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ABSTRACT

This longitudinal study concerns the impact of information technology developments on the information handling techniques of laboratory and clinical scientists from the perspective of perceived value or benefit based on subjective evaluation by users. The project's main method of data collection is the semi-structured interview utilising samples from various categories of Imperial Cancer Research Fund staff plus a composite external comparison group. This method is complemented by analyses of library records (particularly statistics of database usage and requests relating to document supply) and, where possible, indications of usage of molecular biology databanks, electronic mail and remote login facilities (to provide further background to the degree of electronic activity of users).
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CHAPTER 1
1. Introduction

1.1 Context

The latter half of the 1990s is dominated by buzz phrases such as “information superhighway”, “networked information services”, “electronic library”, “on-demand publishing”, “document delivery”, “user empowerment”, “lifelong learning” and “transferable skills”. There is now general acceptance that information and communication technologies have far reaching implications for the way that people acquire the skills and knowledge that they need to succeed in a rapidly changing global economy (Office of Science and Technology, 1993; Department for Education and Employment, 1995a; Department for Education and Employment, 1995b; Department for Education and Employment, 1995c; Department for Education and Employment, 1997). Looking back from 1997, the seeds of these developments had already been sown in the late 1980s and their germination was apparent by 1995 in the academic and research sector generally and at the Imperial Cancer Research Fund (ICRF), a United Kingdom (UK) research institute, more specifically.

The late 1980s and the early 1990s were characterised by a number of on-going debates in the information community such as access versus holdings and article purchase versus journal subscription. In addition, a combination of factors and developments such as technological advances, growth of networks, increasing amounts of information available in electronic form, economic factors resulting, for example, in intolerable pressure on library budgets, and the shift from teaching to learning in UK higher education induced by a change in government education policy, made working in the library and information profession in the early 1990s a confusing, daunting and uncertain experience - but an exciting and challenging one too.

Two of the questions constantly emerging from the above-mentioned debates, developments and factors were “what are the changing user demands?” and “is information technology (IT) helping to satisfy these demands?”

By 1992, much money had been spent by organisations such as the British Library Research and Development Department (BLR&DD) (priorities of the electronic library / electronic journals / networked information tools / management issues), the Higher Education Funding Councils’ (HEFC) Joint Information Systems Committee (JISC) (Janet
Many writers/researchers have bemoaned the lack of involvement of information practitioners in action research which, it is surmised, may be due to pressure of routine work in an increasingly demanding environment. It is true that the pressures on practitioners are considerable due to factors which will be elaborated on below. However, this researcher is an information practitioner who is very interested in action research through user-oriented evaluation with its aim of “generating information which may be used, in some way, to improve information systems and services” (Bawden, 1990, 93).

This introduction focuses on the background issues involved in the present study, which spans the period October 1992 to September 1995. Inevitably, this concentrates on the early 1990s (as evidenced by the bulk of references) from the perspective of 1997 to put this study in context and to give an explanation of how developments occurred and events unfolded. A literature review is included to provide a framework for the study described herein and the aims and objectives of this thesis are stated.

A large number of figures, printed in colour, are included in an appendix for ease of printing. The figures are referenced by a number in the text of the document (further details included in the introduction to the figures in Appendix 8). Percentages in the text are rounded up to one decimal point. Where percentages given are close or to facilitate interpretation of the data, actual figures are included also. Breakdowns by category of staff, in the case of the ICRF sample group, or by sector, in the case of the composite external comparison group, are only given where differences are remarkable. Where a rating scale of one to five is employed in the questionnaire, responses of “3.5” are rounded up to “4”. The references in the bibliography follow the Harvard citation style with the option of exclusion of the place of publication.

1.2 Aims and Objectives
The aims of this research project are:
• to ascertain to what degree new information technology developments are altering the way laboratory and clinical research scientists handle bibliographical and textual information in the conduct of their work.

• to explain the nature of any impact

• to develop a framework for the measurement of any impact

• to assess the implications of these findings within the framework of this case study and briefly to suggest their relevance to library and information services generally

1.3 Background Issues

By 1992, academic and research libraries had experienced two decades of changes and these changes are expanded on below.

1.3.1 Access versus holdings (the collection development debate)

The period had been marked by insufficient funding which had meant that libraries have been unable to keep their collections up to date. Book and journal prices had risen far higher than general inflation but there had been a large increase in the number of new publications (especially journals) appearing. It is widely acknowledged that scientific and technological journals are far more costly than other subject areas: for example, in the five year period 1985 to 1989, the average price of biology journals increased by 33% and biochemistry and microbiology journals by 42% (Merriman, 1989). This picture is confirmed by published statistics in the United States (US) and the UK. The Association of Research Libraries (ARL) reported that expenditures for serials in the 119 ARL member libraries rose 52% from 1986 to 1990 and another 63% between 1990 and 1994 (ARL, 1994). Blackwell’s annual survey of periodical prices published in the Library Association Record showed that the average price of science and technology journals had increased by 28.46% between 1988 and 1991 (Periodical Prices, 1988; Periodical Prices, 1989; Periodical Prices 1990, 1990; Periodical Prices 1991, 1991) and by another 56.51% between 1992 and 1995 (Annual Periodical Prices For 1992, 1992; Annual Periodical Prices For 1993, 1993; Annual Periodical Prices For 1994, 1994; Annual Periodical Prices For 1995, 1995), the duration of this research project.
This serials pricing issue is an on-going topic in the literature. The 1981 Royal Society study (Royal Society, 1981) was very much concerned with the proliferation of journal titles and the rising costs of journal publishing. Indeed, the demise of the printed journal had been predicted for some years, most memorably by Lancaster (1978a; 1978b). But the late 1980s witnessed a series of studies and analyses from the library community and they were accompanied by some counterclaims by the publishers. Notable among the former was the ARL report on serials prices consisting of two commissioned reports, one by Economic Consulting Services Inc. (1989) and the other by Okerson (1989). Spigai's review (1991) of the literature output of the period summarised the possible causes and proposed solutions. Among the possible causes identified for the huge price increases were exchange rates, rising costs of doing business (especially due to journal page growth), inflation and rampant profiteering. Among the possible suggested solutions were to boycott certain publishers, cancel subscriptions, negotiate with publishers, educate faculty (authors and readers), justify larger budgets, stimulate competition and alternative technologies, and share resources. Dougherty and Johnson (1988) went so far as to postulate “If scholars and librarians can’t communicate easily through publishers, we must learn to communicate around them”. White (1988a, 1988b), on the other hand, vigorously argued for increasing dialogue between publishers and librarians to avoid this “doomsday scenario”.

The proliferation of new journal titles has been attributed to attempts by publishers to bolster what they claim to be their dwindling incomes, brought about by the erosion of existing journal subscriptions by academic and research libraries, the growing number of articles submitted to be published and the general increase in end-user photocopying. The growing number of articles (i.e. the growth of authors' output) increases total publication size and increases costs of production and distribution. Often this activity is in response to requests (by authors, scholars and librarians) for comprehensive coverage and/or sometimes to meet the competition (Byrd, 1990; Merriman, 1989). The proliferation of journals in narrower and narrower subject areas, an activity called “twigging”, exacerbates the situation as the subscription base of existing titles is eroded by the competition. Clack (1989) reported that STM (scientific, technical and medical) journals reject
50-75% of submissions after 1st review (more after 2nd or 3rd reviews) whereas learned society journals accept most of their members’ papers.

Practitioners’ concern about the situation in July 1989 resulted in the establishment of the electronic publication, *Newsletter on Serials Pricing Issues* (Newsletter on Serials Pricing Issues, 1992), as a focus for reporting research and news on the serials pricing crisis. In 1990, a major UK conference took place on “Scholarly communications and serials prices” (Brookfield, 1991). Brindley (1991) in her paper at that conference stressed that IT for the electronic library could not be seen as an immediate help with financial crises caused by printed sources, as more funding was needed for IT infrastructures and the electronic library.


“Can we hope that funding bodies and university faculties will mitigate our problems by encouraging the publication of fewer, shorter and better papers? Alternatively, can they be persuaded that unless there are adequate funds for the acquisition and dissemination of information, much of their spending is of no benefit to anyone other than the person doing the research”.

Academics’ reaction to this breakdown in collection development by libraries was reported in survey findings (Erens, 1991, 53) published in 1991 where “more than two in five academics said their journal collection [in their institution’s ‘central library’] had deteriorated over the past five years”.

The continuing concern of academic librarians over “the incremental creep of journal spend as a proportion of the total expenditure on acquisitions” was seen in
the results of a survey (Baker, 1992a) of university librarians reported in 1992. Of 23 librarians responding, all but 2 spent more than 40% of their non-payroll budget on journal subscriptions in 1989/90. Another librarian (Law, 1993) observed that “There is the perception that we pay for the research, give away the results and then buy them back”, whilst an academic (Mackay, 1993) asked “in what other profession are the products of one's labours given away for nothing to people who then sell them”. Discussion by librarians on this issue on the discussion list “lis-link” during April 1993 in response to this suggestion raised doubts about whether the retention of copyrights by universities and research councils would really help the situation. However, Mackay (1993) asserted that he has (successfully) informed publishers on two occasions that the institution funding the research will give the publisher an exclusive licence to the material for perhaps two years.

During the course of this research project, the UK Higher Education Funding Bodies set up a Joint Funding Councils' Review Group (under the Chairmanship of Professor Sir Brian Follett) “to investigate future national needs for the development of library and information resources, including operational and study space requirements for teaching and research in higher education institutions and to identify ways to meet those needs” (Joint Funding Councils' Libraries Review Group, 1993, 75). As a direct response to the Follett report, the JISC established the Electronic Libraries Programme (eLib) with a steering committee to oversee it known as the Follett Implementation Group for Information Technology (FIGIT). The Programme’s objectives included the use of IT to improve delivery of information through increased use of electronic library services, to allow academic libraries to cope better with growth, to explore different models of intellectual property management, and to encourage new methods of scholarly publishing. FIGIT identified several programme areas, including the pump-priming of electronic journals, and called for expressions of interest in 1994. With a budget of 15 million pounds over three years, FIGIT announced funding for 30 projects in 1995, including digitisation, electronic journals and on-demand publishing. In the final year of this research project, this attempt to pump-prime access as opposed to holdings was already under attack from some quarters. “Access can serve as a reasonable substitute for holdings of older materials, but not for much current material” (Line, 1995).
The access versus holdings debate continues into 1997. Sir Brian Follett, Vice-Chancellor of the University of Warwick, in response to questions after his paper "HEFCE (Higher Education Funding Council for England) - Strategic Issues" (given at the Joint JISC and UKERNA (United Kingdom Education and Research Networking Association) Library Strategy Workshop held at Robinson College, Cambridge, 6-7th January 1997) concluded that universities retaining copyright was not a workable solution to the serials pricing issue after he and his colleagues had investigated the work done in this area by universities in the US. If this is indeed the case, then it appears that the academic and research community's ace card cannot break into this vicious circle of events.

1.3.2 Demands on Funds from New Electronic Services
At a time when library funding was under pressure at many institutions, a number of new developments in information technology, such as automated catalogues, CD-ROMs, and online links to external databases, were making further demands on limited financial resources. Despite the undoubted potential benefits for academics' research, the expense of the introduction of these new electronic services further increased the financial pressure on libraries. Indeed, these information technology developments (and others covered in the following sections) have enormous implications for staffing, the range of skills staff possess and the need for continuing training (Hepworth, 1991; De Bruijn, 1991; Malinconico, 1992, Dyer, 1993; Jespersen, 1993).

During the course of this research project, the pressure to network CD-ROM resources increased, as evidenced by the complex issues (Blake, 1993; Burley, 1994; Mendelsohn, 1994; Paster, 1994; Watson, 1994; Wiedemer, 1994) and implementation case studies (Connolly et al., 1993; Van De Sompel, 1994; Ensor, 1994; Yeadon, 1995, Marshall, 1995) in the literature, and the importance of setting up gopher and world-wide web servers became apparent (Arfield and Brown, 1995). This was accompanied by user studies on awareness and usage of electronic resources (Laribee and Lorber, 1994; Siddiqui and Mirza, 1994; Furner-Hines and Willett, 1995; Wu, 1995) and continued concern about staff training, as evidenced by the Fielden Report (John Fielden Consultancy, 1993) and by the sponsoring by JISC via the Electronic Libraries Programme of, amongst others, the Netskills, EduLib and IMPEL (Impact on People of Electronic Libraries).
initiatives. Netskills aims to help the UK higher education community make effective use of the Internet for teaching, research and administration. EduLib aims to provide a nationally recognised and accredited network of library and support workers who will possess both the networked information skills and the teaching skills required to make the use of electronic libraries an everyday part of teaching, learning and research (the first wave of training workshops running from February to June 1997). IMPEL2 is an extension of the IMPEL Project (Edwards et al., 1993; Edwards et al., 1995) which investigated the human aspects of increased electronic provision in UK academic libraries, focusing on the social and organisational impact on qualified librarians. IMPEL2 intends to carry out a series of four linked projects to take forward the understanding of change in academic libraries, using the methodological approach developed for the IMPEL Project: Project A will continue to monitor change and focus on the key issues in the IMPEL Project's original case study sites and in others; Project B will investigate the impact of the Electronic Library on academic staff and students; Project C will investigate the impacts on library and information services of resource based learning; and Project D will monitor the impact of the educational development for higher education library staff.

