
<td>54</td>
</tr>
<tr>
<td>Facilities</td>
<td>Contact information with mailings</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Ability to specify interest profile by keyword</td>
<td>54, 60</td>
</tr>
<tr>
<td></td>
<td>Keyword descriptors of postings</td>
<td>54</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of service</td>
<td>54</td>
</tr>
<tr>
<td>Presentation, layout and arrangement</td>
<td>Format (e.g. one-way mailing list)</td>
<td>54</td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose (e.g. one-way mailing list)</td>
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</tr>
<tr>
<td></td>
<td>Intended audience</td>
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### Table 39: Evaluation criteria: Catalogues

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<tbody>
<tr>
<td>Accessibility</td>
<td>Speed of access</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Mode of access (e.g. WWW)</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Reliability of access</td>
<td>66</td>
</tr>
<tr>
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<tr>
<td>Authority</td>
<td>Institution responsible</td>
<td>66</td>
</tr>
<tr>
<td>Comparison</td>
<td>Search facility</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Coverage</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Currency</td>
<td>66</td>
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<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>66</td>
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<tr>
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<td>Uniqueness of coverage</td>
<td>66</td>
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<td>Level of detail</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Pointers to further information</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Pointers to journal references</td>
<td>66</td>
</tr>
<tr>
<td>Currency</td>
<td>General currency</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Frequency of updating</td>
<td>66</td>
</tr>
<tr>
<td>Ease of use</td>
<td>General ease of use</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Ease of printing</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Help information on searching</td>
<td>66</td>
</tr>
<tr>
<td>Facilities</td>
<td>Contact information</td>
<td>66</td>
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<tr>
<td>Overall impression</td>
<td>Value/usefulness of information</td>
<td>66</td>
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<td>Criteria heading</td>
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<td>Interviewee No.</td>
</tr>
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<td>---------------------------------------------------------</td>
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<td>Accessibility</td>
<td>Speed of access</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Mode of access (e.g. Telnet)</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Reliability of access</td>
<td>34</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Comprehensiveness of coverage</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Level of detail</td>
<td>34</td>
</tr>
<tr>
<td></td>
<td>Uniqueness of coverage</td>
<td>34</td>
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<tr>
<td>Comparison</td>
<td>Level of detail</td>
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</tr>
<tr>
<td></td>
<td>Frequency of updating</td>
<td>34</td>
</tr>
<tr>
<td>Ease of use</td>
<td>General ease of use</td>
<td>34</td>
</tr>
<tr>
<td>Presentation, layout and arrangement</td>
<td>General presentation, layout and arrangement (e.g. well-laid out)</td>
<td>34</td>
</tr>
<tr>
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<td>Categorisation of information</td>
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<tr>
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<td>Clarity of screen layout</td>
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<tr>
<td></td>
<td>Volume of information per screen</td>
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</tr>
<tr>
<td>Purpose</td>
<td>General purpose</td>
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<td>Statement of scope and coverage</td>
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Table 40: Evaluation criteria: Databases

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<tr>
<td>Accessibility</td>
<td>Additional software required</td>
<td>48</td>
</tr>
<tr>
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<td>Ease &amp; speed of downloading additional software</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Cost and what charged for</td>
<td>39, 48, 57, 59</td>
</tr>
<tr>
<td></td>
<td>Password required</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Registration required</td>
<td>66</td>
</tr>
<tr>
<td></td>
<td>Mirror site</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
<td>39, 48, 66, 67</td>
</tr>
<tr>
<td></td>
<td>Location</td>
<td>48, 66</td>
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<tr>
<td>Accuracy</td>
<td>Stringency of refereeing process</td>
<td>67</td>
</tr>
<tr>
<td>Authority</td>
<td>Reputation of editorial board</td>
<td>39, 67</td>
</tr>
<tr>
<td></td>
<td>Reputation of institution responsible</td>
<td>57, 67</td>
</tr>
<tr>
<td></td>
<td>Reputation of journal</td>
<td>39, 48, 67, 71</td>
</tr>
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<td></td>
<td>Genealogy (print equivalent)</td>
<td>48, 71</td>
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</table>

Table 41: Evaluation criteria: Electronic Journals
<table>
<thead>
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<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Cost of software</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Mode of access available (e.g. FTP, WWW)</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
<td>32, 59</td>
</tr>
<tr>
<td></td>
<td>Location and speed of access</td>
<td>32, 59</td>
</tr>
<tr>
<td></td>
<td>Mirror site available</td>
<td>32, 59</td>
</tr>
<tr>
<td></td>
<td>Reliability of access</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Provision of onward link</td>
<td>32</td>
</tr>
<tr>
<td>Authority</td>
<td>Reputation of site</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Reputation of organisation responsible</td>
<td>32, 59</td>
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</table>

Table 42: Evaluation criteria: FTP Archives
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<tr>
<th>Coverage</th>
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<tbody>
<tr>
<td></td>
<td>Trial versions of software available</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Upgrades and back versions of software available</td>
<td>32, 59</td>
</tr>
<tr>
<td></td>
<td>Single/multiple platforms available</td>
<td>32, 59</td>
</tr>
<tr>
<td></td>
<td>Coverage of mirror site compared to original</td>
<td>59</td>
</tr>
<tr>
<td>Currency</td>
<td>Software updates available</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Latest versions of software available</td>
<td>32</td>
</tr>
<tr>
<td>Ease of use</td>
<td>General ease of use</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Ease of downloading software</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Help information/README files available</td>
<td>32, 59</td>
</tr>
<tr>
<td></td>
<td>Help information/README files for all directories</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Help information about search facility</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of help information</td>
<td>32</td>
</tr>
<tr>
<td>Facilities</td>
<td>Contact information available</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Expiry dates for shareware/freeware provided</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Information on file origins</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Information on file sizes</td>
<td>32, 59</td>
</tr>
<tr>
<td></td>
<td>Information on file status</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Information on software version number</td>
<td>32, 59</td>
</tr>
<tr>
<td>Maintenance</td>
<td>General maintenance (e.g. 'well-maintained')</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Continuous maintenance of site</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Responsibility for maintenance (e.g. dedicated staff)</td>
<td>59</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of site</td>
<td>59</td>
</tr>
<tr>
<td>Presentation, layout and arrangement</td>
<td>General presentation, layout and arrangement (e.g. 'well-organised')</td>
<td>32</td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose of site</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Statement of coverage</td>
<td>59</td>
</tr>
<tr>
<td>Search facilities</td>
<td>Availability of search facilities</td>
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</tr>
</tbody>
</table>

**Table 43: Evaluation criteria: Image-based information sources**

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<th>Criteria heading</th>
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<th>Interviewee No.</th>
</tr>
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<tr>
<td>Accessibility</td>
<td>Cost</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
<td>41, 52, 71</td>
</tr>
<tr>
<td></td>
<td>Reliability of access</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Password required</td>
<td>41</td>
</tr>
<tr>
<td>Authority</td>
<td>Expertise of those responsible for images</td>
<td>52</td>
</tr>
<tr>
<td>Criteria heading</td>
<td>Evaluation details</td>
<td>Interviewee No.</td>
</tr>
<tr>
<td>------------------</td>
<td>--------------------</td>
<td>-----------------</td>
</tr>
<tr>
<td><strong>Coverage</strong></td>
<td>Coverage of images</td>
<td>41, 52, 71</td>
</tr>
<tr>
<td></td>
<td>Scope of coverage</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Number of images</td>
<td>41, 71</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of images</td>
<td>52, 71</td>
</tr>
<tr>
<td></td>
<td>Explanatory information on images available</td>
<td>41, 52, 71</td>
</tr>
<tr>
<td></td>
<td>Level of detail of explanatory info.</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Value/usefulness of explanatory info.</td>
<td>41, 52</td>
</tr>
<tr>
<td></td>
<td>Pointers to further images</td>
<td>71</td>
</tr>
<tr>
<td><strong>Currency</strong></td>
<td>Currency of images</td>
<td>41, 52, 71</td>
</tr>
<tr>
<td></td>
<td>Frequency of updating of images</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Date for images</td>
<td>52</td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td>General ease of use</td>
<td>41</td>
</tr>
<tr>
<td><strong>Maintenance</strong></td>
<td>Improvements</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Feedback mechanism for site improvements</td>
<td>41</td>
</tr>
<tr>
<td><strong>Presentation, layout and arrangement</strong></td>
<td>Clarity of images</td>
<td>41, 52, 71</td>
</tr>
<tr>
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<td>Image resolution</td>
<td>41, 52, 71</td>
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<td>Image format (e.g. .gif)</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Storage size of images</td>
<td>71</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>General purpose</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>Intended aims</td>
<td>41</td>
</tr>
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<td>Intended audience</td>
<td>71</td>
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</table>

**Table 44: Evaluation criteria: Molecular biology resources**

<table>
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</tr>
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<td>Speed of access</td>
<td>36, 43, 51, 60, 66, 68, 72</td>
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<td>Reliability of access</td>
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</tr>
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<td></td>
<td>System compatibility</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>Mirror site available</td>
<td>51, 53, 70, 72</td>
</tr>
<tr>
<td></td>
<td>Modes of access available</td>
<td>45, 53, 68, 70</td>
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<td></td>
<td>Restrictions to researchers in field</td>
<td>51, 70</td>
</tr>
<tr>
<td></td>
<td>Cost</td>
<td>51, 53, 60</td>
</tr>
<tr>
<td></td>
<td>Password required</td>
<td>53, 68</td>
</tr>
<tr>
<td></td>
<td>Registration required</td>
<td>53, 68, 70</td>
</tr>
<tr>
<td><strong>Accuracy</strong></td>
<td>Disclaimer available</td>
<td>51</td>
</tr>
<tr>
<td></td>
<td>Feedback mechanism available for reporting inaccurate data</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>Quality control of data input</td>
<td>43, 53, 68, 70</td>
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<tr>
<td></td>
<td>Collaboration with journal for data submission</td>
<td>60</td>
</tr>
<tr>
<td>Authority</td>
<td>Description</td>
<td>Codes</td>
</tr>
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<td>-----------------------------------------------</td>
<td>--------------------------------------------------</td>
<td>-------</td>
</tr>
<tr>
<td>Reput. of source</td>
<td></td>
<td>43, 70, 72</td>
</tr>
<tr>
<td>Reput. &amp; exp. of editor</td>
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<td>72</td>
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<td>Editorial team</td>
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<td>72</td>
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<tr>
<td>Reput. &amp; exp. of institution res.</td>
<td></td>
<td>51, 53, 62, 68, 72</td>
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<td>Individual author info.</td>
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<td>Length of establishment of site</td>
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<td>60, 68</td>
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<tr>
<td>Genealogy</td>
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<td>72</td>
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<tr>
<td>Comparison</td>
<td></td>
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<td>Cost</td>
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<td></td>
<td>51, 60, 68</td>
</tr>
<tr>
<td>Currency</td>
<td></td>
<td>72</td>
</tr>
<tr>
<td>Frequency of updating</td>
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<td>51, 60, 72</td>
</tr>
<tr>
<td>Ease of use</td>
<td></td>
<td>68, 72</td>
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<tr>
<td>Location</td>
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<td>68</td>
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<tr>
<td>Search facilities</td>
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<td>60</td>
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<td>Speed of access</td>
<td></td>
<td>60</td>
</tr>
<tr>
<td>Coverage</td>
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<td></td>
</tr>
<tr>
<td>General coverage</td>
<td></td>
<td>43, 51, 53, 60, 62, 72</td>
</tr>
<tr>
<td>Scope of coverage</td>
<td></td>
<td>60, 68, 70, 72</td>
</tr>
<tr>
<td>Comprehensiveness of coverage</td>
<td></td>
<td>43, 51, 53, 60, 68, 70, 72</td>
</tr>
<tr>
<td>Databases available</td>
<td></td>
<td>53, 60, 62, 68, 70, 72</td>
</tr>
<tr>
<td>Data analysis facilities available</td>
<td></td>
<td>36, 45, 51, 53, 59, 60, 68</td>
</tr>
<tr>
<td>Pointers to further sites</td>
<td></td>
<td>51</td>
</tr>
<tr>
<td>Uniqueness of coverage</td>
<td></td>
<td>51, 70, 72</td>
</tr>
<tr>
<td>Currency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General currency</td>
<td></td>
<td>43, 51, 60, 68, 70, 72</td>
</tr>
<tr>
<td>Frequency of updating</td>
<td></td>
<td>43, 51, 60, 68, 70</td>
</tr>
<tr>
<td>Update date available</td>
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<td>51, 72</td>
</tr>
<tr>
<td>Update policy in place</td>
<td></td>
<td>43</td>
</tr>
<tr>
<td>Ease of use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General ease of use (e.g. ‘idiot proof’)</td>
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<td>43, 53, 60, 68, 72</td>
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<tr>
<td>Ease of logging-on</td>
<td></td>
<td>68</td>
</tr>
<tr>
<td>Ease of downloading</td>
<td></td>
<td>43, 51, 53, 72</td>
</tr>
<tr>
<td>Ease of navigation</td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>Intuitiveness</td>
<td></td>
<td>53, 60</td>
</tr>
<tr>
<td>User-friendliness</td>
<td></td>
<td>68, 70</td>
</tr>
<tr>
<td>Help information available</td>
<td></td>
<td>68, 70</td>
</tr>
<tr>
<td>Context sensitive help information</td>
<td></td>
<td>53</td>
</tr>
<tr>
<td>Value/usefulness of help information</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Help desk/help line available</td>
<td></td>
<td>68, 51</td>
</tr>
<tr>
<td>Training courses available</td>
<td></td>
<td>51, 68, 70</td>
</tr>
<tr>
<td>Value/usefulness of user support</td>
<td></td>
<td>51, 53</td>
</tr>
<tr>
<td>Facilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact information available</td>
<td></td>
<td>53, 70, 72</td>
</tr>
<tr>
<td>Contact information for researchers</td>
<td></td>
<td>51, 53, 72</td>
</tr>
<tr>
<td>Links to published references, Medline or</td>
<td></td>
<td>43, 51, 53, 60, 70, 72</td>
</tr>
<tr>
<td>other articles</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Improvements to site</th>
<th>53, 60, 68, 70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback facility for suggesting improvements</td>
<td></td>
<td>70</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of site</td>
<td>36, 72</td>
</tr>
<tr>
<td>Presentation, layout and arrangement</td>
<td>General presentation, layout and arrangement</td>
<td>60, 70, 72</td>
</tr>
<tr>
<td>Aesthetically pleasing</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Categorisation of information</td>
<td>72</td>
<td></td>
</tr>
<tr>
<td>Use of advertising</td>
<td>31</td>
<td></td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose</td>
<td>51, 53, 68</td>
</tr>
<tr>
<td>Gateway service to databases</td>
<td>53</td>
<td></td>
</tr>
<tr>
<td>Repository for journal data</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Search facilities</td>
<td>General search facilities available</td>
<td>36, 43, 51, 60, 70</td>
</tr>
<tr>
<td>Alignment checks</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Homology searches</td>
<td>51, 72, 68</td>
<td></td>
</tr>
<tr>
<td>Keyword searching</td>
<td>51, 72</td>
<td></td>
</tr>
<tr>
<td>Sequence comparisons</td>
<td>36, 51, 53, 59, 60, 68</td>
<td></td>
</tr>
<tr>
<td>Search stringency options</td>
<td>60</td>
<td></td>
</tr>
<tr>
<td>Value/usefulness of search facilities</td>
<td>68</td>
<td></td>
</tr>
<tr>
<td>Output options (e.g. e-mail, download, FTP, print)</td>
<td>51, 53, 59, 60, 70, 72</td>
<td></td>
</tr>
<tr>
<td>Details of how much will print out</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