By 1992, the effect on the balance of library budgets was evident in surveys (East 1991) of the resourcing of electronic information services by three representative institutional panels of universities, polytechnics and public libraries, undertaken during 1988-90. East showed that, from their total expenditure on bibliographic datasets, university libraries were already spending 27% on electronic access, with a higher share of this 27% (i.e. 16%) going to CD-ROMs rather than online. During the course of this research project, two follow up studies (East and Tilson, 1993; East et al., 1995) indicated that between 1988 and 1992 the amount spent on electronic services had tripled (£11,000 to £31,000 mean annual expenditure) and that during the period 1992-1994 the mean annual expenditure of universities on database access as a whole nearly doubled (£30,600 to £60,400 mean annual expenditure per university). The problems faced by information managers in allocating resources to externally-produced electronic information services and the factors which determine their decision-making will be recurring themes during the 1990s, as is evidenced in the literature at the start (Cox and Hanson, 1992; Bakker, 1992; Grainger and Lyon, 1992) and throughout the duration of this
research project (Cox, 1993; Hanson and Cox 1993; Renwick, 1993; Friend, 1993; Dyson and Carey, 1993; Corrall, 1994; Rothnie, 1995; Brown, 1995).

1.3.3 Article purchase versus journal subscription debate

By 1992, the lower levels of acquisition of stock, referred to above, had led to an increased reliance on either resource sharing or inter-library loan (ILL). The shift from teaching to learning in UK higher education policy (Department of Education and Science, 1991) induced by changes in government education policy (the abolition of the binary divide between universities and the former polytechnics, the increase in numbers of students with no corresponding increase in resources) had led a number of university librarians to feel under increasing pressure to provide access to electronic sources of information as a way of reducing both total spend on journals and on science subjects in particular (Baker, 1992b). A survey of university libraries (referred to in section 1.3.1) in 1992 had shown that, of the 23 libraries responding, all but two spent more than 40% of their non-payroll budget on journal subscriptions in 1989/90 - and nine spent over 50% (Baker, 1992a).

Indeed, it was widely held that articles were overtaking journals in popularity: the international subscription business was perceived to be growing very slowly, perhaps even remaining static, whilst the article business was growing fast. In their study of electronic publishing published in December 1992, Brown and Worlock (1992, 80) predicted that “by 1998 document delivery will represent half the subscription business”.

This research project’s first year saw the mushrooming of announcements of new Current Alerting Services - Individual Article Supply (CAS-IAS) services, a number of which became operational in the UK during 1993. The only electronic services of this kind available to the UK academic community until then had been the Institute of Scientific Information’s (ISI) Citation Indexes via BIDS (Scanlon, 1992), which equated to an electronic current awareness service, and the ADONIS system (Stern and Campbell, 1989; David and Martin, 1989; Braid, 1989; Compier et al. 1992; Stern, 1992; Smith, 1993) (a publisher consortium CD-ROM system containing the full-text of c. 500 journals from c. 40 publishers, mainly in the biomedical science field), which equated to an electronic document delivery system. Services becoming operational in the UK in 1993 were the British Library’s Inside Information (Wood, 1992; Wood, 1993) (with its electronic
document delivery from September 1993), Faxon's Faxon Finder (Hawks and Alexander, 1992; Leach and Tribble, 1993) (with its Faxon Xpress accelerated document delivery), CARL's (Colorado Alliance of Research Libraries Systems Inc) UnCover Database (with its UnCover2 electronic document delivery service) (Lenzini and Shaw, 1992; Leach and Tribble, 1993; Beckett, 1993; Notess, 1993) and OCLC's (Online Computer Library Center) FirstSearch system containing the ArticleFirst and ContentsFirst Databases (Leach and Tribble, 1993) (again backed by a document supply service). Inside Information and Faxon Finder were, or were planned to be made, available via the BIDS service whilst ArticleFirst was made available via the NISS (National Information Services and Systems) Gateway. The UnCover service was "free" to end-users via telnet facilities. An example of a currency analysis performed by the ICRF LIS staff in September 1993 (and submitted as a contribution to JUGL's PLANET - Plan for Library Action on Networks - initiative) of some of the CAS-IAS services available is included in Appendix 4, with commentary by the authors on various aspects of the results intended to generate input from other practitioners. As Brown and Worlock (1992, 77) observed in late 1992, "the range of services emerging shows that there is limited expertise as yet to indicate who has got it right. The short record services offer a manageable database; the larger records provide more information on which an order may be made".

Other document supply services were also becoming available or planned to become available to libraries and end-users alike such as the French INIST (Institut de l'Information Scientifique et Technique) service (Electronic Documents dominate the agenda, 1993), the US Research Libraries Group CitaDel system (journal citation and document delivery service) (Leach and Tribble, 1993; Jackson 1992; Jackson, 1993) together with ARIEL (their proprietary document delivery software), Article Express International Inc's system (joint venture between Engineering Information (EI) and Dialog Information Services), EBSCO's system and Swets' table of contents system. The full-text of articles from selected titles on the traditional online hosts should not be forgotten either, e.g., BRS's CCML (Comprehensive Core Medical Library), Dialog's MEDTEXT and Health Periodicals Database (the latter being available on Data-Star also) and STN International's collection of chemical journals from about 6 publishers - although, obviously, these services provided the full-text minus graphics. In contrast to
these "articles minus graphics services" was the Online Journal of Current Clinical Trials (OJCCT) (Keyhani, 1993), a scientific peer-reviewed journal published by the American Association for the Advancement of Science (AAAS) and mounted by OCLC. Access was via its Guidon interface (a Windows-based graphical user interface) and online ordering facilities were available for document supply via fax or mail. Launched in July 1992, it was the first electronic journal to support graphs, tables, illustrations and mathematical equations, in addition to high-quality text. Despite critics of the concept (Palca, 1991), OCLC announced in 1993 the publication of two more online journals, the Institute of Electrical Engineers' Electronic Letters and the Online Journal of Knowledge Synthesis for Nursing, both of which were launched in 1994.

The challenge for information practitioners was (and still is) to evaluate the existing and new services, particularly the CAS-IAS services, and to decide on the preferred service, or combination of services, for their particular library, given their limited budgets. For current awareness services, factors of importance included currency, title coverage (varies with subject areas of interest), article coverage (journal articles only or the addition of book reviews, editorials, letters to the editor and news briefs), data format (all authors, as in the case for example of ISI's Citation Indexes; first ten authors as in the case of Faxon Finder; or first four authors as in the cases of Inside Information and UnCover), presence or not of abstracts, and last (but by no means least) cost (which varied with supplier and depended on mode of delivery). Decisions, particularly in the case of the service options via BIDS, often had to be made at relatively short notice, after minimal periods of service trial and often at inconvenient stages of the budget year. For document supply services, criteria such as coverage, ease of use, mode of ordering, speed of response, mode of delivery, quality of copies and, of course, cost were all important factors in the decision-making process. The results of a document supply analysis, based on four trials (totalling 40 documents from five suppliers) conducted by ICRF LIS staff during the course of this project, are also included in Appendix 4 (see Table 3). The targeting of end-users by many of these new systems by encouraging payment by credit cards (especially out-of-hours) and the changes in the UK higher education system, whereby increasingly departments have their own document acquisitions budgets rather than being collectively held by the university's library, were other factors affecting this fast moving situation.
Moreover, practitioners needed to keep abreast of developments concerning a host of on-going document delivery trials and projects, a number involving publishers, libraries and computer/software companies. In the first year of this research project, these included OCLC's CORE Project (conversion of contents of 20 chemical journals in association with Bellcore, American Chemical Society and Cornell University's Chemistry Department) (Krumenaker, 1993); Elsevier's TULIP (The University Licensing Program) Project (concerning 42 materials science journals in collaboration with 15 US universities) (Baldwin, 1993); Springer-Verlag's Red Sage Project (concerning 20 molecular biology and 20 radiology journals in association with the University of California and AT&T Bell Laboratories) (Badger and Wallace, 1993); the SPIRS (SuperJANET Project on Information Resources) Electronic Journal Demonstrator; PICA's (Dutch Centre of Library Automation's) RAPDOC (Rapid Document Delivery Project in collaboration with Swets & Zeitlinger and SURFnet) (Costers and Koopman, 1993; Costers, 1993); the UK/Netherlands RIDDLE Project (Rapid Information and Document Delivery in Library Environments involving UK Rutherford and Appleton Laboratory, the Dutch Centre for Mathematics and Computer Science and Longman Catermill); Carnegie Mellon University's Project Jupiter (concerning the development of a campus-wide electronic library, including testing in the Netherlands in association with the Catholic University Brabant and the Royal Library); NCSU's (North Carolina State University) Digitized Document Transmission (Jackson, 1993) Project (concerning delivery of scanned images of articles to end-users involving 14 American universities within the framework of the inter-library loans system); De Montfort University's (Arnold et al., 1993; Ramsden and Zimin, 1993a; Ramsden and Zimin, 1993b) ELINOR Project (Electronic Library and Information Online Retrieval - in collaboration with BLR&DD and IBM UK Scientific Centre); EDIL (Electronic Document Interchange between Libraries) Project (built on the achievements of the Foudre Project (Menil, 1993), concerning development of software, according to agreed standards like the GEDI (Group on Electronic Document Interchange, 1991) standards, for the electronic interchange of journal articles between scientific libraries) involving the UK's British Library, France's INIST, Germany, Portugal and the Netherlands' PICA; and Springer Verlag's Preview Service Project (whereby contents pages of 30 of its journals, with an abstracts option, were made...
available for a fee via the Internet three to six weeks before the printed version of each journal was published).

During the course, and since the completion of this research project, the marketplace has had a shakeout - some projects have ended, some have been superseded and others have become operational services. The period also saw an increasing number of publishers, professional groups and subscription agents offering various separate current awareness and article supply services. Reports on usage or accounts of developments of established services, such as ADONIS (Pilling, 1994; Morris, 1994; Compier and Campbell, 1995), INIST (Lupovici, 1994), and BIDS (Smethurst, 1994; Poynder, 1994; Morrow, 1995) abound in the literature.

Of particular note in 1994 was the launch of UnCover Reveal, an electronic table of contents alert service. It provided table of contents indexing from nearly 17,000 journals worldwide and allowed users of the service to create a personal, bespoke list of journal titles and receive e-mailed table of contents from any of the selected titles when the UnCover database was updated (documents may be ordered through e-mail and will be delivered by fax for a service charge of $8.50 plus copyright and a fax surcharge outside the USA or Canada). In 1995, the UnCover Company launched a new service UnCover Single Order Source (SOS), which enabled users to order (by fax, phone, e-mail or post) articles from over 16,000 periodicals, delivery being guaranteed by fax within 24 hours at a cost of $10 per article plus copyright and fax charges. In 1995 also, SilverPlatter selected UMI as its document supplier for users accessing SilverPlatter databases via the Internet or ERL (Electronic Reference Library) server utilising an electronic ordering link.

The most notable superseded project was the TULIP Project (Zijlstra, 1994), which has been replaced by the EES (Elsevier Electronic Subscriptions) service, which was launched commercially in 1996 as the result of a 1995 agreement between Elsevier Science and OCLC (all Elsevier's titles eventually being made available through OCLC's SiteSearch system accessed locally or via OCLC's Guidon interface). Again in 1995, the Chemical Abstracts Service (CAS) announced plans to cooperate with Elsevier Science and the Royal Society of Chemistry (RSC) on a pilot project to deliver electronic journal subscriptions to the desktop through SciFinder, CAS's new information retrieval product. CAS
already provided access to complete page images of American Chemical Society (ACS) journals, including article charts, tables and pictures through SciFinder. The autumn of 1995 saw the commencement of ISI’s Electronic Library Project with a pilot installation at the Thomas Jefferson University, Philadelphia. ISI announced plans to have four other North American sites operational by early 1996. The Electronic Library Project provides tables of contents, bibliographic data and abstracts of papers of approximately 1350 scholarly periodicals, with the addition of the full images of those periodicals for which those publishers have agreed to allow electronic storage and delivery.

More recently (1997), Elsevier Science has enhanced its EES service with a web interface, renaming it the ScienceDirect service. Journal full text is available in PDF format, is fully searchable, and is accessible using standard web browsers. Elsevier forecasts that all of its life sciences journals will be available via ScienceDirect by the end of 1997. Springer Verlag have expanded their Preview Service into SpringerLink, which gives web access to the electronic versions of over one hundred of its journals (mainly in PDF format) before their printed counterparts are published, provided subscribers are registered for the journal in question. Also, all twelve RSC journals have been made available on the Internet via CatchWord (a UK based distributor of electronic journals) in an electronic publishing format called RealPage, although OCLC will also be making the same journals available via the web later in 1997.

Finally, Appendix 5 contains an overview by ICRF LIS staff and ex-staff of the state of play in July 1997 of this fast moving scenario. Welcome additional assistance to information professionals in grappling with the CAS-IAS choices before them came in the form of a British Library Research & Innovation Centre (BLRIC - formerly BLR&DD) grant to Aston University to investigate the functionality, costs, value and impact of Current Awareness/Individual Article Supply (Brunskill, 1996) and a number of document supply projects and studies set up under FIGIT’s Electronic Libraries programme, such as EDDIS (Electronic Document Delivery - the Integrated Solution) Project, InfoBike (document ordering facilities via BIDS and electronic journals, initially in Adobe Acrobat PDF format) and MA/HEM (Methodology for Access/Holdings Economic Modelling). Perhaps most significant of all in 1995 was the UK Pilot Site Licence Initiative (Commonwealth Higher Education Management Service, 1997) set up by the four
UK higher education funding bodies. Under this initiative, the funding bodies arranged for Academic Press, Blackwell Publishers, Blackwell Science and the Institute of Physics Publishing to make available to UK universities and colleges during 1996 and 1997 printed journals at discounted prices and an extensive range of electronic material. This led to what have been termed "aggregator" agreements in which several publishers make their journals available via the same service, BIDS' JournalsOnline and SilverPlatter's SilverLinker being examples of such an arrangement.

1.3.4 Technological Developments
The technological advances of the past decade and a half have facilitated the developments mentioned in the above sections and those that are covered in the following sections. These advances include more effective and more powerful microcomputers, better telecommunications, more efficient storage media (optical media such as compact discs) and continued growth of electronic information sources.