**Table 45: Evaluation criteria: Organisational sites**

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Speed of access</td>
<td>42, 47, 50, 56, 61, 64</td>
</tr>
<tr>
<td></td>
<td>Length of site address</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Location and speed of access</td>
<td>61, 62, 64</td>
</tr>
<tr>
<td>Accuracy</td>
<td>General accuracy</td>
<td>37, 56, 61, 64</td>
</tr>
<tr>
<td></td>
<td>Typographical errors</td>
<td>37</td>
</tr>
<tr>
<td>Authority</td>
<td>Reputation of organisation responsible</td>
<td>42, 47, 50, 61, 56, 64</td>
</tr>
<tr>
<td></td>
<td>Expertise of authors</td>
<td>50</td>
</tr>
<tr>
<td>Comparison</td>
<td>General comparison</td>
<td>62, 64</td>
</tr>
<tr>
<td></td>
<td>Accuracy</td>
<td>37, 64</td>
</tr>
<tr>
<td></td>
<td>Comprehensiveness</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Coverage</td>
<td>42, 61</td>
</tr>
<tr>
<td></td>
<td>Currency</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Ease of use</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Presentation, layout and arrangement</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Quality of graphics</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Speed of access</td>
<td>50</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>42, 47, 50, 56, 61, 62, 64</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>Breadth of coverage</td>
<td></td>
<td>37, 47, 61</td>
</tr>
<tr>
<td>Scope of coverage</td>
<td></td>
<td>37, 50</td>
</tr>
<tr>
<td>Comprehensiveness of coverage</td>
<td></td>
<td>42, 47</td>
</tr>
<tr>
<td>Uniqueness of coverage</td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>Level of detail</td>
<td></td>
<td>42, 47, 50, 56, 61, 62</td>
</tr>
<tr>
<td>Pointers to further information</td>
<td></td>
<td>34, 37, 42, 50, 56, 61, 64</td>
</tr>
<tr>
<td><strong>Coverage of pointers</strong></td>
<td></td>
<td>64</td>
</tr>
<tr>
<td>Selection and evaluation of pointers</td>
<td></td>
<td>64</td>
</tr>
<tr>
<td><strong>Value/usefulness of pointers</strong></td>
<td></td>
<td>61</td>
</tr>
<tr>
<td>Coverage of images</td>
<td></td>
<td>42, 47, 62</td>
</tr>
<tr>
<td>Purpose of images (e.g. advertising)</td>
<td></td>
<td>42, 62</td>
</tr>
<tr>
<td>Necessity of images</td>
<td></td>
<td>47, 42, 64</td>
</tr>
<tr>
<td><strong>Currency</strong></td>
<td>General currency</td>
<td>37, 50, 61</td>
</tr>
<tr>
<td>Frequency of updating</td>
<td></td>
<td>37, 42, 61</td>
</tr>
<tr>
<td>Update date</td>
<td></td>
<td>62, 64</td>
</tr>
<tr>
<td><strong>Ease of use</strong></td>
<td>General ease of use</td>
<td>42, 47, 50, 62</td>
</tr>
<tr>
<td>Intuitiveness</td>
<td>42, 61, 62</td>
<td></td>
</tr>
<tr>
<td><strong>Facilities</strong></td>
<td>Contact information</td>
<td>42, 47, 50, 61, 62, 64, 56</td>
</tr>
<tr>
<td>Maintenance</td>
<td>Improvements</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Motivation of authors</td>
<td>50</td>
</tr>
<tr>
<td><strong>Overall impression</strong></td>
<td>Value/usefulness of information</td>
<td>42, 50, 56, 61, 64</td>
</tr>
<tr>
<td><strong>Presentation, layout and arrangement</strong></td>
<td>General presentation, layout and arrangement (e.g. ‘well-organised’)</td>
<td>42, 47, 50, 56, 61, 62, 64</td>
</tr>
<tr>
<td></td>
<td>Aesthetically pleasing</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Categorisation of information</td>
<td>47, 62</td>
</tr>
<tr>
<td></td>
<td>Length of pages</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Meaningfulness of links</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Clarity of screen layout</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Volume of information per screen</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Clarity of writing</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Viewable without graphics</td>
<td>61</td>
</tr>
<tr>
<td><strong>Purpose</strong></td>
<td>General purpose</td>
<td>47, 56, 64</td>
</tr>
<tr>
<td></td>
<td>Intended audience</td>
<td>37, 42</td>
</tr>
</tbody>
</table>

**Table 46: Evaluation criteria: Search facilities**

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency</td>
<td>Update date</td>
<td>59</td>
</tr>
<tr>
<td>Ease of use</td>
<td>Information on search process</td>
<td>59</td>
</tr>
<tr>
<td>Output facilities</td>
<td>Description of resources retrieved</td>
<td>59</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of service</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Relevance of search results</td>
<td>59</td>
</tr>
</tbody>
</table>

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Table 47: Evaluation criteria: Subject-based WWW sites

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Cost</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Registration required</td>
<td>59</td>
</tr>
<tr>
<td>Authority</td>
<td>Expertise of authors</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Reputation and experience of institution responsible</td>
<td>59</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>42, 47, 59</td>
</tr>
<tr>
<td></td>
<td>Scope of coverage</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Pointers to further information</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Selection and evaluation pointers</td>
<td>59</td>
</tr>
<tr>
<td></td>
<td>Value and usefulness of pointers</td>
<td>59</td>
</tr>
<tr>
<td>Facilities</td>
<td>Contact information</td>
<td>42</td>
</tr>
<tr>
<td>Overall impression</td>
<td>Value/usefulness of site</td>
<td>47</td>
</tr>
<tr>
<td>Purpose</td>
<td>General purpose</td>
<td>42, 47</td>
</tr>
<tr>
<td></td>
<td>Intended audience</td>
<td>59</td>
</tr>
</tbody>
</table>

Table 48: Evaluation criteria: Usenet Newsgroups and discussion groups

<table>
<thead>
<tr>
<th>Criteria heading</th>
<th>Evaluation details</th>
<th>Interviewee No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>Mode of access</td>
<td>61</td>
</tr>
<tr>
<td></td>
<td>Ease of subscription/unsubscription</td>
<td>60, 65</td>
</tr>
<tr>
<td></td>
<td>Closed membership</td>
<td>40, 65, 69</td>
</tr>
<tr>
<td></td>
<td>Volume of traffic</td>
<td>32, 51, 63, 65, 69</td>
</tr>
<tr>
<td>Accuracy</td>
<td>General accuracy</td>
<td>65</td>
</tr>
<tr>
<td>Administration</td>
<td>List administrator</td>
<td>63, 69</td>
</tr>
<tr>
<td></td>
<td>Administrative information available</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>List owner details</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Membership list details</td>
<td>69</td>
</tr>
<tr>
<td>Authority</td>
<td>Reputation of group</td>
<td>69</td>
</tr>
<tr>
<td></td>
<td>Expertise of participants</td>
<td>40, 61, 63, 65, 69</td>
</tr>
<tr>
<td></td>
<td>Expertise of FAQ compiler</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Institution responsible</td>
<td>51</td>
</tr>
<tr>
<td>Comparison</td>
<td>Coverage</td>
<td>63, 65</td>
</tr>
<tr>
<td></td>
<td>Regional or national coverage</td>
<td>63</td>
</tr>
<tr>
<td>Coverage</td>
<td>General coverage</td>
<td>40, 44, 57, 63, 65, 41, 33, 69</td>
</tr>
<tr>
<td></td>
<td>Regional, national or international</td>
<td>33, 63, 65, 69</td>
</tr>
<tr>
<td></td>
<td>Types of materials (e.g. job adverts)</td>
<td>63, 69</td>
</tr>
<tr>
<td></td>
<td>Uniqueness of coverage</td>
<td>40, 65, 69</td>
</tr>
<tr>
<td>Facilities</td>
<td></td>
<td>61, 63, 69</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>--------------------------------------</td>
<td>------------</td>
</tr>
<tr>
<td>Archive available</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Retrospective coverage of archive</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Search facilities for archive (by date, author and subject thread)</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Messages in digest form</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Frequency of digest</td>
<td></td>
<td>69</td>
</tr>
<tr>
<td>Group FAQ available</td>
<td></td>
<td>40</td>
</tr>
<tr>
<td>Group Home Page available</td>
<td></td>
<td>63, 69</td>
</tr>
<tr>
<td>Subject conventions used for message labelling</td>
<td></td>
<td>63, 69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall impression</th>
<th>Value/usefulness of group</th>
<th>32, 41, 57, 59, 62, 65, 69</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Participants</th>
<th></th>
<th>65, 69</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Location of participants</td>
<td></td>
<td>33, 63, 65, 69</td>
</tr>
<tr>
<td>Expertise of participants</td>
<td></td>
<td>40, 61, 63, 65, 69</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Purpose</th>
<th></th>
<th>33, 52, 69</th>
</tr>
</thead>
<tbody>
<tr>
<td>General purpose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intended audience</td>
<td></td>
<td>41, 52</td>
</tr>
<tr>
<td>Intended coverage</td>
<td></td>
<td>52</td>
</tr>
<tr>
<td>Statement of purpose, aims, intended audience and coverage</td>
<td></td>
<td>69</td>
</tr>
</tbody>
</table>
Appendix C:

Evaluation Criteria Document
Evaluation Criteria Document

Criteria and guidelines for evaluating the quality of medical information sources retrieved via the Internet

Alison Louise Cooke

Department of Information and Library Studies
University of Wales, Aberystwyth

March 1999

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Introduction

Information quality and the Internet

A vast quantity and range of sources of information are now available via the Internet which are of potential interest to users of health and medical information. Many of these sources are both valuable and of a high quality, but they are often hidden amongst the huge volume of inaccurate, unreliable and useless material which is also available.

Library and information science (LIS) professionals have long been involved in the selection and evaluation of sources of information, and criteria are available for assessing the quality of a wide range of paper-based and traditional electronic materials. However, the Internet poses new information quality problems, not only in terms of the volume of information which is available, but also the variety of different types of information sources designed for different purposes. Moreover, the frequent lack of introductory details regarding the scope, purpose or authority of sources means that traditional techniques for assessing quality are frequently inappropriate.

What is the Evaluation Criteria Document?

This document is designed to assist LIS professionals in selecting and evaluating the quality of information sources available via the Internet. Detailed evaluation criteria with guidelines on their implementation and use, guidelines on how to approach evaluating different types of sources, and checklists for assessing a wide range of source types, are provided to offer a comprehensive tool for assessing health and medical information available via the Internet.

What is the role and purpose of this document?

The purpose of this document is to act as a guide to the evaluation process by suggesting a range of different criteria which might be used to assess the quality of different information sources. Any assessment of quality is dependent upon a wide range of inter-related factors. These factors are often affected by the needs of the individual seeking information, as well as the nature of the source concerned. Therefore, the document is not prescriptive and ultimately, the evaluator will need to decide which criteria are appropriate under which circumstances, bearing in mind the needs of the users and the nature of the source concerned.

When can this document be used?

There are a number of circumstances when this document might be useful:

- when selecting and evaluating sources for individual library users,
- when selecting and evaluating sources for inclusion in the library collection,
- when training library staff and library users regarding information quality issues,
- when selecting and evaluating sources for subject-based gateway services, and
• when developing and maintaining sites in order to select other material to link to for further information, as well as to ensure the quality of the site itself.

Who is this document aimed at?

The document is aimed primarily at LIS professionals involved in the selection and evaluation of Internet-based information sources. The document will be of particular value to those LIS professionals who are new to using the Internet, or who are less experienced in evaluating the quality of information sources, as it provides a comprehensive guide to assessing information quality. The document will also be of value to experienced evaluators and Internet users as the checklists offer a reminder of the different issues requiring consideration in source evaluation.

Although the document is not aimed primarily at end-users, it will also be of value to them. For example, the document can be used when training people on how to assess the quality of information available via the Internet, and in order to increase awareness regarding the need to think critically about sources of information generally.

Lastly, the document will be of value to those involved in the development and maintenance of WWW sites and other Internet materials, particularly those involved in selecting sites to link to from an organisational or other such home page, and those concerned with ensuring the quality of the site itself.

The document was developed by examining health and medical use of the Internet within the context of higher education and research in the UK. Therefore, the evaluation criteria, the different source types, and the examples which are discussed throughout the document are biased towards this audience. However, it is assumed that the document will be more widely applicable, although users will need to select the appropriate criteria depending upon the individual circumstances.

What are the Evaluation Criteria?

Within the context of this document, 'evaluation criteria' refers to those factors or characteristics of a source of information which affect its quality, value or usefulness. The 'Evaluation Criteria' section of the document covers ten areas of assessment which require consideration in the evaluation of any information source available via the Internet. Each area of assessment is defined, an explanation is offered regarding how to approach evaluation, and a summary is provided of the points to consider during assessment. In addition, quotes from Internet users relating to source assessment are provided in italics.

What are the Source Specific Criteria?

The Internet offers access to a wide range of different types of information sources. Different sources are used and assessed in different ways, and consequently require a different approach to evaluation. Thus, the 'Source Specific Criteria' section of the document provides details of the factors to consider in relation to specific source types. Each source type is defined, an explanation of the factors to consider in relation to each source type is provided, a summary of the points to consider when evaluating each source type is listed, and readers are directed towards any appropriate generic criteria. Again, quotes from users of the Internet relating to assessment of the different source types are provided in italics.
What are the Evaluation Checklists?

Each ‘Evaluation Checklist’ is a comprehensive list of all of the issues requiring consideration in relation to each source type. The lists are drawn from both the generic evaluation criteria, as well as the source specific criteria, and the different points are rephrased as questions designed to be asked during source evaluation. In addition, a checklist of generic criteria is provided for users unable to specify a source type.

How should this document be used?

Newcomers to evaluation should begin by reading through the generic Evaluation Criteria in order to become familiar with source assessment. By reading through this section in its entirety, the user is provided with a thorough grounding in the various factors affecting the quality of an information source available via the Internet.

Users should then decide what type of information source they wish to evaluate. In many cases, this will be immediately obvious from the names given to each source type, but in other situations, users may want to examine the definitions of the different types, either in the Glossary or in the Source Specific Criteria section. Once the user has decided which source type they want to evaluate, they should examine the detailed notes relating to the Source Specific Criteria. These notes also direct the reader to the appropriate generic criteria.

The Evaluation Checklists are intended as the major working tool of the document. Each checklist provides a comprehensive set of questions to be asked in relation to each type of information source. In addition, a generic set of questions is provided as users may not be able to always identify a source type. It is not intended that users attempt to elicit an answer to all of the questions, but rather use the checklists as a point of reference or reminder of the factors which they may wish to consider. Users who are familiar with evaluation, and with the types of information available via the Internet, may find that they can refer immediately to the checklists. Other users will find it beneficial to refer to the detailed explanatory notes, as discussed above.

How was this document developed?

The document was developed as part of a Doctoral Research Project at the University of Wales, Aberystwyth in the UK. Two sets of interviews were held with medical users of the Internet during 1996 and 1997 regarding the different sources they accessed and used while using the Internet to look for work-related information. The interviews were transcribed and the contents analysed in order to develop a theory regarding how end-users assess the quality of the sources they access and use, and to elicit the criteria used when assessing source quality. A first draft of the document was reviewed by information professionals and subject experts to ensure its value and usefulness to the LIS community.
Purpose

Assessing the purpose of a source:

Purpose refers to the aims and objectives of a source.

A range of factors relate to the purpose of a source, including any aims or objectives of the providers, the intended coverage, any limitations in terms of coverage (the scope), and the intended audience. Intended coverage includes not only the intended subject coverage, but also the types of materials intended to be covered. The audience of a source or service is of particular concern as the user may require information designed for a particular audience, such as first year students or a post-doctoral researcher.

Evaluation will involve determining whether any aims, objectives or limitations are stated within the source or service, and examining any such statements. An assessment of the purpose of a source is inextricably linked to an assessment of its coverage. By examining the other criteria described elsewhere in this document, it will be possible to determine whether the intended purpose has been achieved, whether the intended subject areas or materials are covered, and whether the information is appropriate to the intended audience.

Consider:

- whether there is a statement of the intended purpose of the source,
- the aims and objectives of the source,
- the intended coverage, including any limitations to coverage, and
- the intended audience of a source.

Coverage

Assessing the coverage of a source:

Coverage relates both to the subject content and the types of material or information covered by a source.
The principal factor affecting access to and use of any information source is often the subject area covered and the other factors described elsewhere in this document are often of secondary importance.