The phenomenal growth in the performance of low-cost computers, based on microprocessor technology, has led to a mass market of users. A European survey (Consulting Trust, 1993, A2) in the first year of this research project stated "The penetration of personal computers in Europe has reached some 25% in offices (USA 35%) and 15% in homes (USA 20%) and is growing rapidly". Indeed Baskett and Hennessy (1993) predicted that "The rapid progress in microprocessor performance since the early 1980s is likely to continue for at least five more years". They maintained that just as microprocessors have become the dominant force in low-cost computing, they are becoming the major building block for scientific supercomputers. "Future supercomputer-class machines will be parallel computers that use tens to hundreds of high-performance microprocessors".

Consulting Trust's overall conclusions about computing power to the year 2000 were similar. Component density (how closely components can be packed on a computer chip, thereby providing more capability) would increase about another 10 times over the next decade; the number of components per chip would increase about 50 times that of today's chips; and component costs are falling - e.g. memory prices reduce to one-tenth over ten years. It was predicted that part of the
additional available processing power would go into improved input and output facilities (new low-consumption, flat-screen display technologies replacing the conventional CRT (cathode ray tube) display and growth of cheap, fast printers). In terms of capacity, optical storage leads over magnetic discs but with somewhat slower access times and slightly lower data transfer rates - but it is maintained that "both technologies will continue to play a significant role for the next ten years" (Consulting Trust, 1993, J12).

The implications for information practitioners of this rapidly changing hardware scenario (increasing processor speeds, higher densities, reductions in cost) relate to the planning process with hardware having shortening life cycles and an increasing rate of obsolescence (sometimes accompanied by compatibility problems).

Practitioners face similar planning problems with the accompanying software developments, particularly in terms of operating systems. The Spring 1993 Ovum report "Software Product Markets Europe" reported in Aslib Proceedings (No Winner in the Desktop Operating Battle, 1993), forecast that there would be no clear winner in the desktop operating systems battle. It predicted that the main competitors would be Microsoft's Windows and Windows NT, IBM's OS/2, Macintosh and versions of UNIX from USL/Novell, Sun (Solaris) and SCO. It anticipated that in Europe, by 1997, the market distribution of installed desktop systems by primary operating system would be as follows: MS-DOS (which in 1992 had 78% of the market) would hold 29% of the market; Macintosh (which in 1992 had 10% of the market) will still hold 10%; Windows (which in 1992 had 7% of the market) would hold 28%; UNIX (which in 1992 had 4% of the market) would hold 10%; OS/2 (which in 1992 had 1% of the market) would hold 8%; and Windows NT (which in 1992 had 0% of the market) would hold 14% of the market. Consulting Trust confirmed that existing operating systems with substantial installed bases would probably remain popular, but with improved inter-operability (Windows NT likely to supersede Windows as most popular operating system for Intel-based machines; the popularity of UNIX would grow; a new generation of object-oriented operating systems would appear).

However, information practitioners cannot rely solely on Ovum forecasts (which are updated monthly and are not cheap to acquire) and one-off reports (like that of Consulting Trust) to assist them in their forward planning for new
equipment/software. Nevertheless, such reports are an important guide to the constantly changing hardware/software scenario and must be taken into account in the planning process.

1.3.5  Growth of Networks
The Internet, the worldwide system of interconnected computer networks, has become the foundation of computer communications over the last two decades. Fibre optics have revolutionised digital transmission in much the same way as integrated circuits have revolutionised digital electronics. The parallel development of Local Area Network (LAN) technology has meant that computers connected to LANs give users shared access to information stores and peripheral equipment. An increase in communications bandwidth, based on optical fibre, is now seen as the requirement to facilitate future high-speed access to data, graphics and sound. At the start of this research project, these requirements were being translated into actions in the United States, with the passing of the National High Performance Computing Act, establishing NREN (the National Research and Education Network) and in the UK with the awarding of the SuperJANET contract to British Telecom in November 1992, worth 18 million pounds.

The origins of the Internet can be traced back to the ARPAnet (US Department of Defense Advanced Research Projects Agency Network) Project of the late 1960s which was an experiment in packet switched networking to support military research, through the USENET (Network News) and BITNET academic network developments of the 1970s to the establishment in 1986 of the NSFNET (The National Science Foundation), designed to link together US researchers through 5 super-computer centres, standardising on TCP/IP (Transmission Control Protocol / Internet Protocol) as its communications protocol.

JANET (the Joint Academic Network and the UK part of the Internet) was established by the Computer Board in 1984, has over 200 higher education and research organisations connected to it and supports two major network protocols, ISO's OSI (International Organisation for Standardisation's open system interconnection) and IP (Internet Protocol). It is funded by the Department for Education and Employment (Department of Education and Science in 1992) through the Higher Education Funding Councils' JISC (the Computer Board's successor).
By the commencement of this research project and throughout its duration, the Internet experienced exponential growth in the number of networks, the number of hosts and the volume of traffic. The President of the Internet Society was reported to have stated in the summer of 1993 that there were between 5 and 15 million individual Internet users and that the numbers were doubling each year (Pool, 1993). According to the Internet Society's statistics (Internet Society, 1996), the number of networks increased from 7,354 (October 1992) to 79,986 (September 1995); the number of host computers increased from 1,136,000 (October 1992) to 7,891,869 (October 1995) - a seven fold increase; and the number was projected to more than double again to 17,753,266 by January 1997. A 1996 survey by NUA Ltd. (NUA Internet surveys, 1997) reported that: 83% of Internet users were located in the US and only 6% in Europe; 80% of them preferred Netscape as an Internet browser; and a greater percentage of users accessed the Internet from work in Europe, whereas most accessed it from home in the US.

By 1992, library networking had become widely established, facilitated by the establishment of UKOLN at the University of Bath and its hosting of a number of datasets, most notably ISI's Citation Databases, giving access to academic end-users. Use of JANET in the library community has been promoted also by JUGL out of which has grown BUBL (Bulletin Board for Libraries) (originally run jointly by the Universities of Glasgow and Strathclyde and now based at the University of Bath). Training projects such as Jupiter and the Mailbase project at Newcastle have also been important for libraries, Mailbase's impact being evident in the managing of 244 mailing lists during the first year of this research project (July 1993) and an impressive 1527 lists by January 1997.

In the United States the Clinton Administration, particularly Vice President Senator Gore, was reported to be heavily committed to the Internet, a reflection of its perceived importance. UKOLN published a report (UKOLN, 1993) highlighting the importance of networks and calling for a national policy for the development of the physical network and for the services that run on it. Robinson (1993) listed the bodies concerned with networking within the UK: the ACN (Advisory Committee on Networking), and UKERNA, both funded from the HEFC via the JISC; BIC (Book Industry Communications), IUCC (Inter University Computing Committee), and SCONUL (Standing Conference on
National and University Libraries), who have joined forces to form the INA (Information Networking Alliance), which mirrors the US organisation CNI (Coalition for Networked Information). “A national forum is still lacking however, although interested parties are growing, to include: the British Library, Janet User Group for Libraries (JUGL), Laser/Viscount, Library and Information Cooperation Council (LINC), the Library Association, Public Libraries Networking Awareness Steering Group, and the Publishers Association” (Robinson, 1993). The final year of this research project (1995) saw the formation of the Library and Information Commission, which was set up as a national focus of expertise in library and information services of all types and in all sectors in the context of rapid technological change. Its remit is to be a national focus for library and information services, to advise government on library and information services issues, to encourage co-operation and co-ordination, to develop a UK research policy, and to represent the UK internationally. More recently, the National Committee of Inquiry into Higher Education (1997) has recommended that the JISC should: continue to manage and fund quality and cost-effective Communications and Information Technology (C&IT) services for researchers, introduce charges for services on a volume-of-usage basis, and be invited to report, within a year, on options to provide sufficient protected bandwidth to support UK research.

In 1992, the information practitioner's ability to access the Internet's resources and to gain familiarity with navigation tools such as Alex (filesystem providing transparent read access to files in anonymous ftp sites), Archie (database of anonymous ftp files), Gopher (network browser), Veronica (Gopher menu hopper), Jughead (Gopher indexed file locator), world wide web (document linker, hypertext driven), and WAIS (text searcher) was becoming increasingly important. Comprehensive texts, such as Krol's (1992; 1994) volumes and a host (for example Dern, 1992; Polly, 1992; Bauwens, 1993; Ward, 1993) of brief guides and tours of the Internet resources and navigation tools facilitated the familiarisation process. During the project period, the production of guides continued to flourish (Addyman, 1994, Glowniak and Bushway, 1994; Morgan 1994; Noonan, 1994; Price-Wilkin, 1994; Furner-Hines and Willett, 1995) but by 1995, the vast expansion of Internet resources and access to them required information professionals to have some knowledge of the pros and cons of the
various web search engines (Winship, 1995). Important for practitioners also is an appreciation of some of the system debates and controversies, such as whether or not the OSI standard will eventually replace TCP/IP; or whether the Z39.50 protocol will replace the http protocol (Dempsey, 1993; Joy and Murray, 1995; Dempsey et al., 1996). The technical aspects of these matters are not as important as an awareness of the debates and an understanding of the implications for our profession and on our users of their implementation.

Although there were no exact statistics on what percentage of research scientists or humanities scholars were Internet users, it had been suggested that some groups, such as computer science and electrical engineering, had almost 100% participation, usually started by electronic mail. Examples are the Professor of Classical Studies and coordinator of the Center for Computer Analysis of Classical Texts at the University of Pennsylvania who is reported (Pool, 1993) as stating that a sort of virtual university was being created with electronic mail. "There's one colleague [at another university] whom I used to speak with maybe a couple of times a year. Now we're in e-mail contact twice a day". In physics, Paul Ginsparg (Taubes, 1993) at Los Alamos National Laboratory had set up several bulletin boards that accepted preprints and sent out the abstracts to thousands of subscribers, who could download full texts of any interesting papers. In biology in the early 1990s, researchers were reportedly routinely accessing hundreds of databases containing genetic maps and protein structures (Courteau, 1991). Indeed, it was often independent researchers who had developed the above-mentioned software tools to help navigate the Internet and then distributed them for anyone to use. The Clearinghouse for Networked Information Discovery and Retrieval in North Carolina had an important role here. It was created as a research and development group specialising in distributed information systems in 1992, by a three year co-operation agreement between the Microelectronics Center of North Carolina (MCNC) and the National Science Foundation.

As this trend towards making more and more information easier and easier to get continued, Pool (1993) maintained that "electronic communities" would be created, meaning "collections of researchers in a single field who are linked electronically and who share information, instruments, software and even computing capability". Wulf (1993), Professor of Computer Science at the University of Virginia, called these envisaged electronic communities "national collaboratories" (the word
"collaboratory" being a combination of the words collaboration and laboratory). A 1993 National Research Council (NRC) report (National Research Council, 1993) entitled "National Collaboratories: Applying Information Technology for Scientific Research", explored the ways in which information technology could be used to support a much broader range of the activities in scientific enquiry.

Such developments as the use of the networks by researchers to collaborate in new ways would have far reaching implications for information practitioners and their services.

1.3.6 Increasing Amounts of Information in Electronic Form

As a result of the above-mentioned developments, by 1992 increasing amounts of information were available in electronic form from the point of creation to the point of use.

A great many researchers, scientists and scholars, having gained experience with electronic campus and institutional networks, were creating publications electronically for the networks, as mentioned above. These activities had resulted in Diane Kovacs creating the Directory of Scholarly Electronic Conferences in 1989 and this subsequently led to the Association of Research Libraries combining it in print form with Michael Strangelove's Directory of Electronic Journals, Newsletters and Digests to form the Directory of Electronic Journals, Newsletters and Academic Discussion Lists (Editor-in-Chief, Diane Kovacs). The Directory of Scholarly Electronic Conferences was in its seventh edition (October 1993) in this research project's first year, in its ninth edition by the last year of the project (1995) and its eleventh edition by June 1996 (renamed Directory of Scholarly and Professional E-Conferences). The ARL publication (renamed Directory of Electronic Publications Available) reached its 5th edition by 1995.

In addition, there were thousands of files and papers held on institutional file transfer protocol (ftp) sites that were available for anonymous retrieval. Moreover, there had been the establishment and growth of electronic archives of information such as Project Gutenberg and the Oxford Text Archive. The goal of Project Gutenberg is to give away one trillion electronic text files by 31st December 2001. The Oxford Text Archive had been collecting electronic texts for almost two decades and contained electronic versions of literary works by major authors in English, Greek and Latin as well as other languages. The catalogue of
the Oxford Text Archive (July 1993) listed 1336 titles which had grown to over 1500 titles by November 1995. Most of the texts were freely available (for example, works by Robert Browning, the Bronte sisters, Geoffrey Chaucer, Daniel Defoe, Charles Dickens, Thomas Hardy, William Shakespeare, Jules Verne and Oscar Wilde) although some were restricted in some way. An ftp service for licensed access via the Internet was also available.

The University of Virginia at Charlottesville also had an Electronic Text Center containing text and graphics of scholarly texts, a large number of which were freely available to any Internet user (mostly modern and middle English texts). Because of the contractual obligations with the vendors who supplied the texts and the search software, access to parts of the service is restricted to staff and students of the University of Virginia (for example, the Oxford English Dictionary). During the project period, it was hoped that proposals emerging from, for example, the CITED (Copyright in Transmitted Electronic Documents) Project (Cornish, 1993) under the European Commission's Esprit programme might help with the problems of electrocopying. This project was succeeded by the COPICAT (Copyright Ownership Protection in Computer-Assisted Training) and COPYSMART (CITED Based Multimedia IPR Management on Cost-Effective Smart Device) Projects. The COPYSMART Project aims at the development of an industrial low-cost solution for implementing Intellectual Property Rights management based on the CITED model and runs until November 1997. A collection of papers on copyright issues for the electronic library is now available on JISC's web home page.