Factors affecting coverage are the subject areas and types of material covered, the comprehensiveness of coverage within a given area, the range of different subjects covered (the breadth), the level of detail provided about each subject (the depth), as well as any limitations to coverage (the scope). In addition, the retrospective coverage of a source or service (how far back in time material is covered) affects comprehensiveness and may therefore affect the value and usefulness of a source.

Pointers to further information, such as hypertext links to other sites, links into other databases, or references to published literature, might enhance the coverage of a source or service. Assessment relates to the availability of pointers, their coverage, whether they have been selected and annotated, and their overall value and usefulness.

The level of detail or depth of coverage relates to the intended audience of a source, and users are often concerned with whether information is pitched at the appropriate level for their needs. In addition, users are often concerned with whether sources provide "substantial" or "real" information. Thus, assessment relates to whether there is sufficient information and whether information is provided at the appropriate level for the situation in which it will be used.

In order to assess coverage, evaluators will need to browse the source itself, or conduct a search for information on a topic with which they are familiar. They can then determine the comprehensiveness of coverage by considering whether all the aspects of a subject have been covered which they would expect to be covered. Comparison with other available sources might also indicate comprehensiveness (discussed under 'Comparison to other sources'). As mentioned, the coverage of a source is related to its intended purpose; by determining the actual coverage of a source and assessing the level of detail, it is possible to determine whether it meets its purpose and the needs of the intended audience.

Consider:

- the subject areas covered,
- the types of materials covered,
- the level of detail provided,
- the range of different subject areas covered,
- the retrospective coverage,
- the comprehensiveness of coverage,
- the availability of pointers to further sources,
- the coverage of any pointers to further sources,
- whether descriptive information is available regarding any pointers,
- whether pointers are selected and on what basis, and
- the value and usefulness of any pointers to further sources.

It has to tell me what I want to know, or failing that, point me to somewhere that will get me the information that I'm after.
Authority and reputation

Assessing the authority and reputation of a source:

Authority and reputation relate to the ‘authoritativeness’ and ‘reputability’ of a source of information.

An assessment of authority is based upon a range of factors, but in particular, the knowledge and expertise of those producing the information (the author, research group or institution). A source becomes authoritative because it is written by an expert in the subject, or produced by an institution with recognised knowledge and expertise in the field. Authority is inextricably linked to reputation, including the reputation of the source itself, as well as the reputation of those responsible for producing the source. A good reputation is created because a source has been successful, useful or valuable on previous occasions, or because an individual or an institution is well-known for their knowledge and expertise in an area. The authority and reputation of a source affects the extent to which individuals will rely upon the information it contains, and therefore affects perceptions of the relative strength of a source within a field.

A number of techniques can be used to ascertain authority and reputation. Examples include conducting a literature search in order to determine whether an author has published in a particular field before, and whether they have published in refereed journals. The expertise of an author may also be evaluated by determining whether they are a professional working in a field or a lay person with a passing interest in a subject. Reviews in professional journals or via the Internet itself often provide an expert assessment of information sources. Thus, evaluators might examine any available reviews for an indication of reputation and authority.

It may be difficult to identify an individual or institution responsible for some sources available via the Internet. Consequently, evaluators may need to browse through sites or examine the address of a source in order to determine the originating institution. Furthermore, the proliferation of individuals publishing via the Internet compared to refereed journal articles, means that many authors may be unknown. The reputation of the institution is therefore of increased importance and it might be more useful to focus upon well-known and highly reputable organisations as an indicator of quality.

Evaluators might consider authority and reputation too subjective to merit consideration. Furthermore, while there is an assumption that the work of a reputable author, research group or institution is likely to be of higher quality than those that are lesser known, this is not always a useful indicator. For example, reputations and expertise can change, and a newcomer to a field can obviously produce high quality work. The criteria listed in this document are not mutually exclusive and the intrinsic value of a source must be assessed in relation to a range of criteria. Thus, a quality source of information is likely to become well-known and widely used, but authority and reputation must be considered in relation to, for example, coverage, currency and accuracy.
Consider:

- the reputation of the source,
- the reputation and experience of the author, research group or institution responsible for the information,
- the reputation and experience of any other organisations involved in the production of the information, including publishers, sponsors or funding agencies, and
- the availability and authority of any reviews for the source.

Accuracy

Assessing the accuracy of a source:

Accuracy generally refers to the factual accuracy or correctness of a source of information. However, the ease of assessing accuracy is dependent upon the nature of the information. For example, mathematical information can be either correct or incorrect, but theories are subjective and there may be no right or wrong answer. Moreover, the ease of assessing accuracy is dependent upon the knowledge of the assessor because those with some expertise can search a source for information about which they have some knowledge in order to judge its accuracy. Where subject expertise is unavailable, or it is difficult to ascertain factual accuracy, evaluators might usefully conduct a search on a particular subject area and compare the results from different sources.

A range of other factors may affect the accuracy of a source, as well as users' perceptions of accuracy. These are: whether information has been through a refereeing or editing process; whether information is based upon research, and the quality of the research or the evidence basis for information; the potential for bias introduced by authors, publishers or sponsors (evaluators may wish to consider the motivation of those involved in the production of information); the availability of references to published information; and the "professional" quality of a source, as indicated by spelling, grammatical or typographical errors. Some sources provide a facility to send corrections to any inaccurate information, which is not only useful, but also suggests a concern for accuracy. Other factors mentioned elsewhere in this document include the authority and reputation of the source, the knowledge and expertise of any authors or organisations involved in producing the information, and the currency of the information.

The reason for seeking information often affects the importance of accuracy and the sources which are consequently used. For example, if information is to be cited in a publication, a user is more likely to examine refereed journals. Moreover, the Internet is more likely to be used where accuracy is of less importance, such as for background information. Thus, the sources should be evaluated accordingly.
Consider:

- the factual accuracy of the information contained in a source,
- whether there are any typographical or spelling errors,
- the reliability of the original source of the information, including whether there is a research or evidence basis for the information,
- the potential for bias introduced by any individuals or organisations responsible for the information,
- whether the information has been through any quality control processes, including refereeing or editing,
- the availability of any references to published information, and
- the availability of a facility to e-mail corrections to inaccurate information.

Currency and maintenance

Assessing the currency and maintenance of a source:

The currency of a source relates to how up to date it is, and maintenance refers to whether a source is kept up-to-date.

Information currency is a central factor affecting use of the Internet to look for information as there is a perception that the Internet provides access to the most current information possible. Moreover, currency is an important consideration because out-dated information can become inaccurate or misleading.

Currency and maintenance are assessed by examining the date any information was produced, when the source was last updated, when it will next be updated, and the frequency of updating. Such details may be available from the source itself. However, many sources lack this information and evaluators may need to monitor any changes over time. Furthermore, it may be possible to browse through a source in order to create an impression of whether it is generally "well-maintained". Factors to consider include the currency of any hypertext links. Indicators that sites are 'under construction' have previously been viewed negatively as they suggest sources are incomplete. However, such signs suggest the maintenance of sources, and evaluators might consider returning to sources at a later date for reassessment.

Some sources include a policy regarding the frequency of updating and the updating process. Such a policy may state whether an individual or group is responsible for maintaining a source, their knowledge and expertise, and their motivation for doing so. If an individual or group maintains a site voluntarily, they may be more likely to lose interest and therefore not maintain sites in the long term. Contact information for site maintainers is also a useful feature.

The frequency of updating will be of increased importance in relation to some sources and within some subject areas, while for others it may not require evaluation. For
example, a ten year old tutorial on the human anatomy may still be valuable, whereas a site providing access to funding information should be frequently updated in order to ensure the accuracy of the information.

Consider:

- the date the source was originally produced,
- whether the information has been up-dated,
- how frequently the information is up-dated,
- whether the site is generally ‘well-maintained’,
- whether links to external sources are up to date,
- whether there is an updating or maintenance policy for the source,
- whether an individual or group is responsible for maintenance,
- the knowledge and expertise of those responsible for maintenance,
- whether there is any indication that the source is ‘under construction’, and
- whether contact details are available for the site maintainer.

Accessibility

Assessing the accessibility of a source:

The accessibility of a source or service refers to those factors affecting entry into the source itself. The ease of finding information within a source is discussed under ‘Presentation and arrangement’.

I tend to find that if it’s taking a long time, I’ll stop loading and try somewhere else.

Generally, the motivating factor affecting whether a source of information is accessed and used is the subject area covered, as well as the accuracy, currency and level of detail of the information. However, the accessibility of a source can affect the sources which are used, as well as those which are used regularly. The Internet is used because it is convenient, networked computers are often easily accessible, and it is often faster and easier than going to the library. In addition, the Internet is used because the information is not otherwise available locally and users are loathe to pay for information. Thus, users are reluctant to wait for sites to download and find access restrictions, such as registration procedures, frustrating. Obviously, the importance of these issues is dependent upon the needs of the user and the importance of the information to them.

There are a wide range of factors which affect the ease with which sources may be accessed. In particular, factors affecting speed of access include the location of sources, the number and size of any images, and whether thumbnail images have been used to improve access speeds. Local or less heavily used mirror sites can enable faster access to information, as can the mode or modes of access available (whether sites are only available via the WWW, or also via FTP or Telnet). The reliability of access (whether sites are unavailable or inaccessible at particular times) also affects accessibility, as do
sites which frequently move, or sources which have been moved without providing
details regarding their new location.

Various sources available via the Internet are restrictive due to the cost, the language
used, the need for registration or a password, or the need to prove eligibility. Some
sources enable users to bookmark pages in order to save re-entering passwords each time
they use the site, and others provide a route for users who have forgotten their passwords.
Specific software or hardware may be required to access the full 'bells and whistles'
version of any information. Where software is required, it should be easily accessible,
and there should be instructions in the original source for downloading and use.

Consider:

- the speed of access and the effect of location,
- the reliability of access to the source,
- the availability and location of a mirror site,
- the stability of the source and whether it continuously moves location,
- whether sites which have moved provide a forwarding location,
- the use of thumbnail images to improve access speeds,
- any restrictions to access, including registration, subscription, passwords, proof of
  eligibility or membership of an organisation,
- whether it is possible to bookmark an internal address to save re-entering passwords,
- the availability of a route for users who have forgotten their passwords,
- the language of the information,
- the cost of the information,
- the mode(s) of access available and the effect on speed of access,
- whether any additional software or hardware is required to access information, and
- whether additional software is easily accessible, and instructions are available from
  the original source for downloading and use.

Presentation and arrangement

Assessing the presentation and arrangement of a source:

'Presentation and arrangement' refers to the way in which information is presented and
arranged within a source or service.
As with ‘Accessibility’, the presentation and arrangement of information is generally a secondary consideration to its content. Essentially users are concerned with the information contained in a source and will use a source regardless of how the information has been presented. For example, users will “plough through” a badly written or presented article if it is of interest to them. However, a user is more likely to examine information of peripheral interest if it is well-written and presented. Furthermore, presentation and arrangement can add value to sources designed for teaching or other presentation purposes, and can influence the ease of accessing and assimilating the information contained in a source.

Many of the issues relating to presentation and arrangement are a matter of personal taste and often, one user will feel a particular feature is essential while another feels the same feature is redundant. Furthermore, assessment often relates to an overall impression, such as whether there is a “good overall design” or the source is “professionally” presented. Browsing through a source will enable the evaluator to build such an overall impression, and to consider whether a source is clearly, consistently and logically presented and arranged. However, such an impression should be created in the context of the users’ needs and preferences.

There are a wide range factors which affect the ease of finding and using information. Features such as a site map, contents list, index, menu system, or a search facility will be useful. Evaluators should assess the effectiveness of such features by using them to find information within the source. Where such facilities are unavailable, evaluators might consider whether the information has been appropriately and usefully organised. Further considerations are the number of ‘clicks’ required to locate relevant information, whether steps are unnecessarily repeated or whether useful ‘shortcuts’ are available, and whether too few long pages or too many short pages have been used. In addition, icons for navigating sources and the meaningfulness of links between different pages will affect the ease with which a user can move around a source and find information.

The presentation and arrangement of information on the screen can impede the ease of assimilation. Factors to evaluate are whether screens are clearly laid out and aesthetically pleasing, whether there is too much information on each screen, the font used, whether the text is easy to read and whether headings stand out. Furthermore, the style of writing used and whether the source is well-written influences the ease of accessing and assimilating information, as well as some users’ perceptions of source quality generally.

As already mentioned in relation to ‘Accessibility’, the number and size of images can affect speed of access. Thus, evaluators should examine whether images are necessary and whether they add value to the source. Furthermore, the location of graphics in relation to the text will affect their usefulness. A related point is the use of advertising, and whether it has been used appropriately or whether it simply slows access speeds and detracts from the information itself.

Some individuals prefer simplicity in presentation, while others favour the use of graphics and moving images. Under certain circumstances, the Internet may be used to access information because the use of technologies such as frames and Java add value to a source. However, such technologies should be appraised in terms of whether they have been used appropriately, whether they are necessary and add value to a source, or whether they do little more than slow down access. A further factor is whether pages are viewable.
without the use of frames, images or Java for those users without access to the requisite hardware and software.

Consider:

- an overall impression of the presentation and arrangement of the source, including the professionalism of presentation and whether the source has been well put together,
- the clarity of presentation and arrangement, whether the source has been logically presented and arranged, and the consistency of presentation and arrangement throughout the source,
- the availability of a site map, contents list, index or menu system, and its effectiveness,
- the availability of a search facility and its effectiveness,
- the categorisation of information and whether it has been appropriately organised,
- the number of clicks required to access information, whether steps are unnecessarily repeated and whether shortcuts are available to access information,
- the availability of navigation icons or facilities,
- the meaningfulness of links between pages,
- the layout and arrangement of pointers,
- whether individual screens are clear and aesthetically pleasing,
- the font used, whether the text is easy to read and whether headings stand out,
- the style of writing, and whether the source is well-written,
- the length of pages and whether too few long pages or too many short pages have been used,
- the use of graphics, whether they have been used appropriately, and the location of graphics in relation to the text,
- the use of advertising and whether it has been used appropriately, and
- the use of frames, Java, or other technologies, whether they have been used appropriately and to their full advantage, and whether the source is viewable without graphics, frames and Java.

Ease of use and user support

Assessing the ease of use and user support of a source:

‘Ease of use’ refers to the ease with which a source may be accessed and used, and ‘user support’ refers to any additional facilities designed to enable the ease of using a source.

You could use it, having never used it and be up and running within a couple of minutes. You don’t need any specialist knowledge at all.

Generally evaluators will build an overall impression of whether they feel a source is easy to use, particularly while using it in order to investigate the other criteria which have already been discussed. In addition, the factors affecting ease of use are inextricably
linked to the accessibility of sources, as well as the presentation and arrangement of the information. A specific consideration is whether sites are intuitive and user-friendly, or whether training or familiarity are required before a site can be used effectively.

The provision of any user support might enhance ease of use. Examples include the availability of training courses, help information, telephone helplines or contact information. Evaluators should appraise the value and usefulness of any user support, including the level of detail of help information, whether help information is clear, and whether it is context sensitive (i.e. different help information is available according to the point the user is at in using the source). Other considerations are the meaningfulness of system messages, the response times for telephone helplines, and whether there is a response to e-mails or telephone messages.

Consider:

- whether the source is generally easy to use and user-friendly,
- whether the source is intuitive to use, or training and/or experience is required in order to use the source effectively,
- whether the source is easy to search and navigate,
- whether help information is available, the value and usefulness of any help information, and the level of detail and clarity of any help information and whether it is context sensitive,
- the meaningfulness of any system messages, and
- the availability of training courses, a telephone helpline, or any other user support, and the value and usefulness of any user support.

**Comparison to other sources**

**Comparing different sources:**

In any assessment of the quality of a source, it is essential to determine its value in relation to others that are available. Comparisons are often drawn automatically among the different sources that are available in order to decide which is the best to use under certain circumstances.

All of the criteria and evaluation details which have been discussed could be used as points of comparison: sites might be compared in terms of their coverage, authority and reputation, accuracy, currency and frequency of updating, accessibility, presentation and ease of use. Related issues are whether a source provides coverage of a subject which no other sources cover, whether a source has any unique features or facilities, and whether a source provides access to information in a unique format. Moreover, the LIS profession is constantly restrained by a lack of financial resources and evaluators might be concerned with the comparative cost of sources and their relative value for money. In addition, the potential benefits offered by access to information via the Internet should be considered where information is also available in other formats.
Consider:

- whether a source is unique in terms of its content or format,
- the comparative benefits of accessing information via the Internet,
- the coverage and comprehensiveness of coverage in comparison to other sources,
- the level of detail in comparison to other sources,
- the factual accuracy of the information in comparison to other sources,
- the currency and frequency of updating in comparison to other sources,
- the accessibility of sources, particularly the location and speed of access, in comparison to other sources,
- the presentation and arrangement of information, and the search facilities available in comparison to other sources,
- the ease of use in comparison to other sources, and
- the cost and value for money offered in comparison to other sources.

Overall impression

Creating an overall impression:

Users often create an overall assessment of sources, and describe them as “excellent”, “outstanding”, “a phenomenal information resource”, “not very interesting”, or a “source of rubbish”. An overall impression is generally based upon perceptions or experiences of the value and usefulness of a source, or of the value and usefulness of the information contained in a source. Such an impression will be created through familiarity or extensive and frequent use of sources. However, LIS professionals involved in selection and evaluation will rarely have the time or resources to use a source extensively. Evaluators should therefore attempt to create an overall impression while considering all of the other issues. In addition, evaluators might usefully examine any reviews or seek a recommendation from an expert user in the field. By examining such a review or eliciting a recommendation, the evaluator is provided with someone else's overall impression of the value and usefulness of a source.

Consider:

- the overall value and usefulness of the source,
- the overall value and usefulness of the information contained in the source, and
- whether any reviews are available or it is possible to elicit a recommendation from an expert in the field.
Source Specific Criteria

Organisational WWW sites

What is an organisational WWW site?

An organisational WWW site is a site or page available via the WWW which might be described as a ‘home page’ for a particular organisation or institution. This might include a company, university, a professional or a learned society home page.

Obviously there will be some overlap between personal and organisational home pages, particularly as personal home pages often form part of an organisational site. In addition, there may be overlap between subject-based and organisational sites as organisational sites often cover a particular subject area. Users should evaluate individual pages according to their main focus or the purpose for which they will be used.

Assessing organisational WWW sites:

All of the generic criteria apply in the evaluation of organisational sites. However, there are some criteria which require further attention. In particular, the institution concerned is a central consideration and the organisation name is essential and should be obvious from every page within a site.

Users often access organisational pages because they are interested in a specific fact, such as an address or details of a person working at the institution. Thus, an important issue is the availability of contact information, and the ease of locating contact information within a site. Another concern with organisational sites is whether the site is simply a “front page”, or whether it provides access to any “real meat”. Thus, evaluators should focus upon ‘coverage’ and whether there is sufficient information for user concerned.

Evaluators are referred to the checklist for ‘organisational WWW sites’ towards the end of the document for a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.
Also consider:

- whether it is obvious from each page which institution is responsible for the information,
- the availability of contact information, and
- the ease of locating contact information within the site.

Personal Home Pages

What is a personal home page?

A personal home page is a page or site available via the WWW which is designed and maintained by an individual, and which relates to their personal interests. Obviously there will be some overlap between personal and organisational home pages, as personal home pages often form part of an organisational site, and there may be some overlap with subject-based sites. Users should assess individual pages according to their main focus or the purpose for which they will be used.

Assessing personal home pages:

The generic evaluation criteria apply to personal home pages. Evaluators should focus particularly upon the purpose and coverage of pages, the level of detail provided, and the knowledge and expertise of the individual concerned. Personal home pages are often accessed for contact information and such information should be clearly available. Personal home pages are also accessed to pursue information about an individual’s research interests, and where applicable, this information should be available.

A checklist is provided towards the end of the document for ‘personal home pages’, which contains a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.
Also consider:

- the availability of contact information,
- the ease of locating contact information within the site, and
- the availability of information on the individual’s research interests.

Subject-based WWW sites

What is a subject-based WWW site?

'Subject-based WWW sites' are sites or pages available via the WWW which have a particular subject focus. As already mentioned in relation to organisational sites and personal home pages, there will be some overlap between these different source types, and evaluators may find a page within a personal or organisational home page with a particular subject focus. Individual pages should be evaluated according to their focus and intended use.

Assessing subject-based WWW sites:

The general criteria apply in the review of subject-based WWW sites. Obviously, areas of concern are coverage, particularly the subjects and materials covered, and any pointers to further information which can enhance the coverage of a source. The level of detail should be considered as some sources are designed as ‘link sites’ only, while others offer detailed information on particular subject areas. The presentation and arrangement of the source is also of concern as this can impede the ease of locating information. In addition, the knowledge and expertise of those involved in creating and maintaining a site can affect its overall value and usefulness.

Evaluators should also refer to the checklist for ‘subject-based WWW sites’ towards the end of the document for a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.
FAQ files

What is a FAQ file?

A FAQ file is a file of frequently asked questions, with the answers, about a particular topic or issue.

Assessing FAQ files:

Many of the generic criteria are applicable to the evaluation of a FAQ file. Particular considerations are the subject coverage, the knowledge and expertise of the authors, the accuracy of the information, and whether there is any research basis for the information.

There is also a checklist towards the end of the document for 'FAQ files', which lists a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Electronic Journals

What is an electronic journal?

Electronic journals are often an electronic equivalent of a paper-based journal, although an increasing number are produced entirely in an electronic format. Journals are defined as such because they are produced periodically.

Different levels of evaluation are appropriate to electronic journals as the whole journal or individual articles within a journal may require evaluation. The level of evaluation will depend upon the needs of the user, and evaluators should select the appropriate criteria from those described below.
Assessing electronic journals:

Electronic journals and electronic journal articles are often accessed via the Internet because they are not otherwise available or it is more convenient than going to the library. Consequently, they are used and evaluated in the same way as any printed versions, and many of the criteria relate to the evaluation of any journal or journal article, not only those available via the Internet.

The subject area covered by a journal or article is often the motivating factor affecting its use, and many of the criteria already described in relation to 'coverage' and 'purpose' are applicable. Further issues include whether the whole journal is available via the Internet, and if only parts are available, how those parts have been selected. For example, some sites are simply used to advertise the journal concerned and therefore offer limited coverage, such as only the current issue or the contents pages and abstracts. A further factor is the availability of an archive and the retrospective coverage of the archive.

The general factors affecting 'authority and reputation' are applicable. However, the reputation and authority of journals and articles are complex issues. A hierarchy of refereed journals exists within health and medicine based upon a combination of factors, including the reputation of the journal, its impact factor and its length of establishment. The position of a journal within the hierarchy affects perceptions of the quality of the articles published in the journal, and the consequent effect is cyclical: the higher the position of a journal in the hierarchy, the greater the number of articles submitted to the journal, the more stringent the refereeing process and thus, the higher the quality of the published material. Thus, the reputation of a journal affects perceptions of the quality and authority of the journal, and of the articles published in the journal.

One means of assessing reputation is to examine coverage of the journal by Medline. Further aspects are the reputation and experience of the editorial board, the reputation and experience of any sponsors or other organisations involved in the journal, as well as whether there is a printed equivalent for the journal.

However, the reputation of a journal is not always a useful indicator of quality, as indicated by the above quote. A newly established electronic journal, with no paper-based equivalent, may have a reputable editorial board, the support of a reputable learned society (sponsorship by a learned society indicates an academic need rather than a commercial opportunity), and there may be demand for the journal in a particular subject area. Therefore, the various criteria can not be used independently: authority and reputation should only be considered in relation to factors such as coverage, currency and accuracy.

Determining the accuracy of individual articles is problematic because the quality of the research is a central consideration, and the evaluator may not have the necessary
expertise to make such an assessment. Thus, the general factors relating to 'accuracy' are applicable in the evaluation of individual journal articles. Furthermore, the refereeing and editing of journals are considered essential quality filters which increase confidence in the accuracy and reliability of information, and one consideration is the stringency of the refereeing process. This might be determined by examining rejection rates for the journal.

The factors relating to 'currency and maintenance' are applicable. Further factors are the length of time between article acceptance and publication. In order to establish this, the evaluator may need to browse previous issues to generate an average. In addition, due to the nature of electronic information, it may be possible to revise and update articles. If an article has been revised, the details should be clearly visible.

The 'accessibility' and the 'presentation and arrangement' issues are generally applicable, although there are some additional considerations. Cost is a central concern in any assessment of electronic journals, and evaluators should consider the charging options available, as well as the availability of any free information. Where an archive is available, there should be a search facility which is searchable by subject, author and journal volume, and it should be possible to limit searches by date range. Furthermore, an index for the site as a whole will be useful, and it should be easy to locate the latest copy of a journal, as well as any other copies. A contents list should be available for each issue, and there should be links between the citations at the end of an article and the main body of the text. Additional features which take advantage of the electronic format include the ability to update articles, to e-mail comments on articles, and to link directly into other electronic sources. Where such facilities are available, they should be appraised according to whether they add value to the source.

The 'comparison' issues are applicable. In particular, evaluators might consider the advantages of the electronic format over paper-based journals, the relative currency of an electronic version compared to the printed version, including the frequency of updating, and the coverage of the paper-based journal by the electronic version.

Finally, evaluators should refer to the checklist for 'electronic journals' which is provided towards the end of the document as a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.
Also consider:

- whether the whole journal is available via the Internet, and if only parts are available, how those parts have been selected,
- the impact factor of the journal,
- the genealogy of the journal, including length of establishment and the availability of a paper-based equivalent,
- the reputation and experience of the editorial board,
- the stringency of the refereeing process,
- whether the journal is indexed in *Medline* or any other appropriate bibliographical databases,
- the time delay between article acceptance and publication in the journal,
- whether an archive is available, whether the archive is searchable by subject, author and/or journal volume number, whether it is possible to limit searches by date range, and the overall usefulness of the search facility,
- the availability of a site index, and the ease of locating individual journals within the site,
- the availability of a contents list, and the ease of locating individual articles within the journal,
- the availability of links between citations and the main body of the text in each article,
- the availability of any additional features such as to update articles, to e-mail comments on articles, or to link directly into other electronic sources, and whether they add value to the journal,
- the frequency of updating of the electronic journal in comparison to its paper-based equivalent, and
- the advantages of the electronic journal in comparison to the paper-based equivalent.

**Computer Assisted Learning Materials**

**What are Computer Assisted Learning Materials?**

Computer Assisted Learning materials are generally multi-media packages which are designed to enhance teaching and learning through the use of computing technology.

**Assessing Computer Assisted Learning Materials:**

CAL materials are accessed and used via the Internet because it is a convenient way of accessing teaching materials and may offer time-saving if materials do not have to be developed locally. CAL materials are also used because educators wish to offer materials in an innovative format in order to enhance the learning experience. While many of the generic criteria apply, evaluators should also focus upon the areas described below.
Teaching materials are likely to be used as part of a course and therefore, the subject coverage, the level of detail and the intended audience, are important. In addition, accuracy, currency and authority will also require examination. One further concern in relation to ‘authority’ is whether material is provided commercially or by an academic institution as this can affect perceptions of credibility.

Access to teaching materials via the Internet potentially offers advantages to users in terms of the speed and ease of accessing information. However, students may have limited network access or access via slow computers. Therefore, the ‘accessibility’ of CAL materials is of concern and the generic ‘accessibility’ issues are applicable. A further issue is whether it is possible to download a self-contained package using FTP for local use, or whether the materials are accessed via a WWW site. The mode of access should be considered in relation to speed of access, as well as ease of use.

The generic ‘presentation and arrangement’ issues apply. In addition, evaluators might assess the availability of any features or facilities which take advantage of the multimedia format. Examples include tutorials, self-test materials, images and video graphics. Considerations include the availability of such features, whether they add value to the content, and whether they enhance the learning experience.

In any assessment of the quality of a CAL package, it is essential to compare the package to other material. A CAL package might cover a particular area, present information in an innovative format, or offer unique features or facilities.

A checklist for ‘Computer Assisted Learning materials’ is provided at the end of the document, listing a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Also consider:

- whether material is provided commercially or by an academic institution,
- whether it is possible to download a self-contained package using FTP for local use, or whether materials are accessed via a WWW site,
- the effect of the mode of access on the speed of accessing material,
the effect of the mode of access on the ease of using material,
the availability of any features or facilities which take advantage of the multi-media format, such as tutorials, self-test materials, images and video graphics, and
whether any features or facilities add value to the content and enhance the learning experience.

Image-based information sources

What is an image-based information source?

'Image-based information sources' refers to the use of images as a source of information. Evaluation may be required for an individual image, a whole site which provides access to images, or an individual image which forms part of an otherwise text-based source of information. Evaluators should select the appropriate criteria from those described below, depending upon the circumstances of evaluation.

Assessing image-based information sources:

The Internet is increasingly being used as a source of graphical information within health and medicine. Reasons for use include to illustrate a piece of work, for presentations or to supplement teaching materials. Many of the generic criteria apply in the evaluation of image-based sources, but there is also a range of issues which are peculiar to images.

In relation to 'coverage', evaluation should include the topics covered by individual images, the range of different subjects covered as a whole, and the comprehensiveness of coverage within an area. For example, a site might contain images of foetal development, and considerations include whether all the major stages have been covered, and the number of images for each stage. The availability of explanatory text about any images can enhance their value. Factors include the level of detail, the balance of text and images, and whether the explanatory text is sufficient for the needs of the user concerned. In addition, pointers to further information or further images may enhance the coverage of a source.

The nature of images as a source of information may mean that 'reputation', 'authority' 'accuracy' and 'currency' are less important. However, a particular perspective may result in biased images, or images may become outdated and a site which is regularly updated will be of more value. Factors for consideration therefore include whether there is a date of when each image was taken and produced, whether images will be updated, and the motivation and expertise of those responsible for the images. Related issues are the availability of contact and copyright information.

Sometimes the diagrams that are there are ... in a graphics format that may not be suitable for what I require.
The generic 'accessibility' issues are applicable. Other considerations are the computer storage format of images (the format must be compatible with the software and hardware available to the user), the storage size of images and the impact of size and format on access speeds. Sites might usefully provide information on the storage size and format, provide a local mirror site, or use thumbnail images to improve access speeds.

The 'presentation and arrangement' of a site providing access to images will affect ease of access and use, and the generic criteria apply. A particular issue is the availability of navigational features to assist users in moving between different images.

Further considerations are the clarity of images, whether images are in colour or black and white, and whether images are two dimensional, three dimensional or video clips. Information on the image resolution may be available (the resolution will affect the quality and clarity of images). However, the quality of images may be difficult to reconcile with the speed of access as the more sophisticated the images, the longer they will take to download, and the more computer storage space they will require.

An assessment of the value of images, or sites providing access to images, will require comparison with others that are available. For example, evaluators could compare images to those available in a standard text-book. Further issues are whether a site offers access to a unique source of images, or provides access to images in a unique or innovative format.

Evaluators should also refer to the checklist for 'Image-based information' provided at the end of the document for a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Also consider:

- whether explanatory text is available,
- the level of detail provided in any explanatory text, whether the explanatory text is sufficient for the needs of the user concerned, and whether the explanatory text enhances the value of the images,
• the balance of text and images,
• whether there is a date of when each image was taken and produced, and whether images will be updated,
• the motivation and expertise of those responsible for the images,
• the availability of copyright information,
• the computer storage format of images,
• the storage size of images, and the availability of information on the storage size,
• the clarity of images,
• whether images are in colour or black and white,
• whether images are two dimensional, three dimensional or video clips, and
• the image resolution.

Usenet Newsgroups and discussion groups

What are Usenet Newsgroups and discussion groups?

‘Usenet’ is a world-wide system of ‘Newsgroups’ or bulletin boards, each focusing upon a different subject area. The groups are hierarchically arranged according to the topics they cover. In order to access or post a message to a Newsgroup, a Usenet News reader has previously been required, but Newsgroups may now be accessed using a WWW browser such as Netscape Navigator. ‘Discussion groups’ are e-mail based conference systems, each with a specific subject focus, which enable subscribed users to discuss issues of mutual interest.