There was even an online journal about online journals and related topics: the Public-Access Computer Systems Review, published by the University of Houston Libraries and distributed free on the Internet (covering campuswide information systems, CD-ROM-based local area networks, document delivery systems, electronic publishing, hypermedia and multimedia systems, network-based information resources and other topics). As Okerson (1992) stated "On many minds, access is considered superior to ownership and more affordable than it. We are now speaking of virtual libraries and libraries without walls".

By 1992, it was clear that academics rated very highly the convenience of having the information delivered directly to their workstations. Meadows (1992) reported
that between 1985 and 1991, the percentage of scientists and engineers using
electronic mail grew from 38% to 70% while, in the same period, the number
accessing academic bulletin boards grew from 2% to 23% and those undertaking
online searching from 24% to 59%. Submission of papers to journal publishers on
disc had become a common occurrence. This greater availability of texts in
electronic form was mirrored in the professional authors (i.e. those who write
extended, or book length, texts) field. Dorner (1988, 1991) in her publications on
authors and information technology, reported that authors were technologically
more advanced than publishers. Her questionnaire survey (reported in her 1991
publication) revealed that 74% of professional authors were already using
computer tools, and that 34% of those using word-processing packages submitted
work to publishers on disc.

However, as Borman (1993) pointed out, electronic publishing of scholarly
research is not yet accepted by administrators of the academic reward system. "A
scholar publishing in an electronic journal, even a refereed electronic journal, does
not find that work treated with the same respect as work published in a paper
journal".

The revolution in electronic information was a key factor in the deliberations of the
funded by FIGIT from 1995 to increase the amount of published information in
electronic form included digitisation, electronic journals, electronic document
delivery, electronic short loan and on demand publishing.

With the networks continuing to attract more and more scholars, one of the most
important questions concerns the future funding of the network infrastructures, the
proportion of public to private funds and how visible or how transparent those
expenses will be to what categories of users (Okerson, 1992). The outcome will be
of immense importance to information practitioners and their users.

In the UK, it seems certain that there will be some sort of increased charge by
JISC to higher education institutions for JANET/Internet access from August 1998
as there is a risk that all JISC funding will be swallowed up by the costs of leased
line links to the United States. The JISC stated in July 1996 (JISC, 1996, 40)

"The demands for bandwidth, particularly international links, will soon exceed
the JISC's ability to fund them; the cost of leased lines is static but not falling."
Current traffic predictions are that over 100Mbps would be required to meet transatlantic demand alone; this sort of bandwidth is not commercially available, and if it were, would cost over £20M pa. This inevitably means that the institutions will have to meet some of the cost if networking demands are to be satisfied”.

1.3.7 Publish or Perish Syndrome/Scenario
The scale and complexity of the often quoted “information explosion” in science periodical publishing had also been a subject of hot debate. Ulrich’s Directory (Ulrich’s International Periodicals Directory 1990-91, 1990) recorded that 8,062 science journal titles were launched before 1978 and that this figure rose to 29,621 between the period 1979 and 1988. John Naisbitt (Naisbitt, 1982) estimated that 6,000-7,000 articles are written every day, that scientific/technical/medical information increases 13 per cent each year and that with the growth in the number of scientists, data will double every twenty months. Edward Huth (Huth, 1989) referred to the results of the 1988 Louis Harris poll carried out for the New York Academy of Sciences as confirmation that the medical community indeed faced an “information explosion” whilst others have called for greater investment in “systems for data and information collection, storage and analysis” to cope with the problems of information overload contained in scientific publications (Roe, 1989). In contrast, Eugene Garfield (Garfield, 1991) has labelled the concept of “ever-mounting flood” of scientific journals “baseless mythology”; Archibald and Line (1991) cast doubt on the supposedly continuing exponential growth of literature based on their study of a sample of 190 journals between 1950 and 1987; Williams and Clark (1992) concluded that the explosive (i.e. increasing at an increasing rate) growth was not in the amount of new information produced but rather in the distribution (dissemination and recycling) of information. The debate continues.

Whatever the truth of the matter, scholars feel increasing pressure to publish in order to justify research grants and to obtain academic promotions. Merton (1969) and Stossel (1987), among others, have referred to this “publish or perish” syndrome resulting in excessive publication. This situation is exacerbated by the increase in multi-authored papers, brought about by research undertaken by teams of investigators, with the result that the description of research is published in bits known as “least perishable units”, a practice lamented by some (Carrigan, 1991) and rigorously defended in some quarters (Refinetti, 1990). As one academic
(Mackay, 1993) has put it “Increasingly the status and pay of scientists are determined by what they publish and by ratings in the Science Citation Index”.

The premise that the number of times a paper is subsequently cited (its citation count or score) is a partial indication of scientific excellence is another continuing debate. Anderson (1991) quoted the judgments of some British academics, participating in a Royal Society survey on behalf of the University Funding Council and the Committee of Vice-Chancellors and Principals (CVCP), on the use of citation counts to measure the impact of research papers: “pseudoscience”, “utterly misconceived”, “based on a conceptual fallacy”, “totally mistaken”, “the refuge of Philistines”. Von Borstel (1991) also argued why citation counts should be mistrusted, whilst Edward (1992) suggested a linkage between the frequency of the citations and the utility of the research. Indeed, during the course of this research project, this trend appeared to be continuing with ISI’s marketing of the “Institutional Citation Report”, offering organisations measures of research output (publication counts) and impact (citation counts) and the Wellcome Trust’s Unit for Policy Research in Science and Medicine’s (PRISM) "Research Outputs Database”, aimed at offering UK biomedical research organisations data concerning the success of the research they support to aid policy decisions.

However, the results of citation analyses have, in turn, generated discussions on related topics. At the request of the journal Science, statistics compiled by David Pendlebury of the Philadelphia-based Institute for Scientific Information (ISI) in 1990 indicated that 55% of the papers published between 1981 and 1985 in journals indexed by the Institute received no citations at all in the five years after they were published (Hamilton, 1990). Pendlebury stated that this result confirms the view that “10% of all journals get 90% of the citations” and that “these are the journals that get read, cited and have an impact”. In an earlier ISI study of articles published between 1969 and 1981 in the hard sciences (including medicine) it was shown that only 42% received more than one citation. A later study showed that the rate of uncitedness in the biological sciences was 41.3% (Hamilton, 1991). Moreover, Pendlebury maintained that self-citation accounted for between 5% and 20% of all citations.

The reportedly high percentage of uncited papers has led to controversy (Siekevitz, 1991; Refinetti, 1991) in the literature as to why this should be so and to question
whether much of the research being done is worthwhile at all. Campanario (1993), on the other hand, explored the difficulties experienced and problems encountered by authors in getting their papers published in the first place. Nevertheless, attempts are being made by some universities and funding bodies to address the quantity versus quality issue concerning publications: Harvard Medical School's promotion committees will only review applicants' 5-10 most significant papers (Culliton, 1988), whilst the National Science Foundation allows scientists to submit no more than five publications with their grant applications. In reality, however, HEFCE's 1996 Research Assessment Exercise (RAE) in the UK and similar exercises perpetuate the concern for publication and impact counts. In fact, Oppenheim (1996a) suggested that citation counts can replace the costly RAE in assessing the research output of university departments.

1.3.8 Acquisitions and Mergers
1992 was the tenth year of the CD and one in which the CD-ROM industry was characterised by an increasing number of mergers, buy-outs and reorganisations, the majority aimed at future product development and market growth. During the course of this research project, the online industry, document delivery companies, computer companies and professional associations were also subjected to volatile changes many of which involved developments which impacted upon information practitioners' software, products, services or equipment. In their study of 1993, Broadview Associates detailed 895 merger and acquisition deals in Europe in the IT area in 1993 alone - and the information services sector accounted for nearly half of all those deals (Broadview Associates, 1994).

The months before the commencement of this research project were indicative of the types of on-going activities. In February 1992, Dataware Technologies (CD-ROM software provider with distribution partners in 12 European countries) and Reference Technology (RTI) (strong service bureau expertise, originally involved in the establishment of the High Sierra file format standard) merged, the resulting new company becoming the largest independent supplier of software and services to the CD-ROM and multimedia publishing industry. During Spring 1992 Dataware also made a joint marketing agreement with Optimage Interactive Services (thus bringing multimedia, in the form of CD-I - Compact Disc Interactive, to its customers) and acquired the distribution arm of Archetype.
Systems (renamed Dataware Technologies (UK) Ltd), thus strengthening its international position and its position in the British market in particular. The company Macromedia was formed in 1992 as the result of a merger between MacroMind-Paracomp (industry leader in scripting and animation) and Authorware (the pre-eminent corporate/educational authoring tool company) which in turn followed the merger of MacroMind and Paracomp in the autumn of 1991 and MacroMind's purchase of Farallon Computer's sound product line. The appointment in May 1992 of Nathaniel Goldhaber as Chief Executive Officer of the company Kaleida, a joint venture company formed in the autumn of 1991 by Apple (a company strong on end-user interface) and IBM (a company strong on basic technology), brought renewed speculation about Kaleida's future. The company's stated aim was to create and establish a standard multimedia platform to compete with those from Microsoft, Philips (CD-I), Sony, Nintendo, Sega and Commodore. However, the uncertainty of multimedia development, still in its embryonic form at that time, was reflected by the fact that both Apple and IBM continued their own in-house R&D on multimedia platforms and products.

During the course of this research project (October 1992 to September 1995) the acquisitions and mergers taking place in the marketplace of interest to information professionals gathered apace.

In January 1993, the United Kingdom Association for Information and Image Management (UKAIIM) amalgamated with Cimtech Ltd, Europe's leading consultancy and research centre for document and image management. In March 1993, Knight-Ridder Inc, the US newspaper and information services company announced the acquisition of RadioSuisse AG, whose principal business was Data-Star, Europe's leading online information service. Knight-Ridder already owned Dialog Information Services, the US-based online information services company and the combined services resulted in a comprehensive range of business and scientific databases. In the Spring of 1993, OCLC acquired Information Dimensions Inc (IDI) from Battelle Memorial Institute. Since then IDI, located in Dublin, Ohio, has operated as a for-profit subsidiary of OCLC, a non-profit organization which is also located in Dublin, Ohio. The Chairman of the IDI Board of Directors, stated "IDI provides an exciting strategic fit with OCLC in full-text electronic publishing, electronic archiving and information management ... areas of growing importance for both organisations". Spring 1993 saw the
takeover of IOD Inc, which provided document delivery services under the name of Information on Demand, by Article Express International Inc, a document delivery company jointly owned by Dialog and Engineering Information (Ei). The Chairman of Article Express stated that the acquisition would provide its customers with expanded document delivery services in a variety of formats and that the name Information on Demand would be retained. In May 1993 SilverPlatter Information and Cambridge Scientific Abstracts formed a strategic alliance in which SilverPlatter assumed Cambridge Scientific Abstracts’ CD-ROM publishing activities, popularly known as Compact Cambridge.

With the breakup of the InfoPro Technologies (formerly known as Maxwell Online) in 1994, BRS Online was bought by CD Plus, the Orbit Search service by Questel (a French Telecom subsidiary), and BRS Software Products (the core product being BRS/Search text retrieval system) by Dataware Technologies. Dataware, a CD-ROM and services company, hence broadened its software and services offerings to include information management and online delivery. In 1994 also, an agreement between BIDS and the UnCover Company (part of the BH Blackwell group) gave the UK’s higher education community access to over 5 million articles worldwide. In addition, 1994 was the year in which the WordPerfect Corporation was sold to Novell, Aldus was purchased by Adobe Systems, and Quattro Pro (Borland) was acquired by Novell.

In 1995, Learned Information (Europe) Limited announced the acquisition of Mecklermedia Corporation’s UK trade shows. Included in the purchase were Computers in Libraries International, Electronic Books International and Internet World International. In 1995 also, Swets subscription service concluded an agreement with SilverPlatter to provide customers with remote Internet access to SilverPlatter databases located on a Swets network server, on a subscription basis. ERL retrieval clients, WinSPIRS, PC-SPIRS and MacSPIRS were to be used to search both the remote Internet and local databases. Internet subscriptions are modelled on CD-ROM subscriptions and are priced in the same manner as corresponding CD-ROM titles in a network environment. 1995 was also the year CD Plus announced plans to adopt Ovid Technologies Inc as the official company name, following the acquisition the previous Spring of the BRS Online and Colleague services; IBM announced its ambitious move into company software by means of the acquisition of Lotus Development; Knight-Ridder Information
acquired total interest in the UnCover Company, a joint partnership of CARL Corporation and Blackwell Ltd.; Dialog acquired a 100% interest in document supplier Article Express International (AEI) with plans to amalgamate AEI with Dialog SourceOne document delivery service; and UMI acquired the San Francisco based document delivery company, The Information Store, integrating it with its existing Article Clearinghouse to offer a premier document delivery service to organisations around the world.

Finally, Dialog announced changes in pricing which included some options that were more like CD-ROM pricing (connect time was cut by 30 per cent with the intention of eliminating it, a new “view fee” was introduced for every Type, Print or Display command, and two fixed price options, which used to be offered only to large clients, were made available to everyone); and Verity Inc and Netscape Communications Corporation announced a partnership that brought Verity’s Topic software technology to the Internet by embedding Topic in its Netscape servers and reselling Verity’s Agent Server technology. Topic, already used in many well-known software products including Adobe Acrobat and Lotus Notes, will bring agents and topic query objects to the Internet. Topic agents allow users and online providers to filter incoming information against interest profiles and send automatic alerts via personal HTML pages, electronic mail or fax. Topic objects also allow information to be categorized and browsed by subject.

In addition, during the course of this research project, many Internet service providers went public and others merged or grew by acquisition.