Usenet Newsgroups and discussion groups are differentiated by the mode of access. However, there are a number similarities in the nature of the information disseminated and in the ways in which they are used. Furthermore, many discussion groups are available via Usenet, and vice versa. Thus, both types of sources are discussed here, although distinctions have been drawn in the criteria where appropriate.

There are three ways in which groups might be used: users may wish to post a query to a group, to ‘lurk’ in a group in order to follow the discussion, or to browse previous discussion using an archive. Thus, evaluators may be concerned with assessing an individual message or with evaluating the whole group as an information source, and the appropriate criteria should be selected from those described below.

Assessing Usenet Newsgroups and discussion groups:

The criteria relating to ‘purpose’ are applicable. Some groups have a Home Page or FAQ which might provide useful information about the intended subject coverage and audience. In addition, the intended coverage of a group can often be ascertained from the group’s name.

The generic criteria relating to ‘coverage’ are applicable to the evaluation of either individual messages or a whole group. Particular issues are the types of material covered...
as groups might be used to post job adverts, new WWW sites of interest, or information about meetings. Evaluators may need to browse recent messages in order to determine whether discussion focuses upon the intended area. Other considerations are whether real exchange and discussion takes place via a group, as indicated by the proportion of questions answered and whether discussion threads develop, or whether the group largely comprises one-off messages. If an individual is responsible for monitoring or moderating the content of a group, the discussion might be more focused on the intended subject area. It is often possible to determine whether a group is moderated by examining the discussion itself or by consulting any introductory information. The availability of an archive will affect the usefulness of a whole group as an information source. One consideration is the retrospective coverage of the archive as archives may be maintained for as little as a month.

I wanted to get the opinion of other people, my peers as to what they would do. You get about eleven hundred people on this world-wide so that's a phenomenal information resource.

The participants of a group can have an impact upon its overall value and usefulness, as well as the topics which are discussed. Usenet Newsgroups and discussion groups are useful for contacting a large number of people, for contacting people all over the world or in a particular locality, or for contacting a specific sub-set of a population (for example, General Practitioners in the UK). Therefore, factors requiring examination are the number of people involved, whether the group is local, national or international, as well as the actual audience of the group. Such criteria are more applicable to discussion groups where participants subscribe, and there may be a publicly viewable membership list on the group Home Page. However, where a list of group members is unavailable, or in relation to Usenet Newsgroups, evaluators could examine recent messages as an indication of the participants.

Hearing it from the lips of someone who has established his credentials within the journals is in a way more powerful because it's from the horse's mouth, and why should he suddenly start telling lies if he's got an international reputation?

Groups are sometimes used to seek advice or opinions from others. Examples include asking others about their personal experiences with a piece of equipment or polling them on their attitudes towards a treatment or drug. Consequently, it may be necessary to establish the likely knowledge and expertise of the participants as a whole, as well as the expertise of an individual author. Similarly, a group may have a reputation as a useful source of ideas and opinion, and reviews may be available to indicate this.

It would be just like talking to someone really.

The questionable accuracy of information retrieved via Usenet Newsgroups and discussions groups is often considered their main drawback. However, users often do not expect to rely upon the information to the same extent they would expect to rely upon a journal article because the different sources are used for different purposes. Essentially, the groups are used, not as a source of quality information, but as a useful way of contacting people and seeking their advice or opinions. The information is treated as a conversation and relied upon to the same extent a conversation is relied upon. Some criteria relating to 'accuracy' are relevant (for example, if a refereed journal article is cited in a message, the information will be considered more reliable), but evaluators should bear in mind the informal nature of the information.
The issues relating to 'currency and maintenance' are not generally applicable, although evaluators may wish to consider the date of an individual message if it is being independently assessed.

The 'accessibility' issues are generally not applicable. Those issues which require consideration are whether there are any restrictions to access (some discussion groups have a closed membership), and the mode of access (whether a discussion group or Usenet Newsgroup). A further concern is the likely volume of traffic to a group as in some circumstances, it can be unmanageable. In order to monitor the volume, evaluators could browse a Newsgroup, examine the archive where available, or subscribe to a discussion group for a limited time period. The availability of facilities for searching an archive will affect the accessibility of the information, and it is useful if the archive is searchable by date, author and subject thread. A searchable archive may be available from a group Home Page, or files of discussion might be transferable from an FTP site. Another useful facility is the ability to receive messages in digest form (users are able to receive the day’s or week’s postings as one message). The frequency of the digest would consequently be a consideration.

The issues relating to 'presentation' and 'arrangement', as well as 'ease of use and user support' are also not generally applicable. Alternative considerations are whether the group has adopted conventions for labelling messages according to whether they provide information about jobs, conferences, etc., as this can affect the ease of sifting through the volume of material. Other issues relate to group administration. If there is an individual responsible for list administration, any problems which arise, such as mail loops (an individual’s e-mail system automatically replies to a group, they receive that reply, the system automatically replies back again, etc.), may be dealt with more quickly. Likewise, administrative and help information may be available via a Home Page or FAQ, or might be posted regularly to the group. Such information should cover, not only the intended coverage and audience as mentioned, but also how to subscribe, unsubscribe and post messages to the group. The usefulness of any such information should be assessed.

Evaluators should also refer to the checklist for 'Usenet Newsgroups and discussion groups' provided at the end of the document for a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- comparison to other sources, and
- overall impression.

Also consider:

- whether there is a group Home Page or FAQ,
- whether real exchange and discussion takes place or whether the group largely comprises one-off messages,
- whether the group is moderated,
whether an archive is available or whether files of discussion are transferable from an FTP site, and the retrospective coverage,

the availability of facilities for searching an archive, including by date, author and subject thread,

whether a list of group members or participants is available, the number of participants of the group, whether the group is local, national or international, and the likely knowledge and expertise of the participants as a whole,

the reputation and expertise of the author of an individual message,

the date of individual messages,

whether there are any restrictions to accessing or subscribing to a group,

the likely volume of traffic, and whether it is ‘manageable’,

whether it is possible to receive messages in digest form, and the frequency of the digest,

whether the group has adopted conventions for labelling messages,

whether there is an individual responsible for list administration, and

whether administrative and help information is available, and the coverage and usefulness of the information.

Current Awareness Services

What are Current Awareness Services?

Current Awareness Services (CAS) are services which are designed to alert users regarding a particular topic or issue. Various types of CAS are available via the Internet, including services for the contents of current journals, or mailing lists on sources of funding information or job advertisements. Essentially, the criteria used will depend on the nature of the service being evaluated and the needs of the user concerned, but evaluators might usefully read the notes below.

Assessing Current Awareness Services:

Many of the generic criteria are applicable to the evaluation of CAS. However, the factors affecting ‘currency and maintenance’ are dependent upon the nature of the CAS. If the CAS is available via a WWW site, the generic criteria are applicable, but the frequency of distribution is the only issue which relates to mailing lists.

One further consideration is the timeliness of the information. ‘Timeliness’ refers to whether information is received when it is most needed. Considerations include whether journal contents information is received in synchronisation with publication of the journal itself, and whether funding information is received prior to the submission dates.

The factors relating to ‘coverage’ are applicable. A further issue is whether it is possible to submit a profile to the service in order to restrict the information received to the
subjects of most interest. Where such a facility is available, it can alleviate the problems associated with information overload.

The evaluation factors relating to ‘accessibility’, ‘presentation and arrangement’ are again dependent upon the format of the CAS. Most of the issues will apply to services available via the WWW. However, only certain issues will apply to services available as a mailing list (mode of access, restrictions to access, language and cost). One additional issue is the ability to identify the subjects covered by individual postings, as this enables the user to easily identify whether they wish to read the material.

Evaluators should also refer to the checklist for ‘Current Awareness Services’ provided at the end of the document for a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Also consider:

- the frequency of distribution of a mailing list,
- the timeliness of the information provided by the service,
- whether it is possible to submit a profile to the service in order to limit the information received to particular subjects, and
- the ability to easily identify the subjects covered by individual postings.

FTP Archives

What is an FTP archive?

An FTP archive is a collection of files of software, textual or numerical data, which can be accessed and retrieved using FTP. FTP stands for the File Transfer Protocol, the software which enables users to transfer files from one computer to another. FTP archives were previously only accessible using an FTP browser. However, it is now possible to access them using a WWW browser such as Netscape Navigator.

Reasons for using an FTP archive include to download an upgrade to existing software, to download software to read a particular file (such as a journal article), or to download...
software for accessing the Internet. The issues discussed relate to an evaluation of the sites themselves, rather than the software or data, as these are outside the scope of this document.

Assessing an FTP archive:

The generic criteria relating to 'purpose' and 'coverage' are applicable. The types of software or data available from a site will obviously be a central consideration in its usefulness. Other aspects include the format of any software, and whether software for different platforms is available. In addition, coverage might include upgrades, trial versions, and older versions of data or software. The availability of a mirror site is often useful, and evaluators may wish to compare the coverage of the mirror site with the original site.

Some of the factors affecting 'authority and reputation' are applicable. For example, a site may have an excellent reputation as a source of software or data. In addition, sites are accessed because of the reputation of the individual or institution responsible. For example, if an upgrade to Apple software is required, the Apple site would obviously be the most authoritative source. A further issue is the origin of the data or software, and information should be available indicating this.

The issues relating to 'accuracy' are not applicable to FTP archives. However, the site may provide some quality control or virus checking facilities for software or data which would obviously provide a useful filter.

As mentioned, sites may be used to access upgrades. Thus, many of the 'currency and maintenance' issues are applicable. The user needs to know how regularly a site is updated, and whether there is a time delay between software development or data generation and availability on the site. Other useful features are information on software version numbers and the expiry date for trial versions. If a site is 'under construction', an evaluator may need to reassess the site at a later date to determine any changes and whether those changes enhance the value of the site. As with other sources, contact information for the site maintainer is useful as a user may wish to know when the next version of software will be available.

The Internet is often used because it is a fast and convenient means of accessing files and data. Thus, the 'accessibility' criteria are applicable. However, many of the 'presentation and arrangement' factors are not applicable unless an archive is accessed via the WWW. Issues which are of concern are the availability of information on file sizes, and the availability of a search facility which allows the user to browse or search by filename, platform, or type of application.

The questions relating to 'ease of use and user support' are generally applicable. In particular, the availability of help information, often in the form of 'README' files, will be particularly useful, and evaluators should consider the value of the information provided. Where a search facility is available, help information might be of value. Moreover, evaluators might usefully compare an archive to others available in order to determine whether the archive provides unique coverage of software or data, or whether there are any particularly useful features or facilities which assist in file transfer.

Evaluators are also referred to the checklist for 'FTP Archives' provided at the end of the document for a comprehensive set of questions for use in evaluation.
Refer to:

- purpose,
- coverage,
- authority and reputation,
- currency and maintenance,
- accessibility,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Also consider:

- the format of any software, and whether software for different platforms is available,
- whether upgrades, trial versions and older versions of data or software are available,
- whether a mirror site is available and the coverage of the mirror site in comparison to the original,
- whether any quality control or virus checking facilities are available,
- whether there is a time delay between software development or data generation, and availability via the archive,
- the availability of information on file origins, software version numbers, the expiry date for trial versions, and file sizes,
- whether contact information is available for the site maintainer,
- the availability of a search facility, and whether it allows the user to browse or search by filename, platform, or type of application, and
- the availability of help information or ‘README’ files, including help information for any search facilities, and the value and usefulness of the information provided.

Databases and databanks

What are databases and databanks?

‘Databases’ or ‘databanks’ are generally a collection of data items, whether numeric, textual or image-based. There are a wide range of sources available via the Internet which might be described as such, including library catalogues or databases of funding sources. The terms ‘database’ and ‘databank’ are used synonymously, and the issues described here refer to any type of database.

‘Bibliographical databases’ and ‘molecular biology sources’ are obviously databases which are heavily used within health and medicine. Likewise, many ‘search facilities’ for retrieving Internet materials are also databases. However, there are a range of criteria which are peculiar to these source types, and readers are referred to the sections relating specifically to them.
Assessing databases and databanks:

Many of the generic criteria are appropriate in the evaluation of databases and databanks. In relation to coverage, evaluators might also examine the amount of information offered in each record of the database, and consider whether the amount of information is sufficient for the user concerned.

The presentation and arrangement of a database will affect whether or not a user can access the information it contains. Additional issues relate to the searching and browsing facilities that are available. The facilities will be dependent upon the individual source and users should evaluate them according to their usefulness, effectiveness and ease of use. Further points are the ease of outputting and downloading data from the database, including the ability to upload data into another package. However, the need to upload data will depend upon the nature of the data and the needs of the user.

Some databases will be in the form of a catalogue where material is available for loan or purchase. Under such circumstances, it should be possible to order material directly via the source, and contact information should be readily available.

Much of the information required to conduct an evaluation will be available in any introductory information or help files. In addition, evaluators will need to carry out a number of searches in order to make an assessment.

Evaluators should also refer to the checklist for ‘Databases and databanks’ provided at the end of the document for a comprehensive set of questions for use in evaluation.

Refer to:
- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Also consider:
- the amount of information offered in each record of the database,
- whether the amount of information in each record of the database is sufficient for the needs of the user,
- the searching and browsing facilities that are available, and whether any searching and browsing facilities are useful, effective and easy to use,
- the ease of outputting and downloading data from the database,
- the ability to upload data into another package,
- whether it is possible to order material directly from the database, and
- the availability of contact information.
Bibliographical databases

What are bibliographical databases?

'Bibliographical databases' are generally databases of references to journal articles, books, conference proceedings, etc. Various bibliographical databases are now available via the Internet, some of which were previously available electronically or as printed indexes, while others have been developed specifically for use via the WWW or Telnet. Many of the criteria refer to bibliographical databases generally, while others are peculiar to the use of bibliographical databases via the Internet.

Assessing bibliographical databases:

The generic criteria are applicable to the evaluation of bibliographical databases. However, there are a wide range of issues which are specific to them.

In relation to 'coverage', evaluators should examine the subject areas and types of materials covered, the comprehensiveness of coverage and the retrospective coverage of the database. Comprehensiveness might be assessed by determining the number of journals or other materials indexed within a particular area. A facility to determine the material covered will be of value, else evaluators could conduct a number of searches relating to an area with which they are familiar. The coverage of a database will also be enhanced by links to any other electronic sources, such as full-text articles or scientific data. During recent years, various versions of Medline have been made freely available via the Internet, and one consideration is the difference between the coverage of any free versions and the original Medline.

Bibliographical databases are used via the Internet to save time. If a user can make an informed assessment of the relevance of a publication from the information provided by a database, then that database will be of more value. Consequently, the level of detail provided in each record, and the value and usefulness of that information, is a consideration. Further factors are the amount of information offered, including whether references only or abstracts are available, and for what percentage of the database abstracts are provided. The database provider may stipulate the percentage of records which have abstracts or the evaluator could examine a sample of records. A further aspect is whether the abstracts have been truncated by word length, as this can be frustrating where valuable information has been omitted.

The issues relating to the 'reputation' of the database and the 'authority' of any institutions concerned with its production are of interest. Evaluators could examine a guide to reference works, such as Walford's, as inclusion of a database in such a guide indicates its reputation. Furthermore, evaluators may wish to determine who the abstracts are written by as an indication of their authority.
The generic criteria relating to ‘accuracy’ are not generally applicable. However, citation accuracy is essential in the evaluation of a bibliographical database, and any typographical or spelling errors, particularly in medical terms, can affect recall effectiveness. The evaluator could examine a number of references to assess their accuracy, or where possible, examine the index for commonly misspelled terms.

In order to assess ‘currency’, it may be possible to ascertain how frequently the database is updated from any introductory information or by searching the database for recent publications. Additional factors are the time delay between publication of materials and appearance in the database, and similar techniques should be used.

Many of the issues discussed in the general section relating to ‘accessibility’ and ‘presentation and arrangement’ are appropriate to bibliographical databases, particularly the searching and browsing facilities that are available. Certain features should be available, such as the ability to search by author, title or subject keyword, as well as the ability to limit by publication type and date range. Some versions of Medline offer more sophisticated searching facilities such as automatic keyword mapping, and the ability to amend and re-run search statements, and the BIDS ISI databases offer a citation search option. Any available search or browse facilities should be assessed in terms of their effectiveness, ease of use and value.