Traditionally, success and importance in the business arena have been associated with corporate size, numbers of employees, gross turnover and number of years in business. “In the past, companies succeeded, became big and important, and stayed big and important for decade after decade” (Information Market Observatory (IMO), 1994, 5, 6). Examples in the twentieth century information business include IBM, Sony, and AT&T. However, with the newer technology areas, the latter decades of the twentieth century have witnessed the quick rise to success and fame of smaller companies such as Apple, Microsoft, Lotus, Novell and Intel.

“... increasingly, many new technology and information areas could well be dominated by a kaleidoscopic and ever-changing array of smaller
companies, rather than continue to be dominated by a few giants. When life speeds up, giants have problems (as IBM, for one, has discovered)".

In short, the report concluded that the electronic information area would continue to be dominated by new small companies who, if successful, would be acquired by larger ones.

As we move into the twenty-first century, this fast-moving acquisitions and mergers issue is yet another area for information professionals to keep themselves appraised.

1.4 Literature Survey

1.4.1 Evaluation of Library & Information Services

Over the last two decades, libraries have increasingly been held accountable for their performance and the literature is rich with reviews of evaluation methods and effectiveness concepts (Swanson, 1975; Lancaster, 1977; Du Mont and Du Mont, 1979; Blagden, 1980; Lancaster, 1988; Goodall, 1988; Ford, 1990; Blagden and Harrington, 1990; Baker and Lancaster, 1991; Morgan, 1995b). Recent years have witnessed a UK Government led drive to cut costs and/or improve quality in the public sector (thinking embodied in the Citizen's Charter (1991) with its emphasis on quality, choice, standards and value), by compulsory competitive tendering in local authorities, and "market testing" of large bodies of work in the Civil Service. This scenario mirrored what had happened in the private sector with companies embracing the concepts of "customer care" (with its emphasis on the needs of the user rather than the convenience of the producer) and "total quality management" (with its principles of continuing quality improvement) as the keys to success and survival. British Standard 5750 (now superseded by ISO's 9000 series of standards) and related regulations lay down what is required of a quality system in terms of fitness for stated and implied purpose but what is required is an effective system of performance measurement which includes ways of assessing the needs of the users and determining how well these needs are being met.

In the library and information services context, the purpose of evaluation is to gather information on how well a library is accomplishing its objectives, with a view toward improvement of the situation, or a revision of its objectives, if needed. Performance measures or indicators provide the basis for determining the extent of
operational efficiency and improvements over time (i.e. performance criteria by which achievements can be measured). Several manuals have been published which provide detailed advice on a wide range of output measures and performance indicators (Orr, 1973; Kantor, 1984; Van House et al., 1990; King Research Ltd., 1990; Bloor, 1991; Committee of Vice-Chancellors and Principals, annual; Joint Funding Councils’ Ad-hoc Group on Performance Indicators for Libraries, 1995). The difficulty of defining suitable criteria for performance indicators has been discussed at length (Orr, 1973; Swanson, 1975; Revill, 1980; Blagden, 1980; Goodall, 1988). Indeed, the identification of appropriate measures has proven so difficult that it has come to be known as “the criterion problem” (Swanson, 1975; Knightly, 1979). Whilst acknowledging the fundamental difficulties involved in attempting to measure the performance of library services, Goodall (1988), in her selective historical review of performance measurement from the 1960s to the late 1980s concluded that, despite the plethora of literature, there appeared to have been a notable lack of progress. “The research appears to be collateral rather than cumulative; it is too often the case that old ideas are regurgitated with modifications rather than improvements”.

Critical success factors (CSF) and related terms (strategic success factors, strategic factors, key success factors and key result areas), which are often used interchangeably, are also discussed in the literature. It is generally accepted that Daniel (1961) introduced the concept of success factors in his article on the problem of inadequate management information and that Rockart (1979) added the adjective “critical” in what is regarded as the first systematic presentation of the CSF approach. It has evolved from a methodology, which supported the design and development of information systems to meet the needs of senior management, into a practical evaluation technique. Its relevance in the evaluation of services lies in the definition and measurement of success. The priority and performance methodology developed by Broadbent and Lofgren (1991) is drawn from, and builds on, the critical success factors approach.

The phrase cost-benefit analysis encompasses a wide range of evaluation procedures. Many references appear in the information systems field (Parker et al., 1988; Keen, 1991) with the emphasis on cost justification but, in the library and information services field, they have been related mainly to evaluations of alternatives in the purchase and implementation of automated systems and security
systems. The most notable exceptions are Lancaster (1981), who related costs of systems and services to overall benefits, and King and Griffiths (1991) in the special library and information centre area. The latter maintain that the major contribution of special libraries is the saving of the time of professionals through the provision of information efficiently and effectively. Thus any form of cost-benefit analysis requires output from users on the value of their use of particular library and information services, and their assessment of the impact of providing or not providing them.

Historically, the lack of consensus over measures of performance has led to information practitioners and researchers adopting a variety of techniques and approaches (Brember and Leggate, 1985; Williams, 1988; Abbott, 1990; Harris, 1991; Poll, 1991; Broadbent and Lofgren, 1991). Documented effectiveness measures include accuracy of reference enquiry services (Williams, 1987), availability of material (Revill, 1987), precision/recall of information retrieval systems (Sparck Jones, 1981) and user satisfaction of services (McElroy, 1982). Griffiths and King (1990) provided a more elaborate conceptual framework for performance measurement, identifying four types of measures: inputs (resources used by the library), outputs (what services the library provides to its users); outcomes (effect on users of what the library provides); and higher order effects on work and society (resulting from the provision of the service). In this and other research, they have addressed more long-term and profound effects of the library service on the users it serves, such as the amount of research time which is saved as a result of using the library service.

To date, the 1990s have been characterised by a rejection of the BS 5750 approach as being insufficiently focused on quality of services (Town, 1995), the publication of several documents on effectiveness in academic libraries, the introduction of the stakeholder approach to the construction of performance measurement, and an increasing interest in techniques used in other service sectors to assess customer satisfaction.

The Follett report (Joint Funding Councils’ Libraries Review Group, 1993) covered the development of performance indicators, advocating that they should be based on the principles of integration, user satisfaction, effectiveness, efficiency and value for money, and economy. The framework was meant to be flexible,
allowing institutions to choose appropriate indicators for their circumstances. “The Effective Academic Library” (Joint Funding Councils’ Ad-Hoc Group On Performance Indicators For Libraries, 1995, 4) was a consultation report, which aimed “to help institutions and their libraries improve their performance”, set out “the principles to be used in the construction and application of library performance indicators”, and put forward “a framework to identify overall library effectiveness”. Within the framework of five areas, it recommended 33 indicators. Like the CVCP / HEFCE indicators for “old” universities, which have been criticised because they are based only on expenditure and give no information about user satisfaction, the thrust of “The Effective Academic Library” was still on input measures.

Van House and Childers (1993) were responsible for the multiple constituencies stakeholder model, which defines effectiveness as the extent to which the needs of key constituencies or stakeholders are met. This methodology has been employed by Cullen and Calvert (1995) in their work with public and academic libraries in New Zealand and by Glasgow Caledonian University Library (Pickering et al., 1996) (in conjunction with 15 other institutions) in a survey to 10 stakeholder groups, consisting of 91 performance measures for ranking on a scale of 1 to 7.

The SERVQUAL methodology, developed by Zeithaml et al. (1990) in the US for use in the service industry, measures five key dimensions of service: reliability, assurance, tangibles, empathy, and responsiveness. Brophy (1995) maintains that “they move us away from performance based on counting, whether issues or seats or books, to quality management based on identifying what matters to customers and responding to those concerns”.

Finally, service level agreements, for example, the SCONUL volume (Revill and Ford, 1994) containing agreements from seven UK universities, and benchmarking are further tools for performance measurement. There is a variety of benchmarking methodologies, for example, Zairi and Leonard (1994) propose processes involving from 5 up to 35 steps, and Oakland (1993) a 15 step approach, which has been adopted by Town (1995). Shaughnessy (1993) advocates that academic service quality might be defined in terms of “reliability or consistency, timeliness, competence, access, courtesy, communication, credibility
... and the overall fit between the customer's needs and the service" and that therefore "the most important and relevant data will be that provided by library users".

The thrust in this study is evaluation based on user perception of benefits of services and potential services rather than on the value of information, as economic approaches have not been successful in producing practical means for measuring the value of information (Repo, 1989). Knowledge of the expectations of different user groups yields better information on which to base strategic planning decisions concerning services.

1.4.2 Perceived value of information and information systems

If the real impact of an information system cannot be measured, the perceived value may have to be accepted instead, the assessment being expressed either in monetary terms or more usually on a ranking scale (Broadbent and Lofgren, 1991).

Perceived value is measured through the application of survey, interview or other research technique, although the perceived value approach cannot result in an objective measure of impact. The complexities of measuring attitudes have been emphasised by Line and Stone (1982). Powell (1988) in his review of the relationship of user studies to performance measures claimed that user opinions are of little value because their expectations of a service are conditioned by what they have been used to. Users may have unrealistic expectations of a service for a variety of reasons (Blagden & Harrington, 1990). In spite of these potential problems, Harris (1991) maintained that "it is surely appropriate that organisations designed for user service should be measured, in part at least, on user opinion" and goes on to point out that "for some services asking the user is the only way to measure opinion". Griffiths and King (1991) accepted the amount of time respondents believe they spend on reading documents, which they relate to other indicators such as quantity of research output, as a proxy for real impact. Eason (1988, 194) concurred that "to seek the perception of users of the changes that have taken place in the way they work and their assessment of whether these changes have been beneficial or detrimental" is likely to be the most productive approach.
This research project incorporates qualitative and subjective comments from users concerning the impact of information technology developments on their information handling techniques.

1.4.3 User Studies
User studies in the library/information context first became of importance during the 1940s, an important catalyst in the UK being the 1947 Royal Society conference on scientific information provision, “which stimulated a variety of activities which can loosely be regarded as ‘scientific’ studies of information needs and provision” (Bawden, 1990, 41). Since then there has been a great amount of literature on user studies and various forms of information-seeking behaviour (Herner, 1967; Paisley, 1968; Wood, 1971; Ford 1977; Crawford 1978; Wilson 1981; Brittain 1982; Krikelas, 1983; Dervin and Nilan 1986; Kuhlthau, 1988; Hewins, 1990; Bawden, 1990; Allen, 1991; Reneker, 1993; Michel, 1994).

Information-seeking behaviour stems from the recognition of some need perceived by the user (Wilson, 1981; Krikelas, 1983), which may result in demand on, or use of, a formal information system such as a library or information service. There are long-standing difficulties in defining information need and the related concepts of use and demand, as an information need may be unperceived, perceived but unexpressed, or expressed. Factors long identified in the literature as influencing information-seeking behaviour include: total information resources (libraries, information services, meetings, and colleagues), physical accessibility and ease of use (Line 1970; Soper, 1976), personal characteristics including age and experience (Ford, 1977; Palmer, 1991), and work role (Wilson, 1981). More recently, Kuhlthau (1988) has emphasised that information-seeking involves an emotional component and that uncertainty and anxiety can be expected in the early stages of the information search process (Kuhlthau, 1993).

For over a decade, research has concentrated on the cognitive aspects of information-seeking (that is, the way in which an individual receives, processes and uses information), spearheaded by Dervin and Nilan’s (1986) call for a “paradigm shift” from the traditional view of information-seeking to an updated view incorporating qualitative approaches to supplement quantitative approaches. Michel (1994) has identified eleven sources of information used during library and
database searching, some internal to the searcher ("reasons for the search, necessary beliefs, object of the search, object knowledge, domain knowledge and search knowledge"), some created by the searcher ("expressed object and search knowledge"), and others external to the searcher ("guidance devices, system terms and the collection"). Allen (1991) maintained that the term "cognitive" means many things to many people. Michel endorsed this view and claimed that the cognitive processes of the searcher will be a long-term research endeavour. Barry (1995) concluded that there is a "growing realisation that information-seeking is an extremely complex activity".

Although not synonymous with evaluation, the relevance of user studies is clear (Bawden, 1990, 40-41). "Satisfaction of user needs is the ultimate and only justification for the existence of any information service, and obtaining information as to the way in which it is used, and the degree of success achieved by its users is a good, indeed a fundamental, part of its evaluation".

1.4.4 Research into the Application of Information Technology Developments to the Academic Communication System

The late 1980s and early 1990s witnessed a number of conferences and published reports on the application of information technology developments to the academic communication system. The Electronic Campus Conference held in October 1988, sponsored by the BLR&DD, aimed to explore key issues for the future information environment of the electronic campus, to share experience and to create greater awareness of developments in the UK and the USA. The papers focused on the implications of IT for the nature and methods of teaching and research across all disciplines; economic issues of the new information systems and services; organisational implications of the electronic campus; strategic planning for information resources and an extensive overview of trends in IT. The Information Technology and the Research Process Conference held at Cranfield in July 1989, jointly sponsored by the BLR&DD and the Pittsburgh School of Library and Information Science, addressed the opportunities and potential problems resulting from the way information technology was revolutionising the traditional research process (Feeney and Merry, 1990).