Many users maintain their own databases of references. It is therefore useful if the data can be easily downloaded from the database and uploaded into a reference manager or word processor without the need for any data conversion. In addition, some databases offer facilities to output results via e-mail, and the available output options should be considered.

Evaluators should also refer to the checklist for ‘Bibliographical databases’ provided at the end of the document for a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Also consider:

- the comprehensiveness of coverage within a particular area, and whether information is available regarding the material which is indexed in the database,
- where different various versions of the same database are available, the differences in coverage,
- the level of detail provided in each record of the database, and the value and usefulness of that information
- whether references only or abstracts are available, for what percentage of the database abstracts are provided, whether the abstracts have been truncated by word length, and the authority of the abstracts,
- whether there are any typographical or spelling errors, or errors in citations,
- the time delay between publication of materials and appearance in the database,
- the different searching and browsing facilities available, including the ability to search by author, title or subject keyword, to limit by publication type and date range, and any additional features,
- the effectiveness, ease of use and value of any searching and browsing facilities, and
- the ability to easily output and downloaded data into a reference manager or word processor.

Molecular biology sources

What are molecular biology sources?

The Internet provides access to a vast quantity of molecular biology data, and 'molecular biology sources' refers to any collection of such data which is of interest to molecular biologists, such as genetic sequence and protein databanks.

Some sites offer a gateway service to a range of different databases, while others offer access to an individual database. Thus, evaluators will need to select the appropriate criteria from those described according to the nature of the source being evaluated.

Assessing molecular biology sources:

Many of the generic criteria are appropriate. However, there are a number of additional issues which require attention when assessing molecular biology sources.

In relation to 'coverage', considerations include the databases covered by a whole site, as well as the coverage of individual databases. Numerous sites also offer access to computing facilities for data analysis, and the coverage of such facilities will also require consideration. Features which may enhance the coverage of a site include links into further sources of information, such as links into other databanks or into Medline for access to the published literature.

Many of the factors relating to 'authority and reputation' require assessment in relation to molecular biology sources. Some sources are highly reputable, or are provided by reputable institutions, and the genealogy of the source could be considered. In addition, Nucleic Acids Research provides an annual review of many databases in the field which can provide a useful indicator of reputation, as well as coverage. Where the names of the researchers or institutions responsible for data are available, users will be able to make an
assessment of their reputation and experience, and therefore, assess the authority of the data.

There's always an element of doubt about the DNA sequences because the only people who check most DNA sequences are the people who sequenced it. It's not as if they sent that sequence into a database and somebody else then goes and sequences the same piece of DNA to check it.

There are a number of stages in the development of a source where inaccuracies may occur, such as during the research itself through the misinterpretation of results, or a typing error during data input which can distort the data. The site may offer a warning of likely inaccuracies, there may be quality control mechanisms in place (such as a refereeing process or an editorial board), or there may be a facility to correct inaccurate data. Links to any published papers about the data would add credibility, and the availability of researcher details might be used as an indication of accuracy. Furthermore, some sites are provided by a refereed journal as a repository for published data.

For many users of molecular biology data, accuracy is not an issue. Sites are used to determine whether an area of research has already been investigated, and if accurate data is required, users will often conduct the research themselves. Furthermore, accuracy is not always an issue in deciding which site to use because the data may have originated from the same researchers. The availability of those features and facilities described above will obviously affect the ease of assessing accuracy, and therefore the usefulness of the site, but evaluators should bear in mind the needs of the user as well as the limitations of the data.

The criteria relating to 'currency and maintenance', 'accessibility', 'ease of use and user support' are generally applicable. Restrictions to access are of particular concern as many sites require proof of eligibility, registration and a password, and there may be a charge for access.

There are a range of additional elements to 'presentation and arrangement' which might require consideration, such as the range of specialist search facilities (keyword access by gene or organism name, item accession number search, sequence comparison and alignment, homology searches). Users should be able to specify the stringency of their search according to the nearness with which they wish their data to match the data in the database. Output facilities should include an option to return results via e-mail, FTP, print or download. In addition, data should be represented using standard characters to facilitate searching and downloading. Some sites offer three dimensional structures or images which can be useful where data is used for presentation or teaching purposes.

There is a degree of choice, but as far as quality is concerned, it's basically just the same information.

The data does exist in several locations, but the difference will only be in how recently it's been updated.

The volume of molecular biology data being produced is now far in excess of what is publishable in any printed sources and the Internet consequently offers access to a unique source of data. However, many sites are similar in their coverage, particularly as the data is deposited from the same original sources. Thus, coverage is not always a useful point of comparison, and other factors such as frequency of updating and location are of increased importance.
A checklist for 'Molecular biology sources' is provided at the end of the document which evaluators might usefully examine for a comprehensive set of questions for use in evaluation.

Refer to:

- purpose,
- coverage,
- authority and reputation,
- accuracy,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Also consider:

- the availability of the names of the researchers or institutions responsible for the data,
- whether any specialist search facilities are available, such as keyword access by gene or organism name, an item accession number search, sequence comparison and alignment facilities, or homology searches,
- the ability to narrow searches or specify the stringency of a search,
- the output facilities available, including via e-mail, FTP, print or downloading,
- whether data is represented using standard characters, and
- the availability of three dimensional structures or images.

Search facilities

What are search facilities?

Within the context of this document, 'search facilities' specifically refers to the range of tools and facilities, including search engines and subject trees, which are designed to search the information available via the Internet, and the WWW in particular.

Assessing search facilities:

Many of the generic criteria are appropriate to the evaluation of search facilities and evaluators should select the appropriate criteria from those described. In particular, evaluators might examine the subject areas and the types of materials covered, including whether the facility only searches information available via the WWW or whether other materials are also searched (for example, Usenet Newsgroups). Other questions relate to the comprehensiveness of coverage: some services stipulate an estimated percentage
coverage of the WWW, while others are selective in their coverage of sources within a particular subject area.

The searching and browsing facilities which are available should be assessed in terms of their effectiveness, ease of use and usefulness. Due to the volume of material available via the Internet and consequently covered by such search tools, a particular concern is the ability to narrow searches by subject area or type of information. Again, the effectiveness, ease of use and usefulness of any such facilities should be appraised. Furthermore, the search facility should seek to remove any duplicates from the search results. Some facilities may enable users to browse by subject categories, and the usefulness of the subject headings or categories will require examination. Likewise, the display format and the volume of information provided about the retrieved sources will require assessment, including whether sufficient information is provided for the user’s needs.

With the exception of the reputation of the source itself, the factors relating to ‘authority and reputation’ are irrelevant. Likewise, apart from typographical errors, ‘accuracy’ is not applicable. However, the ease of using the facility requires assessment, and the generic criteria for ‘ease of use and user support’ are applicable. In addition to the availability of help information, there should be details on the updating of the database, how the service searches for information, and how sources are retrieved.

There is a checklist for ‘search facilities’ towards the end of this document which should also be referred to for a comprehensive set of questions for use in evaluation.

Refer to:
- purpose,
- coverage,
- currency and maintenance,
- accessibility,
- presentation and arrangement,
- ease of use and user support,
- comparison to other sources, and
- overall impression.

Further considerations:
- whether the facility only searches information available via the WWW or whether other materials are also searched,
- the searching facilities which are available, and the effectiveness, ease of use and usefulness of the searching facilities,
- whether there are any facilities to narrow searches, and their effectiveness,
whether the duplicates are automatically removed from the search results,
whether it is possible to browse by subject categories, and the usefulness of any subject headings or categories,
the display format and the volume of information provided about sources which are retrieved, and whether there is sufficient information to make an assessment of relevance, and
whether information is provided on the updating of the database, how the service searches for information and how sources are retrieved.
Evaluation checklists

Generic criteria

Purpose
- what are the aims and objectives of the source?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered?
- what level of detail is provided, and is the level of detail sufficient for the audience?
- what range of different subjects are covered?
- what is the retrospective coverage of the source?
- is the subject covered comprehensively?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the source? is the source well-known?
- what is the reputation and experience of the author, research group or institution responsible for the source?
- what is the reputation and experience of any other organisations involved in the production of the source, such as publishers, sponsors or funding agencies?
- are any reviews available for the source? is the review authoritative?

Accuracy
- is the information in the source factually accurate?
- are there any typographical or spelling errors?
- how reliable is the original source of the information? is there a research or evidence basis for the information?
- are there any references to published information?
- is there potential for bias from any individuals or organisations responsible for the information?
- has the information been through any quality control processes, such as refereeing or editing?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- when was the source originally produced, either in a printed form or on the Internet?
- has the information been up-dated? will the information be updated? how frequently will the information be-updated?
- are any pointers to further sources up to date?
- is the source generally 'well-maintained'? is there an updating or maintenance policy? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the source is 'under construction'?

Accessibility
- is the source fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
- is the source reliable to access, or is it frequently unavailable? is it stable, or does it continuously move location? if the site moves, is a forwarding location provided?
• are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
• what language is the information?
• is there a charge to access the information? what charging policies are available?
• what mode(s) of access are available? does the mode of access affect the speed?
• is any particular hardware required? is any additional software required? is any additional software easily accessible, and are instructions available from the original source for downloading and use of the software?

Presentation and arrangement
• is the source professionally presented and well put together? is it clearly presented and arranged? is it logically presented and arranged? is the presentation and arrangement consistent throughout?
• is there a site map, contents list, index, menu system or search facility? are any such features effective?
• is the information categorised, and has it been appropriately organised?
• are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
• are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
• is the source well-written?
• have either too few long pages or too many short pages been used?
• are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
• are there any adverts and have they been used appropriately?
• are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

Ease of use and user support
• is the source generally easy to use and user-friendly? is the source intuitive to use, or are training and/or experience required in order to use the source effectively? is the source easy to search and navigate?
• is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
• are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources
• is the source unique in terms of its content or format?
• what are the comparative benefits of accessing this information via the Internet?
• how does the source compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
• what is the cost of this source and value for money offered in comparison to others that are available?

Overall impression
• what is your overall impression of the value and usefulness of the source?
• what is your overall impression of the value and usefulness of the information contained in the source?
• are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the source?
Organisational WWW sites

Purpose
- what are the aims and objectives of the site?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered?
- what level of detail is provided, and is the level of detail sufficient for the audience?
- what range of different subjects are covered?
- what is the retrospective coverage of the source?
- is the subject covered comprehensively?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the site? is the site well-known?
- what is the reputation and experience of the institution concerned?
- is it obvious from each page of the site which institution is responsible for the information?
- is contact information readily available for the institution concerned?
- are any reviews available for the site? is the review authoritative?

Accuracy
- is the information in the source factually accurate?
- are there any typographical or spelling errors?
- has the information been through any quality control processes, such as refereeing or editing?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- when was the site originally created?
- has the information been up-dated? will the information be updated? how frequently will the information be up-dated?
- are any pointers to further sources up to date?
- is the site generally ‘well-maintained’? is there an updating or maintenance policy for the site? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the site is ‘under construction’?

Accessibility
- is the site fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
- is the site reliable to access, or is it frequently unavailable? is the site stable, or does it continuously move location? if the site moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
- is there a charge to access the information? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required to access the site? is any additional software required? is any additional software easily accessible, and are instructions available from the site for downloading and use of the software?
Presentation and arrangement

- is the site professionally presented and well put together? is the site clearly presented and arranged? is the site logically presented and arranged? is the presentation and arrangement consistent throughout the site?
- is there a site map, contents list, index, menu system or search facility? are any such features effective?
- is the information categorised, and has it been appropriately organised?
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- is the site well-written?
- have either too few long pages or too many short pages been used?
- are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
- are there any adverts and have they been used appropriately?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

Ease of use and user support

- is the site generally easy to use and user-friendly? is the site intuitive to use? is the site easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?

Comparison to other sources

- is the site unique in terms of its content or format?
- what are the comparative benefits of accessing this information via the Internet?
- how does the site compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the cost of this site and value for money offered in comparison to others that are available?

Overall impression

- what is your overall impression of the value and usefulness of the site?
- what is your overall impression of the value and usefulness of the information contained in the source?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the site?
Purpose

- what are the aims and objectives of the Home Page?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage

- what subject areas and types of materials are covered?
- is information on the individual's research interests available, where applicable?
- what level of detail is provided, and is the level of detail sufficient for the audience?
- what range of different subjects are covered?
- what is the retrospective coverage of the Home Page?
- is the subject covered comprehensively?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation

- what is the reputation of the Home Page? is the Home Page well-known?
- what is the reputation and experience of the author, research group or institution responsible for the Home Page?
- is contact information readily available?
- are any reviews available for the Home Page? is the review authoritative?

Accuracy

- is the information in the Home Page factually accurate?
- are there any typographical or spelling errors?
- how reliable is the original source of the information? is there a research or evidence basis for the information?
- are there any references to published information?
- is there potential for bias from the individual or organisation responsible for the information?
- has the information been through any quality control processes, such as refereeing or editing?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance

- when was the Home Page originally produced, either in a printed form or on the Internet?
- has the information been up-dated? will the information be updated? how frequently will the information be up-dated?
- are any pointers to further sources up to date?
- is the Home Page generally 'well-maintained'? is there an updating or maintenance policy for the Home Page? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the Home Page is 'under construction'?

Accessibility

- is the Home Page fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
- is the Home Page reliable to access, or is it frequently unavailable? is the Home Page stable, or does it continuously move location? if the site moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
• is there a charge to access the information? what charging policies are available?
• what mode(s) of access are available? does the mode of access affect the speed?
• is any particular hardware required to access the Home Page? is any additional software required? is any additional software easily accessible, and are instructions available from the original Home Page for downloading and use of the software?

Presentation and arrangement
• is the Home Page professionally presented and well put together? is the Home Page clearly presented and arranged? is the Home Page logically presented and arranged? is the presentation and arrangement consistent throughout the Home Page?
• is there a site map, contents list, index, menu system or search facility? are any such features effective?
• is the information categorised, and has it been appropriately organised?
• are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
• are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
• is the Home Page well-written?
• have either too few long pages or too many short pages been used?
• are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
• are there any adverts and have they been used appropriately?
• are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the Home Page viewable without graphics, frames and Java?

Ease of use and user support
• is the Home Page generally easy to use and user-friendly? is the Home Page intuitive to use, or are training and/or experience required in order to use the Home Page effectively? is the Home Page easy to search and navigate?
• is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?

Comparison to other sources
• is the Home Page unique in terms of its content or format?
• what are the comparative benefits of accessing this information via the Internet?
• how does the Home Page compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
• what is the cost of this Home Page and value for money offered in comparison to others that are available?

Overall impression
• what is your overall impression of the value and usefulness of the Home Page?
• what is your overall impression of the value and usefulness of the information contained in the Home Page?
• are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the Home Page?
Subject-based WWW sites

Purpose
- what are the aims and objectives of the source?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered?
- what level of detail is provided, and is the level of detail sufficient for the audience?
- what range of different subjects are covered?
- what is the retrospective coverage of the source?
- is the subject covered comprehensively?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the source? is the source well-known?
- what is the reputation and experience of the author, research group or institution responsible for the source?
- what is the reputation and experience of any other organisations involved in the production of the source, such as publishers, sponsors or funding agencies?
- are any reviews available for the source? is the review authoritative?

Accuracy
- is the information in the source factually accurate?
- are there any typographical or spelling errors?
- how reliable is the original source of the information? is there a research or evidence basis for the information?
- are there any references to published information?
- is there potential for bias from any individuals or organisations responsible for the information?
- has the information been through any quality control processes, such as refereeing or editing?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- when was the source originally produced, either in a printed form or on the Internet?
- has the information been up-dated? will the information be updated? how frequently will the information be-up-dated?
- are any pointers to further sources up to date?
- is the source generally ‘well-maintained’? is there an updating or maintenance policy for the source? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the source is ‘under construction’?

Accessibility
- is the source fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
- is the source reliable to access, or is it frequently unavailable? is the source stable, or does it continuously move location? if the site moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
- is there a charge to access the information? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required to access the source? is any additional software required? is any additional software easily accessible, and are instructions available from the original source for downloading and use of the software?

**Presentation and arrangement**
- is the source professionally presented and well put together? is the source clearly presented and arranged? is the source logically presented and arranged? is the presentation and arrangement consistent throughout the source?
- is there a site map, contents list, index, menu system or search facility? are any such features effective?
- is the information categorised, and has it been appropriately organised?
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- is the source well-written?
- have either too few long pages or too many short pages been used?
- are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
- are there any adverts and have they been used appropriately?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

**Ease of use and user support**
- is the source generally easy to use and user-friendly? is the source intuitive to use, or are training and/or experience required in order to use the source effectively? is the source easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
- are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

**Comparison to other sources**
- is the source unique in terms of its content or format?
- what are the comparative benefits of accessing this information via the Internet?
- how does the source compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the cost of this source and value for money offered in comparison to others that are available?

**Overall impression**
- what is your overall impression of the value and usefulness of the source?
- what is your overall impression of the value and usefulness of the information contained in the source?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the source?
FAQ files

Purpose
- what are the aims and objectives of the FAQ?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered?
- what level of detail is provided, and is the level of detail sufficient for the audience?
- what range of different subjects are covered?
- what is the retrospective coverage of the source?
- is the subject covered comprehensively?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the FAQ? is the FAQ well-known?
- what is the reputation and experience of the author, research group or institution responsible for the FAQ?
- what is the reputation and experience of any other organisations involved in the production of the FAQ, such as publishers, sponsors or funding agencies?
- are any reviews available for the FAQ? is the review authoritative?

Accuracy
- is the information in the FAQ accurate?
- are there any typographical or spelling errors?
- how reliable is the original source of the information? is there a research or evidence basis for the information?
- are there any references to published information?
- is there potential for bias from any individuals or organisations responsible for the FAQ?
- has the FAQ been through any quality control processes, such as refereeing or editing?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- when was the FAQ originally produced?
- has the FAQ been up-dated? will the FAQ be updated? how frequently will it be up-dated?
- are any pointers to further sources up to date?
- is the FAQ generally 'well-maintained'? is there an updating or maintenance policy for the FAQ? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?

Accessibility
- is the FAQ fast to access? does the location affect the speed of access? is there a local mirror site?
- is the FAQ reliable to access, or is it frequently unavailable? is the FAQ stable, or does it continuously move location? if the FAQ moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the FAQ?
- is there a charge to access the FAQ? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
Presentation and arrangement

- Is the FAQ professionally presented and well put together? Is the FAQ clearly presented and arranged? Is the FAQ logically presented and arranged? Is the presentation and arrangement consistent throughout the source?
- Is there a contents list, index, menu system or search facility? Are any such features effective?
- Is the FAQ categorised, and has it been appropriately organised?
- Are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? Are any navigation icons or facilities available? Are they effective? Are the links between pages meaningful? Are any pointers to further information well-laid out and arranged?
- Are individual screens clear and aesthetically pleasing? Is the text easy to read and do headings stand out?
- Is the FAQ well-written?
- Have either too few long pages or too many short pages been used?
- Are there any graphics? Have they been used appropriately? Are any graphics logically arranged in relation to the text?
- Are there any adverts and have they been used appropriately?
- Are frames, Java, or other technologies used? Are they used appropriately and to their full advantage? Is the source viewable without graphics, frames and Java?

Ease of use and user support

- Is the FAQ generally easy to use and user-friendly? Is the FAQ intuitive to use, or are training and/or experience required in order to use the source effectively? Is the FAQ easy to search and navigate?
- Is any help information available? Is the help information sufficient? Is the help information context sensitive? Is the help information clear? Is the help information valuable and useful? Are any system messages meaningful and useful?

Comparison to other sources

- Is the FAQ unique in terms of its content or format?
- How does the FAQ compare to others in terms of its coverage? Accuracy? Authority and reputation? Currency and maintenance? Accessibility? Presentation and arrangement? Ease of use and user support?
- What is the cost of this FAQ and value for money offered in comparison to others that are available?

Overall impression

- What is your overall impression of the value and usefulness of the FAQ?
- What is your overall impression of the value and usefulness of the information contained in the FAQ?
- Are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the FAQ?
Electronic journals

Purpose of the site
- what are the aims and objectives of the site providing access to the journal? is the site intended for advertising purposes? is there a statement of the intended purpose of the site?
- what is the intended coverage and intended audience of the journal?
- what is the intended coverage and intended audience of the article?

Coverage
- is the whole journal available via the site? if only parts are available, how are those parts selected?
- what subject areas are covered by the journal? what types of materials are covered by the journal?
- what is the subject of the article? what level of detail is provided and is it sufficient? does the article cover the subject comprehensively?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?
- is there an archive for accessing back issues of the journal? what is the retrospective coverage of the archive?

Authority and reputation
- what is the reputation of the site? are any reviews available for the site?
- what is the reputation of the journal? what is the impact factor of the journal? are any reviews available for the journal? is the journal indexed in a bibliographical database such as Medline?
- what is the genealogy of the journal? how long has the journal been available? is there a printed equivalent?
- what is the reputation and experience of the editorial board?
- what is the reputation and experience of any other organisations involved in the production of the journal, such as publishers or sponsors?
- what is the reputation and experience of the author, research group or institution responsible for the individual article?

Accuracy
- is the journal refereed? how stringent is the refereeing process for the journal?
- is the information in the article factually accurate?
- how reliable is the original source of the information? is there a research or evidence basis for the information?
- are there references to other published articles?
- are there any typographical or spelling errors?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- when was the article originally produced, either in a printed form or on the Internet?
- what is the time delay between article acceptance and publication in the journal?
- is there a facility for updating articles? are details provided on any updating?
- are any pointers to further sources up to date?
- is the site generally ‘well-maintained’? is there an updating or maintenance policy for the site? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the site is ‘under construction’?

Accessibility
- is the site/journal/article fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
• is the site/journal/article reliable to access, or is it frequently unavailable? is the it stable, or does it continuously move location? if the it moves, is a forwarding location provided?
• are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
• what language is the site/journal/article?
• is there a charge to access the site/journal/article? what charging policies are available? are parts of the journal or article freely available?
• what mode(s) of access are available? does the mode of access affect the speed?
• is any particular hardware required? is any additional software required? is any additional software easily accessible, and are instructions available from the original site for downloading and use of the software?

Presentation and arrangement
• is the site/journal/article professionally presented and well put together? is the it clearly presented and arranged? is the it logically presented and arranged? is the presentation and arrangement consistent throughout?
• is there a site map or index? is it easy to locate individual journal issues within the site?
• do individual issues have a contents list? is it easy to locate individual articles within an issue?
• is there a search facility for the archive? is the archive searchable by subject, author and journal volume number? is it possible to limit searches by date range? how effective is the search facility?
• are there links between the main body of the text and citations within each article?
• are there any additional features to update articles, to e-mail comments on articles, to link directly to other sources? do they add value to the journal?
• are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
• are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
• is the article well-written?
• have either too few long pages or too many short pages been used?
• are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
• are there any adverts and have they been used appropriately?
• are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

Ease of use and user support
• is the site/journal/article generally easy to use and user-friendly? is the site/journal/article intuitive to use, or are training and/or experience required in order to use the source effectively? is the site/journal/article easy to search and navigate?
• is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
• are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources
• is the site/journal/article unique in terms of its content or format?
• what are the comparative benefits of accessing the journal or article via the Internet? how does the electronic version compare to the paper-based version in terms of its coverage? currency and maintenance? accessibility? presentation and arrangement? ease of use? what is value for money offered in comparison to the paper version?
• how does the site/journal/article compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support? value for money?

**Overall impression**

• what is your overall impression of the value and usefulness of the site/journal/article?
• what is your overall impression of the value and usefulness of the information contained in the site/journal/article?
• are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression?
Computer Assisted Learning Materials

Purpose
- what are the aims and objectives of the source?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered?
- what level of detail is provided, and is the level of detail sufficient for the audience?
- what range of different subjects are covered?
- what is the retrospective coverage of the source?
- is the subject covered comprehensively?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the source? is the source well-known?
- what is the reputation and experience of the author, research group or institution responsible for the source?
- what is the reputation and experience of any other organisations involved in the production of the source, such as publishers, sponsors or funding agencies?
- are any reviews available for the source? is the review authoritative?

Accuracy
- is the information in the source factually accurate?
- are there any typographical or spelling errors?
- how reliable is the original source of the information? is there a research or evidence basis for the information?
- are there any references to published information?
- is there potential for bias from any individuals or organisations responsible for the information?
- is the source provided by a commercial or academic institution?
- has the information been through any quality control processes, such as refereeing or editing?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- when was the source originally produced, either in a printed form or on the Internet?
- has the information been up-dated? will the information be updated? how frequently will the information up-dated?
- are any pointers to further sources up to date?
- is the source generally ‘well-maintained’? is there an updating or maintenance policy for the source? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the source is ‘under construction’?

Accessibility
- is the source fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
- is the source reliable to access, or is it frequently unavailable? is the source stable, or does it continuously move location? if the site moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
- is there a charge to access the information? what charging policies are available?
- what mode(s) of access are available? is it possible to download and use the package locally, or are the materials accessed via the WWW? does the mode of access affect the speed?
- is any particular hardware required to access the source? is any additional software required? is any additional software easily accessible, and are instructions available from the original source for downloading and use of the software?

Presentation and arrangement
- is the source professionally presented and well put together? is the source clearly presented and arranged? is the source logically presented and arranged? is the presentation and arrangement consistent throughout the source?
- is there a site map, contents list, index, menu system or search facility? are any such features effective?
- is the information categorised, and has it been appropriately organised?
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- is the source well-written?
- have either too few long pages or too many short pages been used?
- are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
- are there any adverts and have they been used appropriately?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?
- are there any features or facilities which take advantage of the multi-media format, such as tutorials, self-test materials, images or video graphics? do the features add value to the content? do they enhance the learning experience?

Ease of use and user support
- is the source generally easy to use and user-friendly? is the source intuitive to use, or are training and/or experience required in order to use the source effectively? is the source easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
- are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources
- is the source unique in terms of its content or format?
- what are the comparative benefits of accessing this information via the Internet?
- how does the source compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the cost of this source and value for money offered in comparison to others that are available?

Overall impression
- what is your overall impression of the value and usefulness of the source?
- what is your overall impression of the value and usefulness of the information contained in the source?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the source?
Image-based information sources

Purpose
- what are the aims and objectives of the site?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what is the subject of the image?
- what subject areas are covered by the site? what range of different subjects are covered? is the subject covered comprehensively?
- is any explanatory information available? what level of detail is provided, and is the level of detail sufficient for the audience? does the explanatory information add value to the images? is there an appropriate balance between text and images?
- are there pointers to any further information/images? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the site? is the site well-known?
- what is the reputation and experience of those responsible for the images?
- are any reviews available for the site? is the review authoritative?
- is copyright information available?

Accuracy
- are there any typographical or spelling errors?
- what is the motivation of those responsible for the images? is there potential for bias from any individuals or organisations responsible for the site?
- has the information been through any quality control processes?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- when was the image originally taken and produced?
- has the site been up-dated? will the site be updated? how frequently will the site up-dated?
- are any pointers to further sources up to date?
- is the site generally ‘well-maintained’? is there an updating or maintenance policy for the site? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the site is ‘under construction’?

Accessibility
- is the site fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
- is the site reliable to access, or is it frequently unavailable? is the site stable, or does it continuously move location? if the site moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- is there a charge to access the images? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required to access the site? is any additional software required? is any additional software easily accessible, and are instructions available from the original source for downloading and use of the software?
- what is the computer storage format of the images?
- what is the storage size of the images? is information provided on the storage size?
Presentation and arrangement

- is the site professionally presented and well put together? is the site clearly presented and arranged? is the site logically presented and arranged? is the presentation and arrangement consistent throughout the site?
- is there a site map, contents list, index, menu system or search facility? are any such features effective?
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?
- are the images in colour or black and white?
- are the images two dimensional, three dimensional or video clips?
- what is the image resolution? are the images clear?

Ease of use and user support

- is the site generally easy to use and user-friendly? is the site intuitive to use, or are training and/or experience required in order to use the source effectively? is the site easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
- are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources

- is the site unique in terms of its content or format?
- what are the comparative benefits of accessing the images via the Internet?
- how does the site compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the value for money offered in comparison to others that are available?

Overall impression

- what is your overall impression of the value and usefulness of the site?
- what is your overall impression of the value and usefulness of the images contained in the site?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the site?
Usenet Newsgroups and discussion groups

Purpose
- what are the aims and objectives of the group?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a group Home Page or FAQ? is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered by the group?
- is there an archive for the group? what is the retrospective coverage of the archive?
- is there real exchange and discussion, or does the group largely comprise one-off messages?
- is the group moderated?

Authority and reputation
- what is the reputation of the group? is the group well-known?
- what is the reputation and experience of the group moderator? of the FAQ compiler?
- are any reviews available for the group? is the review authoritative?
- is there a membership list? who are the participants of the group? how many participants are there? what is their knowledge and expertise? is the group local, national or international?
- what is the reputation and experience of the author responsible for an individual message?

Accuracy
- is the information in an individual message factually accurate?
- are there any typographical or spelling errors?
- how reliable is the original source of the information? is there a research or evidence basis for the information?
- are there any references to published information?
- is there potential for bias from the individual responsible for the message?

Currency and maintenance
- what is the date of the individual message?
- how frequently are the digests distributed?
- is there an individual responsible for group administration? is any administrative information available? is the administrative information useful?

Accessibility
- what mode of access is available?
- are there any restrictions to accessing the group? is there a closed membership?
- what is the average volume of traffic? is the volume of traffic manageable?
- is it possible to receive messages in a digest form?
- has the group adopted conventions for labelling messages?
- is the archive searchable? by date, author and subject thread?
- is it possible to FTP the files of discussion?

Comparison to other sources
- is the group unique?
- how does the group compare to others in terms of its purpose? coverage? authority and reputation?
- what is the value for money offered in comparison to sources that are available?

Overall impression
- what is your overall impression of the value and usefulness of the group?
- what is your overall impression of the value and usefulness of the information posted to the group?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the group?
Current Awareness Services

Purpose
- what are the aims and objectives of the service?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered? what range of different subjects are covered? is the subject covered comprehensively?
- what level of detail is provided, and is the level of detail sufficient for the audience?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?
- is it possible to submit a subject profile to the service, indicating personal preferences?

Authority and reputation
- what is the reputation of the service? is the service well-known?
- what is the reputation and experience of any organisations involved in the production of the service, such as publishers, sponsors or funding agencies?
- are any reviews available for the service? is the review authoritative?

Accuracy
- is the information provided factually accurate?
- has the information been through any quality control processes, such as refereeing or editing?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- how frequently is the information be updated?
- how frequently is the mailing list distributed?
- is the information timely? is the information provided when it is most needed?
- is the service generally ‘well-maintained’? is there an updating or maintenance policy for the service? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the service is ‘under construction’?

Accessibility
- is the service fast to access? does the location affect the speed of access? is there a local mirror site? have thumbnail images been used to improve access speeds?
- is the service reliable to access, or is it frequently unavailable? is the service stable, or does it continuously move location? if the service moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
- is there a charge to access the service? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required to access the service? is any additional software required? is any additional software easily accessible, and are instructions available from the original service for downloading and use of the software?
Presentation and arrangement
- is the service professionally presented and well put together? is the information clearly presented and arranged? is the information logically presented and arranged? is the presentation and arrangement consistent throughout?
- is there a site map, contents list, index, menu system or search facility? are any such features effective?
- is the information categorised, and has it been appropriately organised?
- is it possible to identify the subject areas of individual messages to a mailing list?
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- is the information well-written?
- have either too few long pages or too many short pages been used?
- are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
- are there any adverts and have they been used appropriately?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

Ease of use and user support
- is the service generally easy to use and user-friendly? is the service intuitive to use, or are training and/or experience required in order to use the source effectively? is the service easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
- are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources
- is the service unique in terms of its content or format?
- what are the comparative benefits of accessing this information via the Internet?
- how does the service compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the cost of this service and value for money offered in comparison to others that are available?