A second study of the scientific information system in the UK, jointly funded by BLR&DD, the Royal Society and the Association of Learned and Professional
Society Publishers, commenced in 1992 (Royal Society, 1993) after a preliminary survey indicated the need for such a study (Meadows and Buckle, 1991). It reported on the strengths and weaknesses of the current system, the major changes affecting it, the economic issues and ways in which users can become better informed about the system and its effective use. The publication of the Follett Report, which led directly to the establishment of the Electronic Libraries projects, has already been mentioned: its recommendations included the use of IT to improve delivery of information through increased use of electronic library services, the exploration of different models of intellectual property management and the encouragement of new methods of scholarly publishing. The substantial volume of papers produced as part of the work of the Information Technology subgroup (HEFC, 1993) contained details on the background to the IT related recommendations in this Report. Towards the end of the project period (April 1995), the JISC published an issues paper (JISC, 1995a) which, after wide consultation, formed the basis of the JISC Strategy to 2001 (JISC, 1996). Among the issues identified to ensure information systems and IT could be fully exploited in the higher education community were the following needs: to expand the reach of the network to the home and workplace and to strengthen links with industry and other education sectors; to provide adequate multi-media personal workstations for faculty and student use; to engender the necessary culture change and training to support the preparation of multi-media teaching material and electronic text book and research material; to promote and improve the exploitation of IT in the creation of virtual laboratories for teaching and research use; to provide high quality databanks of research material for effective analysis; to prove technology and engender the necessary culture change to improve electronic information delivery and the development of the virtual library; to make greater use of information systems to achieve the effective management of higher education institutions; to provide necessary training and awareness throughout the community and to receive feedback on requirements to help ensure technology led initiatives are in tune with the necessary culture change.

In addition, much investigative work has been done on the application of new technology to improve communications within the UK academic community. The BLEND Project explored and evaluated the use of an electronic communication network as an aid to writing, submitting and refereeing papers and as a medium for
other types of scientific and technical communication (Shackel, 1991). This was an experimental programme. The BLEND system was both the object of, and stimulus for, a considerable amount of research besides that forming the main part of the experimental programme (Pullinger and Shackel, 1991). This research included the reading of electronic journals, proofreading, refereeing and the presentation of text and graphics on the screen. Also, the system was used by a number of communities other than the Loughborough Information Network Community. Project Quartet explored the use of electronic mail, computer conferencing, online databases and automated document delivery services (Tuck et al., 1990). However, the major portion of Quartet's work was design and feasibility studies, mainly consisting of developing and evaluating prototype systems.

Ellis et al., in their comparison of the information-seeking patterns of researchers in the physical (physics and chemistry) and social sciences, reported the relatively minor impact which developments in information technology had had on the information-seeking and communication activities of the three groups (Ellis et al., 1993). The employment by researchers of electronic means of identifying references constituted a minor part of their information-seeking activities and their employment of electronic communications in the communication of research was "virtually non-existent". This endorsed Meadows and Buckle's (Meadows and Buckle, 1991) finding that the impact of electronic communication on the scientific communication of academic research in the UK in the early 1990s was negligible. In follow up studies to the 1993 Royal Society study, Rolinson et al. (1995; 1996) have examined the use of IT and information usage in the biology field by surveying samples from four institutions. They found that differences in usage and changes in information handling depend on the institution and specialism involved.

The Information Access Project (Barry, 1997), which commenced at the same time as this research project, was a longitudinal, qualitative study of the information and research behaviour of ten established academics and eleven newer researchers (post-graduate students and post-doctoral and assistant researchers) in the mathematics and education departments at King's College, London. The project investigated the use of traditional and electronic information behaviour in the context of research over a four year period. Problems encountered in evolving a
Research methodology (Barry, 1995) were: incomplete knowledge of basic operating variables, the complexity of information-seeking, the largely implicit nature of research and information skills, the difficulty in detecting the impact of IT systems on research; and the difficulty of explaining learning and take-up of IT. The problems encountered in the process of learning and take-up are related in reports on progress (Squires et al., 1995; Barry and Squires, 1995).

Research into user acceptance of, or resistance to, IT systems spans a range of areas, including technology design and implementation, human-computer interaction (HCI), and information systems (IS). Dillon and Morris (1996) have reviewed theoretical approaches and models to IT design and implementation and concluded that, to date, there is no "overarching theory that will encompass both the explanation and the prediction of user acceptance as well as provide the tools for ensuring that any design process leads to an acceptable product".

1.5 Relevance Of Literature To This Research

This study is intended to contribute to these on-going research areas by carrying out research within an operational situation, rather than in an experimental environment or a feasibility situation. DJB Associates (1990, 44) observed that "Academic publishers have survived thus far on the basis that individuals were innately conservative and cautious in their information-gathering habits. They relied on their earlier experiences, and found comfort in the convenience of printed publications". Meadows (1989) stated that "Researchers have a built-in resistance to changing their style of information handling. Any new alternative must offer very clear benefits in order to be adopted".

Some studies or assessments of what effect information technology is having on people's working practices are only snapshots of reported responses at a specific time (for example, Martyn, 1964; Martyn, 1987; Creating User Pathways to Electronic Information, 1991; Listening to Users, 1992; Reneker, 1993; Laribee & Lorber, 1994; Mehta and Young, 1995). This study monitors reactions and reported responses from a group of people over a three year period, a group of people who, although diverse in specialism and mode of working, are (in general) subject to the same research and political environment, exposed to the same electronic information resources and can avail themselves of the same networking
services. A composite external comparison group is included to compare findings and trends in a range of settings (another cancer research institute, a MRC research institute, a university biochemistry department and two groups of research scientists from pharmaceutical companies). It is hoped that this case study approach will build upon some of the valuable research work already carried out by others and that other practitioners in similar situations will immediately be able to relate to and utilise the findings of this study.
CHAPTER 2
2. The Local Scenario - Setting the Scene

2.1 The Nature of the Organisation
The ICRF is one of the UK's largest medical charities, undertaking over a third of all UK cancer research. Its main laboratory site is at Lincoln's Inn Fields in Central London and a satellite laboratory site is situated at Clare Hall, South Mimms, in Hertfordshire. ICRF also has groups and units, mainly attached to hospitals, throughout the UK. These extra-mural clinical units are tripartite partnerships between ICRF, medical schools and the Health Service and are based mostly on academic departments of oncology established through ICRF-endowed Chairs.

ICRF supports an extensive cancer research programme, ranging from lifestyle and clinical studies to laboratory work on basic mechanisms of cell division, growth control, differentiation and development.

2.2 Categories of ICRF Staff
The majority of the scientific staff are molecular or cellular biologists, but there are also biochemists, geneticists, epidemiologists and clinicians - as well as statisticians, computer scientists, pharmacologists and psychologists. Categories of staff include tenured and contract laboratory scientists; clinical consultants and scientists; post-doctoral research fellows; medically qualified clinical research fellows undertaking a full-time PhD; graduate students also undertaking a PhD; and scientific officers, a proportion of whom hold or are undertaking a PhD. Research fellows, clinical research fellows and graduate students are all on limited term appointments.

2.3 Local Computer Hardware/Software & Network Connections
During the course of this project, the Fund's main computing facility underwent a number of developments. In 1992, it comprised two clustered DEC (Digital Equipment Corporation) VAX 8700 computers running the VMS operating system. In February 1993, these were replaced with two DEC VAX 4600 machines prior to a planned transfer to a UNIX platform in October 1994, namely Digital Alpha machines running the Digital UNIX operating system. Since 1989, ICRF had had its own kilostream TCP/IP network (ICNet) linking over thirty of its remote sites to the central computing facilities. In 1992, Apple Macs, PCs, Suns plus other UNIX workstations and numerous dumb terminals were
connected to this network. In addition, ICRF has access to the JANET network via a leased line to the University of London Computing Centre (ULCC) and, from June 1992, to the JANET Internet Protocol Service (JIPS) via a 64 Kbit/second link to ULCC. During this project, this line was upgraded to 2 Mbits/second.

2.4 External Factors
Most of this research project was undertaken during a time of severe economic recession in the UK. Charities, such as ICRF, which are almost totally dependent on voluntary income, were particularly badly hit and redundancies had already occurred at ICRF at the date of its commencement. Increasingly, ICRF was relying on grants from the European Union and post-doctoral funding agencies. It was not until the final year of the project that ICRF experienced a substantial increase in income, not only from legacies but also from the diversified fund-raising activities undertaken in common with other charities where “Finding ways to hang on to the best donors”, for example, had become a crucial strategy (Rickford, 1994).

These financial constraints of much of the project period were accompanied by turmoil in the clinical area connected with the National Health Service (NHS) changes and with the consequences of the Tomlinson Report on the London Hospitals (Tomlinson, 1992). ICRF’s involvement in several major London hospitals meant that the amalgamation of the medical schools and the closure of some hospitals housing ICRF units, had potentially serious and costly implications (Irwin, 1994; Smyth, 1994). For example, the project period saw the union of the medical schools of St Bartholomew’s Hospital and The Royal London Hospital, and of Guy’s and Thomas’ plus the move of St Mark’s Colorectal Cancer Unit, with the hospital, to Northwick Park.

2.5 Internal Factors
The 1980s were characterised by major advances in the genetics of human cancer and the project period saw a continuation of ICRF’s involvement in this area, particularly its participation in the Human Genome Project, an international collaboration whose aim is to catalogue all the human genes, their DNA (DeoxyriboNucleic Acid) sequences and their positions on the chromosomes.

The shortage of finance affected not only ICRF research programmes but also ICRF central services including Library and Information Services (LIS) (for example, reduction
in the number of non-core journals held) and developments (such as the decision not to subscribe to the ADONIS system).

The combination of financial difficulties and NHS reforms meant that the period over which the research was undertaken saw the closure of a number of ICRF units (such as the Paediatric and Neuro-Oncology Group at the Frenchay Hospital, Bristol, and the Tumour Immunology Unit at University College London Medical School) as well as the establishment of new ones, for example, the Richard Dimbleby Laboratories at St Thomas' Hospital and the Cancer Medicine Research Unit in Leeds. A number of ICRF scientists were involved in unit closures, which resulted in a reduction of the original ICRF sample group for this project.

2.6 Scope of Library & Information Services

The principal services offered on the main computing facility are Library & Information Services' databases and molecular biology analysis programs and databanks. In both cases, the Fund finances these services centrally, the intention being that all ICRF staff country-wide should have access to the same resources, regardless of location.

2.6.1 Databases Service

To alleviate the difficulties encountered by scientists in connecting to and negotiating their way around the central computing facility, the Library & Information Services Department's Databases Service or OPAC (Online Public Access Catalogue - based on the BASIS/BASISplus software) had been made available to users between May and November 1990. Its menu-driven interface was intended to provide easy access to in-house databases and information resources and seamless connection (other than registration required by the remote system) to externally provided databases/databanks. At that time, this Databases Service comprised seven databases, namely, SciSearch, Inter-Library Loans, Books, Journals, Staff Publications, Staff/Laboratories and Scientific Reports. The Research Funding Database and the UK DNA Probe Bank, although not maintained by the LIS Department, were also accessible via the Databases Service. Subsequently and throughout the course of the project, a number of other internal (for example, Cell Services and Research Funding) and external (for example, Electronic Yellow Pages and the Wellcome Trust's Funding and Research Assistant Vacancies) databases and information resources were added to the LIS
Databases Service. Moreover, during this period new technological developments were embraced and, in line with developments in other organisations, an ICRF Gopher Service was launched in March 1994 and an ICRF World-Wide Web Service was introduced in March 1995, both of which had a considerable amount of material mounted and maintained by LIS staff.

The growth in the total number of accesses to the OPAC or Databases Service between October 1991 and September 1995 (that is, recorded over the project's duration and the period immediately prior to it) is shown incrementally in Figures 0.1.1 to 0.1.3. An "access" in this context refers to the process of a user entering, searching and leaving one of the databases, as recorded by a monitoring program operating on each database. The facility to enable users to request documents electronically from LIS was made generally available to users in April/May 1991. There had been a good uptake of these electronic facilities throughout the Fund, despite low or virtually non-existent usage by the staff of some units due to local connection problems.

2.6.2 Current Awareness Service
Besides the Databases Service, two of LIS' other heavily utilised services were the current awareness and document supply services. The Department leased copies of the Science Citation Index (SCI) source tapes with abstracts from the Institute for Scientific Information (ISI) on a weekly basis. These tapes formed the basis of the LIS' current awareness service, although other SDI services were provided to some staff from databases mounted on commercial hosts (for example, Psychological Abstracts, Applied Social Sciences Index, Sociological Abstracts, Dissertation Abstracts, Human Nutrition and CancerLit). The weekly tapes were loaded onto BASISplus, ICRF-held titles being marked during the loading process. Between 350 and 400 profiles were run weekly, according to profiles agreed with individual scientists. The SciSearch Database was also available online via the OPAC for end user searching (a rolling latest six months of data, with abstracts, but abstracts not indexed - due to a shortage of disc space on the central system at that time). In January 1994, the SciSearch Database was extended back to January 1992 and the option to search and/or send abstracts with current awareness output was introduced. The current awareness data were provided in Data-Star MEDLINE format, and the ISI data appropriately lower cased, to
facilitate the downloading and importing of results into reference handling packages such as EndNote, Reference Manager and ProCite.

2.6.3 BIDS and CD Databases
In addition, ICRF was part of the Queen Mary & Westfield College cluster and gained access to the BIDS ISI service in the autumn of 1992. The BIDS ISI service was viewed as a complementary service to the in-house service as BIDS has SciSearch back to 1981 with cited references, but no abstracts (until April 1994), whilst the in-house service had a relatively small amount of data available without cited references but with abstracts. Moreover, since 1989, MEDLINE on compact disc (CD) had been made available at ten ICRF sites. The intention was to network this database over ICNet as soon as it was technically feasible to do so and a multi-platform solution presented itself. This occurred in October 1994 when the LIS Department commenced an alpha, followed by a beta, test of SilverPlatter’s ERL software, the production version being made generally available in June 1995. User accesses to ERL MEDLINE and Cancer Databases between November 1994 and September 1995 totalled 28,500. The facilities to cross year search the entire MEDLINE file from 1966, and to monitor centrally usage in this way, were regarded as major improvements over the multiple stand-alone MEDLINE CD-ROM systems referred to above.