Overall impression
- what is your overall impression of the value and usefulness of the service?
- what is your overall impression of the value and usefulness of the information contained in the service?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression?
FTP archives

Purpose
- what is the intended coverage and are there any limitations to coverage?

Coverage
- what software or data is available?
- what format is the software? is software available for different platforms?
- are upgrades, trial versions and older versions of data or software available?
- are there pointers to any further sites?
- what is the coverage of any mirror sites in comparison to the original?

Authority and reputation
- what is the reputation of the archive? is the archive well-known?
- what is the reputation and experience of the individual or institution responsible for the archive?
- are any reviews available for the archive? is the review authoritative?
- is information available on the origin of the software or data? what is the reputation and experience of the individual or institution responsible for the software or data?

Accuracy
- are there any quality control facilities?
- are there any virus checking facilities?

Currency and maintenance
- how frequently is the archive up-dated?
- is there a time delay between software development or data generation and availability via the archive?
- are software version numbers available? is the expiry date available for trial versions?
- is the archive generally 'well-maintained'? is there an updating or maintenance policy for the archive? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the archive is 'under construction'?

Accessibility
- is the archive fast to access? does the location affect the speed of access?
- is there a mirror site?
- is the archive reliable to access, or is it frequently unavailable? is the archive stable, or does it continuously move location? if the archive moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- is there a charge to access the files? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed? the ease of use?

Presentation and arrangement
- is information available on file sizes?
- is there a search facility? is it possible to search and browse by filename, platform or type of application?

Ease of use and user support
- is the archive generally easy to use and user-friendly? is the archive intuitive to use, or are training and/or experience required in order to use it effectively? is it easy to search and navigate?
is any help information available? are README files available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?

are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources

is the archive unique in terms of its content?
what are the comparative benefits of accessing the files via the Internet?
how does the archive compare to others in terms of its coverage? currency and maintenance? accessibility? ease of use and user support?
what is the value for money offered in comparison to others that are available?

Overall impression

what is your overall impression of the value and usefulness of the archive?
what is your overall impression of the value and usefulness of the files contained in the archive?
are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the archive?
Databases and databanks

Purpose
- what are the aims and objectives of the database?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered?
- what level of detail is provided in each record of the database, and is the level of detail sufficient for the audience?
- what range of different subjects are covered?
- what is the retrospective coverage of the database?
- is the subject covered comprehensively by the database?
- are there pointers to any further sources of information?

Authority and reputation
- what is the reputation of the database? is the database well-known?
- what is the reputation and experience of any organisations involved in the production of the database, such as publishers, sponsors or funding agencies?
- are any reviews available for the database? is the review authoritative?

Accuracy
- is the information in the database factually accurate?
- are there any typographical or spelling errors?
- are there any quality control processes?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- how frequently is the database up-dated?
- is the database generally ‘well-maintained’? is there an updating or maintenance policy? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a database maintainer?
- is there any indication that the database is ‘under construction’?

Accessibility
- is the database fast to access? does the location affect the speed of access? is there a local mirror site?
- is the database reliable to access, or is it frequently unavailable? is the database stable, or does it continuously move location? if the database moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
- is there a charge to access the database? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required to access the database? is any additional software required? is any additional software easily accessible, and are instructions available from the original location for downloading and use of the software?

Presentation and arrangement
- is the database professionally presented and well put together? is the database clearly presented and arranged? is the database logically presented and arranged? is the presentation and arrangement consistent throughout the database?
- what searching and browsing facilities are available? are the searching and browsing facilities useful? effective? easy to use?
- what output facilities are available? are the facilities useful? effective? easy to use?
- is it possible to upload data into other packages?
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- are there any adverts and have they been used appropriately?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?
- is it possible to order materials directly from the database? is contact information available?

Ease of use and user support
- is the database generally easy to use and user-friendly? is the database intuitive to use, or are training and/or experience required in order to use the source effectively? is the database easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
- are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources
- is the database unique in terms of its content or format?
- what are the comparative benefits of accessing this information via the Internet?
- how does the database compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the cost of this source and value for money offered in comparison to others that are available?

Overall impression
- what is your overall impression of the value and usefulness of the database?
- what is your overall impression of the value and usefulness of the information contained in the database?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the database?
Bibliographical databases

Purpose
- what are the aims and objectives of the bibliographical database?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas and types of materials are covered? is a facility available to determine whether a specific journal is indexed by the database?
- what range of different subjects are covered?
- what is the retrospective coverage of the bibliographical database?
- are the subject areas covered comprehensively by the bibliographical database?
- what level of detail is provided in each record of the database? is the level of detail sufficient for the audience? are abstracts available? for what percentage of the records are abstracts available? are abstracts truncated by word length? is the information useful and valuable?
- are there pointers or links into further sources?
- where different versions of the same database are available, how does their coverage compare?

Authority and reputation
- what is the reputation of the bibliographical database? is it well-known?
- what is the reputation and experience of any organisations involved in the production of the bibliographical database, such as publishers, sponsors or funding agencies?
- are any reviews available, for example, in Walford's, for the bibliographical database?
- are the abstracts written by the original authors?

Accuracy
- are the reference details factually accurate?
- are there any typographical or spelling errors?
- are there any quality control processes?
- is there a facility to e-mail corrections to inaccurate information?

Currency and maintenance
- how frequently is the bibliographical database up-dated?
- what is the time delay between publication of materials and appearance in the database?
- is the bibliographical database generally 'well-maintained'? is there an updating or maintenance policy? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a maintainer?
- is there any indication that the bibliographical database is 'under construction'?

Accessibility
- is the bibliographical database fast to access? does the location affect the speed of access? is there a local mirror site?
- is the bibliographical database reliable to access, or is it frequently unavailable? is it stable, or does it continuously move location? if it moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
- is there a charge to access the database? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required? is any additional software required? is any additional software easily accessible, and are instructions available from the original location for downloading and use of the software?
Presentation and arrangement

- is the bibliographical database professionally presented and well put together? is it clearly presented and arranged? is it logically presented and arranged? is the presentation and arrangement consistent throughout?
- what searching and browsing facilities are available? is it possible to search by author, title and subject keyword? is it possible to limit searches by date range and publication type? are there any additional searching or browsing facilities? are the searching and browsing facilities useful? effective? easy to use?
- what output facilities are available? are the facilities useful? effective? easy to use?
- is it possible to upload data into other packages, such as a reference manager package
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- are there any adverts and have they been used appropriately?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

Ease of use and user support

- is the bibliographical database generally easy to use and user-friendly? is it intuitive to use, or are training and/or experience required in order to use the source effectively? is it easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
- are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources

- is the bibliographical database unique in terms of its content or format?
- what are the comparative benefits of accessing the database via the Internet?
- how does the bibliographical database compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the value for money offered in comparison to other sources that are available?

Overall impression

- what is your overall impression of the value and usefulness of the bibliographical database?
- what is your overall impression of the value and usefulness of the information contained in the bibliographical database?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression?
Molecular Biology Sources

Purpose
- what are the aims and objectives of the source?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what databases are covered by the site?
- what computing facilities for data analysis are available?
- what areas are covered by the individual databases?
- what range of different subjects are covered?
- is the subject covered comprehensively?
- are there links or pointers to any further sources of information, such as other databanks or bibliographical databases? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the source? is the source well-known?
- what is the genealogy of the source?
- what is the reputation and experience of any organisations involved in the production of the source, such as publishers, sponsors or funding agencies?
- are any reviews available for the source, for example, in Nucleic Acids Research? is the review authoritative?
- are the names available for the individual researchers responsible for the data? what is their reputation and experience?

Accuracy
- are there warnings for any likely inaccuracies in the data?
- are there any quality control mechanisms in place, such as refereeing or editing?
- are there any typographical or spelling errors?
- is there a facility to e-mail corrections to inaccurate information?
- are there any links to where the data has been published?
- is there potential for bias from any individuals or organisations responsible for the information?

Currency and maintenance
- how frequently is the site up-dated?
- are any pointers to further sources up to date?
- is the site generally 'well-maintained'? is there an updating or maintenance policy? is there an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the site is 'under construction'?

Accessibility
- is the site fast to access? does the location affect the speed of access? is there a local mirror site?
- is the site reliable to access, or is it frequently unavailable? is the site stable, or does it continuously move location? if the site moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- is there a charge to access the site? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required to access the site? is any additional software required? is any additional software easily accessible, and are instructions available from the original site for downloading and use of the software?

**Presentation and arrangement**
- is the site professionally presented and well put together? is it clearly presented and arranged? is it logically presented and arranged? is the presentation and arrangement consistent throughout?
- what searching and browsing facilities are available? are the following available: keyword access by gene or organism name, item accession number search, sequence comparison and alignment facilities, homology searches? is it possible to specify the stringency of the search? are there any additional searching or browsing facilities? are the searching and browsing facilities useful? effective? easy to use?
- what output facilities are available? are the facilities useful? effective? easy to use?
- is it possible to upload data into other packages?
- are any steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
- is the data represented using standard characters?
- is there a site map, contents list, index or menu system? are any such features effective?
- are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
- is the site well-written?
- have either too few long pages or too many short pages been used?
- are there any graphics? are three-dimensional images available? have they been used appropriately?
- are there any adverts and have they been used appropriately?
- are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

**Ease of use and user support**
- is the site generally easy to use and user-friendly? is it intuitive to use, or are training and/or experience required in order to use it effectively? is it easy to search and navigate?
- is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
- are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

**Comparison to other sources**
- is the site unique in terms of its content or format?
- what are the comparative benefits of accessing this information via the Internet?
- how does the site compare to others in terms of its coverage? accuracy? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
- what is the value for money offered in comparison to others that are available?

**Overall impression**
- what is your overall impression of the value and usefulness of the site?
- what is your overall impression of the value and usefulness of the data contained in the site?
- are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression?
Search facilities

Purpose
- what are the aims and objectives of the search facility?
- what is the intended coverage and are there any limitations to coverage?
- who is the intended audience?
- is there a statement of the intended purpose?

Coverage
- what subject areas are covered? what range of different subjects are covered? are the subjects covered comprehensively?
- what types of materials are covered? does the search facility only cover the WWW?
- are there pointers to any further sources of information? is descriptive information available about the pointers? are the pointers selected, and on what basis? are the pointers valuable or useful?

Authority and reputation
- what is the reputation of the search facility? is it well-known?
- what is the reputation and experience any organisations involved in the production of the search facility, such as publishers, sponsors or funding agencies?
- are any reviews available for the search facility? is the review authoritative?

Currency and maintenance
- how frequently is the search facility up-dated?
- is the search facility generally ‘well-maintained’? is there an updating or maintenance policy?
- is an individual or group responsible for maintenance? what is the knowledge and expertise of those responsible for maintenance? are contact details available for a site maintainer?
- is there any indication that the search facility is ‘under construction’?

Accessibility
- is the search facility fast to access? does the location affect the speed of access? is there a local mirror site?
- is the search facility reliable to access, or is it frequently unavailable? is it stable, or does it continuously move location? if it moves, is a forwarding location provided?
- are there any restrictions to access, such as registration, subscription, passwords, proof of eligibility or membership of an organisation? is registration straightforward? is it possible to bookmark an internal address to save re-entering passwords? is there a route for users who have forgotten their passwords?
- what language is the information?
- is there a charge to access the search facility? what charging policies are available?
- what mode(s) of access are available? does the mode of access affect the speed?
- is any particular hardware required to access the search facility? is any additional software required? is any additional software easily accessible, and are instructions available from the original source for downloading and use of the software?

Presentation and arrangement
- is the search facility professionally presented and well put together? is it clearly presented and arranged? is the presentation and arrangement consistent throughout?
- what searching facilities are available? is it possible to narrow a search strategy? are duplicates automatically removed from the results? are the searching facilities useful? effective? easy to use?
- can the information be browsed by categories? has the information been appropriately organised?
- what output facilities are available? are the facilities useful? effective? easy to use?
- what level of detail is provided about the sources retrieved? is the level of detail sufficient?
- are steps unnecessarily repeated and are shortcuts available to access information in as few clicks as possible? are any navigation icons or facilities available? are they effective? are the links between pages meaningful? are any pointers to further information well-laid out and arranged?
  - is there a site map, contents list, index or menu system? are any such features effective?
  - are individual screens clear and aesthetically pleasing? is the text easy to read and do headings stand out?
  - are there any graphics? have they been used appropriately? are any graphics logically arranged in relation to the text?
  - are there any adverts and have they been used appropriately?
  - are frames, Java, or other technologies used? are they used appropriately and to their full advantage? is the source viewable without graphics, frames and Java?

Ease of use and user support
- is the search facility generally easy to use and user-friendly? is it intuitive to use, or are training and/or experience required in order to use it effectively? is it easy to navigate?
  - is any help information available? is the help information sufficient? is the help information context sensitive? is the help information clear? is the help information valuable and useful? are any system messages meaningful and useful?
  - is information provided on how the search facility searches for information?
  - are any training courses, a telephone helpline, or any other user support available? is any user support valuable and useful?

Comparison to other sources
- is the search facility unique in terms of its content or format?
  - how does the search facility compare to others in terms of its coverage? authority and reputation? currency and maintenance? accessibility? presentation and arrangement? ease of use and user support?
  - what is the value for money offered in comparison to others that are available?

Overall impression
- what is your overall impression of the value and usefulness of the search facility?
  - what is your overall impression of the value and usefulness of the information contained in the search facility?
  - are any reviews available or is it possible to elicit a recommendation from an expert in the field on their overall impression of the search facility?
Abbreviations and Glossary

bibliographical database..........................databases of references to journal articles, books, conference proceedings, etc.

CAL materials..................................Computer Assisted Learning materials (see below)

CAS..................................................Current Awareness Service (see below)

Computer Assisted Learning materials .......multi-media materials which are designed to aid teaching and learning through the use of computing technology

Current Awareness Service .......................a service designed to alert users regarding a particular topic or issue

databank ........................................a collection of data items, whether numeric, textual or image-based; used interchangeably with database

database ..........................................a collection of data items, whether numeric, textual or image-based; used interchangeably with databank

discussion group .....................................an e-mail based conference system, with a subject focus, which enables subscribed users to discuss current issues of interest

electronic journal ..................................the electronic equivalent of a paper-based journal, although an increasing number of journals are produced entirely in an electronic format

e-mail...............................................electronic mail, software which enables messages to be sent from one person’s computer to another

FTP ..................................................File Transfer Protocol, the protocol, as well as the software, which enables users to transfer files from one computer to another

FTP archive ......................................a collection of files, such as software, textual or numerical data, which can be accessed and retrieved using FTP (defined above)

FAQ file............................................Frequently Asked Questions, a file of commonly asked questions with answers about a particular topic or issue

Home Page ........................................the opening page of any site on the WWW is generally referred to as the ‘Home Page’; see also Personal Home Page

hypertext................................................text that contains links (hypertext links) to other text so that pages of information can be browsed by following those links

image-based information .........................images which are used as a source of information
Library and Information Science

molecular biology sources refers to collections of data of interest to molecular biologists, including the genetic sequence and protein databanks

Organisational WWW site WWW sites which might be described as a 'Home Page' (defined above) for a particular organisation or institution; such sites might also include 'subject-based WWW pages' and 'personal home pages' (defined below)

Personal Home Page a WWW site which is designed and maintained by an individual and which relates to their personal interests; Personal Home Pages might also include 'subject-based WWW pages' (defined below)

protocol a set of data-exchange rules which enable communication between different computers

search facility used in this context to refer to tools and facilities, including search engines and subject trees, which search the information available via the Internet

subject-based WWW pages WWW pages, and sometimes whole sites, with a particular subject focus

Telnet a protocol and application which permits a user to log onto and use a remote computer

thumbnail image a small-scale image which can be selected in order to view a much larger version of the same image

Usenet Newsgroups a world-wide system of bulletin boards, hierarchically arranged into topic areas

WWW World-Wide Web, the part of the Internet based around hypertext and multi-media

WWW site a collection of pages available via the WWW which are connected, generally through the ownership of the institution responsible