2.6.4 Document Supply Service
As for the document supply service, besides acquiring requested articles from non-ICRF-held journals from the British Library, the LIS Department provided a photocopying service from those titles to which ICRF subscribes (to those many ICRF staff who are not based at the central London laboratory site). The total numbers of documents supplied during the years October 1991 to September 1995 (that is, over the project’s duration and the period immediately prior to it) are shown in Figure 0.2.1 (exceeding 30,000 documents in Phase 2). Figures 0.2.2 to 0.2.5 show the breakdown between electronic and manual requests, the volume of electronic requests peaking at 65% in Phase 2. The effect of the introduction of charging for document supply in October 1994 is evident in the 1994-95 totals in Figure 0.2.1.

Users' requests of both types (inter-library loans and in-house photocopies) emanated from LIS' current awareness service, the online SciSearch Database
service, the LIS' remote literature search service, CD-ROM MEDLINE database service, the BIDS ISI service (from late 1992), user-keyed electronic requests (via the LIS Databases service), user-keyed electronic requests via the LIS web page (from July 1995) and manual requests made on requests cards. The manual requests were keyed into the Inter-Library Loans Database by LIS staff and the electronic requests were uploaded into the Inter-Library Loan Database. The program automatically streamed out those requests that were for ICRF held journals and formatted the rest into ARTTEL format for submission to BLDSC via the JANET network. For much of the period under review, between 100 and 200 document supply requests were received daily by LIS and, analyses carried out by LIS staff showed that articles were being requested from over 2,500 titles.

2.6.5 Electronic Document Requesting Service

Electronic requesting by users for document supply was logged by the Inter-Library Loans Database. The various modes of requesting documents electronically during the years October 1991 to September 1995 are shown in Figures 0.3.1 to 0.3.4. Of particular note here are: the lack of impact made by the BIDS service (no references from that source by the last year of the project); the popularity of user-keyed requests (reflecting that well known method of researching via the papers cited in the bibliographies of key papers); the fact that the current awareness service references and the online SciSearch Database are the source of at least 50% of requests throughout the period; and the emergence of user-keyed requests via the LIS web page by the closing months of the project period.

2.7 Other Indicators of Users' Electronic Activity

In common with other organisations, at the start of this research project, ICRF computing staff kept no historical records of usage of electronic mail (due to system monitoring overheads and the large amount of disc space involved in record keeping) nor of remote logins via PAD (Packet Assembler/Disassembler). Selective records of molecular biology software usage were monitored and retained by the central system in 1992 but the two replacements of central system hardware (referred to in section 2.3) and a radical change in the manner in which molecular biology usage was monitored during the course of the project meant that it is impossible meaningfully to compare the molecular biology usage statistics.
However, with the permission of the ICRF Director-General, ICRF computing staff kindly agreed to give the researcher access to the remote login via PAD statistics (February 1993), to set up an electronic mail monitoring system (May 1993), and to make available transient News Server access records (February 1993), all of which became operational during the project's first year.

2.7.1 Electronic Mail Activity
Soon after mail monitoring had been set up on ICRF's central computing system, there was a proliferation of independent mail servers within ICRF, but the vast majority of mail traffic still went through the central system throughout the project period. The method of logging mail messages also altered shortly after monitoring commenced, resulting in each mail message log containing more information than previously and being, therefore, larger in terms of bytes.

Figure 0.4.1 shows the volume (in terms of size of message files) by month from May 1993 to September 1995. The largest monthly message file during Phase 1 (May 1993 to September 1993) was just over a megabyte. The monthly message files rose to between two and three megabytes in the second half of Phase 2, and took off in Phase 3 to 20 megabytes (or more during the months April to June 1995). The uptake of electronic mail by users is a clear trend but continuous monitoring would be required over a much longer period to establish more definite patterns of usage.

2.7.2 Remote Login Activity
The project period witnessed ICRF users' transition from remote login via PAD, as the only means of interacting with remote computers, to remote login utilising a terminal emulation program known as telnet, part of the Internet protocol. The telnet function allows Internet users from their workstation to login to a remote computer and browse its files as if that workstation were actually connected via a local-area network to that remote computer host. Many library online catalogues and other online databases are telnet accessible in 1997 but, during the project period, the telnet option was not available on some services/databases for some time, and a number were overtaken by web access eventually.
Figure 0.4.2 shows ICRF remote login activity via PAD for the period February 1993 to January 1995, when the PAD facility was withdrawn with the transfer of all users to the new DEC Alpha central computing machines and their use of telnet for remote login having been established. The number of remote logins for eight months of the project's first year totalled 6,804, for the twelve months of the project's second year 10,001, and for four months of the third year trailed off to 413. Analyses of the records of these remote logins show that a relatively small number of users regularly accessed remote computers, except for LIS established services such as BIDS where the user-friendly menu driven interface masked from users the PAD connection procedures.

2.7.3 News Server Activity
ICRF computing staff mounted in-house and made available organisation-wide a subset of the USENET News Service, which organises news items in a hierarchy of subject groups, such as "sci" (scientific research and applications), "comp" (computer science and related topics), and "rec" (hobbies, recreational activities and the arts).

Figure 0.4.3 shows ICRF News Server accesses for the same five month period each year of the project (as continuous statistics were not complete for the whole period due to technical difficulties). Over the period, the number of accesses grew from less than 500 per month in Phase 1 to over 11,000 per month in Phase 3, but trends are difficult to discern over such a short period of time. Nevertheless, the increase in the uptake of the News Service is clear and, with the exception of one month, did not drop below 4,000 accesses per month during Phase 3 (October 1994 to September 1995) of the project.

These records of electronic mail, remote login usage and newsreader access were intended to give background information on the degree of electronic activity of ICRF's scientific community as a whole over the project period which, in turn, provided a useful comparison against which to measure the reported activity of the sample group of interviewees.
CHAPTER 3
3. Parallel Developments Elsewhere: the Composite External Comparison Group

In order to provide valid checks against which the findings of this study could be measured, a composite external comparison group was formed in consultation with ICRF's Director-General and the Assistant Director (Scientific Liaison).

3.1 Another Cancer Research Institute Component

The Cancer Research Campaign is another medical charity whose income is all from voluntary sources. It supports a comprehensive programme of research into cancer in universities, teaching hospitals and institutes of cancer research. The Paterson Institute for Cancer Research, located on the Christie Hospital site in Manchester, is one such research institute and was selected to form another "cancer research institute" component of the composite external comparison group. Like ICRF, the Paterson Institute's research programmes go right through from basic science to clinical practice, although there is a clinical bias because of the close relationship with the clinical staff of the Christie Hospital.

The Library at the Christie serves both the Paterson Institute and the Christie Hospital staff. At the start of this research project in 1992, the Library facilities included: over 100 current journals plus over 40 more bought for and held by departments; a current awareness service consisting of distributed photocopies of contents pages of specified journals, sections from the Leeds Oncology Information Bulletin (a monthly indexing service covering major medical and oncology journals) or updates from online databases (especially MEDLINE); mediated searching of remote online databases; end-user access to BIDS (ISI and later EMBASE databases) and a selection of stand-alone CD-ROM databases. During the course of the project, the MEDLINE database was networked throughout the Institute and a facility for users to request inter-library loans electronically was established. All members of the Paterson staff are eligible to use the facilities of the John Rylands University Library.

With the kind agreement of the Institute's Director, Professor David Harnden, 46 staff members were selected (to correspond as closely as possible to the ICRF sample group) and invited to form the "another cancer research institute" component of the composite external comparison group. A list of the subject areas this group represented is included in Appendix 3. During the course of the project, the sample group lost nine members: one died, one retired, four left the Institute and three withdrew due to pressure of work. Unlike
ICRF, the Paterson Institute did not have a large body of graduate students and scientific officers were not allowed to undertake a PhD whilst in post. Consequently, although this group is not directly comparable to the ICRF scientific officer group, it does give a representation of this important category of staff in the “cancer research” group as a whole.

3.2 A University Biochemistry Department Component

The Department of Biochemistry at Dundee is one of four UK Biochemistry Departments rated as outstanding internationally by HEFC. With over 30 research groups, the Department covers the main areas of research in biochemistry, cell biology and molecular biology.

With the agreement of the then Departmental Head, Professor David Boxer, it was from this group that seven staff members consented to form the “university biochemistry department” component of the composite external comparison group. A list of subjects covered by members of the group is included in Appendix 3. During the course of the project, one member of the group withdrew due to illhealth.

The Biochemistry Department had a departmental Library but had access, naturally, to the range of libraries of the University of Dundee including the Medical Library of Ninewells Hospital. The University Library had the usual range of services including end-user access to BIDS databases.

3.3 An MRC/University Clinical Medicine Department Component

The Institute of Molecular Medicine (IMM) was established in 1989 in the Clinical School of the University of Oxford in an attempt “to solve the problem of carrying out research in the field of molecular and cell biology with direct application to the study of human disease” (Institute of Molecular Medicine, 1993, 2). The Institute has a major role in training young scientists, clinical and non-clinical, who either wish to pursue careers in basic medical research or spend short periods in research during their clinical training. Most of the scientists in the building are research students and post-doctoral fellows.

With the agreement of Professor Sir David Weatherall and Dr John Clegg, it was from this group that 15 staff members kindly volunteered to the IMM Administrator, Dr Stella Keeble, to form what for convenience is called the “MRC” component of the composite
external comparison group. A list of subject areas represented by this group is included in Appendix 3.

In 1992, the Library at the IMM was run by a part-time Librarian, who had recently set-up a current awareness service utilising *Current Contents* on Diskette. MEDLINE via CD was available on a stand-alone basis although networking plans (initially for the PC version) were in hand and came onstream in April 1993. Document supply was available via the MRC network of libraries or via the Cairns Library, also housed on the John Radcliffe Hospital site. All staff are also entitled to use the vast range of libraries of the University of Oxford including the Radcliffe Science Library.

### 3.4 An Industrial Sector Component

In 1992, Glaxo and Wellcome were two international research and development based pharmaceutical companies, the former with UK research centres at Greenford and Ware (with another planned at Stevenage), and Wellcome with its main research site at Beckenham in Kent and its development and production site at Dartford.

The staffs of both companies included chemists, biologists, toxicologists, drug metabolists, pharmacologists, pharmacists and clinicians, and six staff members from each company were kindly selected and invited by the then LIS heads, Dr Sandra Ward and Mrs Elspeth Scott, to form the “industrial” component of the composite external comparison group. A list of subject areas represented by members of this group is included in Appendix 3. During the course of the project, two members of the group left one of the companies.

The LIS facilities of both companies at this time have been covered elsewhere (Swain, 1993; Scott, 1992) but to summarise: both subscribed to over 1,000 journal titles (in the case of Wellcome, duplicate copies of key titles displayed at a number of points on site); both used a mixture of hard copy current awareness products and computer-generated SDI profiles including *Current Contents* (on Diskette in the case of Wellcome, leased tapes in the case of Glaxo); both offered mediated searching of remote online databases, but Glaxo offered end-user access to remote hosts also (mainly via Dialog’s Medical Connection and Chemical Abstracts via STN); both had a mixture of other published information databases leased for in-house use (e.g. REACCS and MACCS chemical structure databases) plus in-house databases of literature on their products; both were working towards the companywide networking of CD databases such as MEDLINE; and Glaxo offered a facility for users to keyboard their own Inter-Library Loan requests.
The project period coincided with a fundamental restructuring of the global pharmaceutical industry, which resulted in the acquisition of Wellcome plc by Glaxo plc in January 1995, the merged company being renamed Glaxo Wellcome plc on 1st May 1995. The purpose of this merger was to ensure the scale and resources needed to sustain successful product innovation and market penetration worldwide. For the UK, the integration of the worldwide activities and facilities of Glaxo and Wellcome resulted in the concentration of research at Stevenage, development at Ware, worldwide headquarters at Greenford, and the closure of the former Wellcome site at Beckenham.
CHAPTER 4
4. Methodology: Case Study Parameters

4.1 Selection of Sample Population
The identification of members of the sample of the population to be surveyed was accomplished by requesting selected printouts from ICRF’s Personnel Department using category of staff as the main criterion. A key aspect of this study is the monitoring of the sample population over a three year period. The search profiles therefore restricted output for some categories of staff (contract research scientists, research fellows, clinical research fellows and graduate students) to those staff members whose contract leaving dates indicated that they would, in all probability, be with ICRF until 1994/95. Criteria for selecting the sample population from the search output centred on covering as many categories of staff and as many laboratories / units as possible within the project timescale. Visiting Research Fellows were an excluded category.

4.2 Quantitative and Qualitative Research Methodologies
Any investigation into people’s uses of information or information needs inevitably requires the employment of particular social research methodologies. Within social science research there are two schools of thought, methodology and practice called quantitative and qualitative research (Slater, 1990). David Oldman (1981) considered why quantitative methods are believed to be more “scientific”, rigorous and ultimately valid than qualitative ones and argued that the term “qualitative” is applied variously to different aspects of research (style, design, epistemology) which are so significantly independent of one another as to make the quantity/quality distinction an artificial one. More recently, Morgan (1995a) alluded to a certain snobbery about research methods. “Crudely put, QUANTITATIVE = reliable, valid, rigorous real research, QUALITATIVE = unreliable, anecdotal, unscientific research”.

One of the most constructive outcomes of the quantitative versus qualitative methodology debate is the recommendation that more than one methodology should be employed so that “a more complete picture of phenomena can be obtained” (Brenner, 1981). Taylor (1983) and Bromley and Allott (1988) have reviewed the move towards the use of qualitative research techniques during the 1980s. This trend has continued into the 1990s and has been discussed in section 1.4.3. In a broader context, Booth (1988) endorses the need for a more qualitatively based approach to the evaluation of IT-based communication systems. This relates to McClure and Lopata’s (1995) argument that a better conceptual
understanding of the networked environment and the formulation of "performance measures to assess interactions and services within this environment" are urgent priorities, given the huge investment made in networks and in their applications by academic institutions and their present financial difficulties.

Morgan (1995a) rightly concluded that quantitative and qualitative data should complement and support each other to provide a rich picture. This research project incorporates qualitative and subjective comments from scientists concerning the impact of information technology developments on their information handling techniques, backed by quantitative background statistics relating particularly to database usage and document supply.

4.3 Choice of Research Techniques

Perceived value is measured through the application of survey, interview or other research technique (Broadbent and Lofgren, 1991). Of the variety of research techniques available, the project's main method of data collection was the semi-structured interview. This interview method gave users an opportunity to elaborate and explain replies to questions. Slater (1990, 111) refers to interviews as the "bread and butter" technique of qualitative evaluation and endorses their use for going deeply into case histories, individual reactions and motivation.

Despite the continuing research into the measurement of attitudes, the commonest method in use is the rating scale. In this project, a numerical scale is used, respondents being asked to give their attitudes or assessments a numerical value on a scale of five ("five" being most favourable). Although this avoids the risk of verbal bias, it is still highly subjective (Line and Stone, 1982). One of the advantages of the one to five rating scale is that it allows the possibility of settling neutrally in the middle, as against a one to four scale, which makes interviewees come down on one side or the other. This one to five rating scale provided a framework for the measurement of the impact of technological developments on information seeking behaviour on facilities scoped in the project's interview questionnaire. In practice, it was found that relatively few respondents chose to settle neutrally in the middle of this scale.
4.4 Construction and Content of Interview Questionnaire

Material and ideas for the construction of the questionnaire were derived from a literature search of previous questionnaires to research scientists (for example, Martyn, 1964; Martyn, 1987; and Royal Society, 1981), from a variety of questionnaire letters and circulars from publishers concerning likely institutional subscription patterns with printed versus electronic versions of journals, and from the researcher's previous questionnaires to her user communities concerning information seeking behaviour relating to specific current or potential LIS services.

In the interviews, questions were asked about current awareness service usage (such as content, mode of receipt, online abstracts facility and currency); core journals; refereeing; browsing habits; sources of photocopied articles; request modes; reference handling; CD-ROM and in-house database usage; remote database/databank usage; usage of networks (electronic mail, list servers/bulletin boards, remote login/file transfer); other information gathering/communication activities; potential usage of full-text electronic sources; previous experience of electronic information sources; usage of information resources provided by LIS; and factors that would increase usage of electronic information sources. A copy of the questionnaire is included in Appendix 1.

4.5 Pilot Interviews and Questionnaire Modification

A short interviewing pilot was undertaken in order to test the content and length of the questionnaire. This pilot consisted of seven interviews and included one laboratory scientist, two research fellows, one clinical research fellow, one graduate student and two scientific officers. As a result of the pilot interviews, the questionnaire was modified slightly: its length was shortened, which entailed rephrasing or making more specific certain sections of it (for example, section 14 on full-text electronic sources); the order of some of the questions was altered to make it more logical and to facilitate the flow of the dialogue (for example, sections 10 to 12 on the use of networks); and, where possible, confusing terminology was simplified (for example, the phrase "current awareness" was substituted for the term "SDIs"). Question 15, concerning the usage of information resources provided via LIS, was retained although it did not produce the anticipated increasing or decreasing trends data. Scientists felt that they had already addressed these service issues in earlier questions.
4.6 Conduct of the Interviews

Approval to conduct interviews was first obtained from the Director-General of ICRF. This was followed up by a brief outline of the research project (plus the fact that participation would be requested) in ICRF’s quarterly Research Administration Newsletter, which was distributed to all research staff. During the course of the first year (Phase 1) of the project, each head of laboratory was approached before individuals within that laboratory were contacted. Each interview commenced with an explanation of the nature and purpose of the research project. Each participant was asked whether he or she objected to the conversation being recorded and assurances were given that anonymity would be preserved.

Despite the apparent closed nature of the optional answers to questions in the questionnaire (see Appendix 1), each interviewee was given the opportunity to freely respond to each question before being guided to the choice of optional answers, if their initial response had not included one of them. In this way, valuable qualitative data was gathered from scientists on particular and related information-seeking issues.

4.7 Methods of Analysis and Presentation of Data

The questionnaire data were analysed by computer using the Lotus 123 spreadsheet package. Selected data concerning journal titles seen/held in laboratories/units and core journal titles, identified by interviewees over the three year period, were input for analysis into a BASISplus database.

Statistical advice was sought and received on the presentation of the quantitative data resulting from respondents’ answers to many of the questions put to them, which required scoring on the rating scale of one to five. Hence, percentages in the text are rounded up to one decimal point and are displayed as such in the figures, and responses of “3.5” are rounded up to “4” and are portrayed as such in the figures to facilitate interpretation of the data.

A large number of quotations, derived from transcribed tape data, are included in the text, the primary intention being to substantiate the quantitative data resulting from the questionnaire responses. Where possible, this entailed selecting and presenting quotations from as many of the ICRF categories of staff and from as many of the external comparison group’s components as possible in each case. The quantity of selected quotations also
related to the strength of feeling of respondents on particular issues. For example, quotations relating to the usage of BIDS by the ICRF sample group on pages 100 and 101 reflect the small initial, and subsequent declining, usage of BIDS over the project period, whereas the number of quotations relating to the importance and growth of written communication, particularly fax on pages 95 and 96, conveys the strength and diversity of positive responses from every category of staff.

Interpretation of transcribed data relating to particular or related information seeking issues (for example, the growth in the volume of papers refereed by individual scientists or the increase in the number of papers submitted and rejected by particular journals over the period) was also undertaken by the researcher. Again, the researcher's interpretation of this qualitative data is backed with quotations, which are presented as evidence on which the researcher's interpretation is based. A qualitative analysis package was not utilised on the basis of scale. It was considered an inappropriate tool as this was only a small part of a large volume of project data.

Throughout the reporting of the ICRF sample's results below, the phrase "clinical scientists" encompasses clinical consultants and clinical research fellows, and either the term "scientists" or the phrase "research scientists" is used to refer to laboratory and clinical scientists jointly. The following abbreviations are utilised to indicate categories of staff in the figures: LS (laboratory scientists), CS (clinical scientists), RF (research fellows), GS (graduate students) and SO (scientific officers).

4.8 Size of the Population
It is generally held that interviews of people over an area extending beyond the locality are rarely practicable. However, because of the dispersed nature of ICRF staff members, every effort was made to include staff from as many locations as possible, within the case study parameters. A list of the laboratories and units covered by the sample members is included in Appendix 2.

Out of the initial total of 226, during the course of the project 39 members of the sample group were lost: 27 left ICRF, 2 went on maternity leave, 7 withdrew due to pressure of work and 3 were excluded when it became apparent that they were Visiting Research Fellows and would not remain for the required three years.
The total number of research scientists interviewed over the three year period was 187. Interviews were conducted by the researcher with samples (see Figure 0.6.1) of 60 laboratory scientists, 32 research fellows, 23 clinical scientists (which included clinical consultants and clinical research fellows), 34 graduate students and 38 scientific officers (who either possessed or were undertaking a PhD): all but three approached agreed to be interviewed (two due to pressure of work and the third due to maternity leave). Figure 0.6.2 shows the ICRF staff sample as a percentage of the total number of ICRF scientific staff at that time, and Figure 17.4.1 indicates the age ranges by category of staff.

4.9 Constraints
Every effort was made by the researcher to maintain a consistent approach with interviewees and thereby obviate any bias which can be a constraint of the interview method. Indeed, an interview itself can influence people's subsequent behaviour, an outcome which is reported by a number of scientists (for example, in subsequently securing a personal current awareness search profile or in utilising a reference handling package).
CHAPTER 5
5. Results of ICRF Staff Sample

5.1 Current Awareness

Over the three year period, there was a slight increase, 66.3% (124 scientists) in Phase 1 to 71.7% (134 scientists) in Phase 2 to 68.5% (128 scientists) in Phase 3, in the total number of scientists who were in receipt of current awareness results directly or indirectly, indirectly meaning one scientist seeing another scientist’s current awareness output regularly every week. Figure 1.1.1 shows that, within this figure, the number of scientists receiving current awareness results directly increased (97 in Phase 1 to 114 in Phase 3) whereas the number receiving results indirectly decreased (27 in Phase 1 to 14 in Phase 3). This phenomenon was reportedly primarily due to the heightened awareness of the current awareness service by scientists as a result of the interviewer’s questioning during Phase 1 of the research project. There was an uptake, either directly or indirectly, by some who, during Phase 1, received current awareness by neither mode, as well as a switch to direct receipt by those who had previously been in indirect receipt of results.

Figures 1.1.2 and 1.1.3 show the breakdown by category of staff of current awareness recipients, direct receipt and indirect receipt respectively. Figure 1.1.2 indicates that it is the research fellow and graduate student categories who are responsible for the increase in direct receipt by the Phase 2 interviews (as a result of Phase 1 interviews referred to above). Figure 1.1.3 shows a decrease in indirect receipt by the graduate student and scientific officer categories in Phase 3 reflecting, in both cases, the completion of their PhD projects. By Phase 3, research fellows constituted 50% of those in indirect receipt.

Figure 1.4.1 gives a breakdown by search profile type of those in direct receipt of current awareness. Over the three year period, the subject profile group (which included a few author name searches) grew steadily from 69% (67 profiles) to 70.2% (80 profiles), the journal contents component decreased from 9.3% to 7% (many scientists cancelling receipt because output was so voluminous), whilst receipt of both subject and journal contents increased only slightly from 21.7% to 22.8%.

A centrally run current awareness service of this type has considerable manpower implications for information professionals. During Phase 2, almost 40% (39.5%) of scientists in direct receipt of current awareness modified their search profile (by adding or deleting terms) as did almost 25% (24.6%) during Phase 3. These figures do not include modifications arising from the uptake of different modes of receipt or additions to services.
(for example, the searching and sending of abstracts with output referred to later in this section). Moreover, a number of scientists during Phases 1 and 2 stated that their search profile was in need of updating, but had not got around to asking.

Of those scientists receiving current awareness output directly (97 in Phase 1 and 114 in Phase 3), there was an increase from 71.1% (69 scientists) to 73.7% (84 scientists) in the number receiving output in electronic form (mainly via e-mail or on disc), as shown in Figure 1.5.1. Those receiving output both in electronic and hard copy format decreased considerably (7.2% to 2.6%) over the period as scientists learned to work with the new mode of delivery and felt more comfortable with the local option to print on receipt. However, even by Phase 3 the number of scientists still receiving output in print format only remained surprisingly high (26.3%). Over half of this group were in units where there was no network connection or, more importantly, no connection to their desktop. Staff in some units and laboratories shared a common current awareness profile, which encompassed all subject interests of the individual unit/laboratory. Results were either regularly e-mailed to laboratory members, print output circulated or print output displayed on laboratory notice board or other common area for consultation by laboratory members. In other cases, the head of laboratory or other designated laboratory staff member downloaded current awareness results to an EndNote reference handling package and this database was made available as a laboratory database.

Of those who did not receive current awareness directly or indirectly during Phase 1, a number stated their intention of taking it in the near future (as evidenced above), a few had recently joined ICRF and had yet to decide, and a cellular differentiation group had their own abstracts bulletin produced by peers. Alternative methodologies to current awareness receipt during Phase 1 included manual scanning of hard copy Current Contents, regular searching of the in-house SciSearch or external BIDS ISI Databases and regular searching of MEDLINE CD-ROM Database (despite the lack of currency problem), but by far the largest number relied on regular scanning of current journals in locally-held collections. This last methodology still persisted in Phase 3 although the regular searching of the in-house SciSearch Database with its extended coverage and the networking of MEDLINE to the desktop had grown in popularity also. However, by Phase 3, the initial interest in the BIDS service had diminished (see 5.7.8) and the manual scanning of hard copy Current Contents had been abandoned.
Scientists' motivations for receiving current awareness output electronically varied (and often involved more than one reason) as shown in Figure 1.6.1: 33.3% of the 69 in Phase 1 to 34.5% of the 84 in Phase 3 receiving electronic output stressed the downloading into reference handling packages like EndNote; 10.1% in Phase 1 and 9.5% in Phase 3, especially those located outside the central laboratories building, emphasised the importance of being able to request documents electronically from LIS; 20.3% in Phase 1 and 15.5% in Phase 3, whose current awareness profile included contents pages of specific journal titles, mentioned the Library Committee's decision to distribute contents pages of journals via e-mail only as the involuntary catalyst; whilst over 50% (53.6% in Phase 1 and 51.2% in Phase 3) stated that e-mail receipt was easier, more convenient or quicker or referred to the saving of trees achieved by this mode of receipt. A few mentioned that e-mail receipt had been recommended by LIS staff or that they thought that e-mail was the only mode of receipt possible. Obviously, historical or on-going developments explain some of the variations in percentage terms. The Library Committee's decision predated the project period and so diminished as a reason during the project. Also, charging for document supply was introduced in October 1994 and so influenced the perceived utility (which peaked at 12.9% in Phase 2) of requesting electronically.

Whatever their initial motivation, during the course of the project there was an increase (from 59.4% or 41 scientists in Phase 1 to 72.6% or 61 scientists in Phase 3) of scientists who claimed that their perceived benefits of receiving their current awareness results electronically had been realised (see Figure 1.7.1). Comments such as "it's ideal" from a research fellow and "brilliant" from a scientific officer are typical. Problems with connections to ICNet had resulted in one Unit changing from receiving electronic output via e-mail to receipt on disc. There was a corresponding decrease (from 18.8% in Phase 1 to 14.3% in Phase 3) in the number of scientists who claimed that their perceived benefits of receiving current awareness results electronically had been partly realised: problems reported included difficulties encountered in file transfer procedure, inexperience in using e-mail, amount of editing required on electronic references before they were usable in reference handling packages for generation of bibliographies for papers, and the exceeding of allocated personal disc quotas on the central system (especially in the case of those receiving contents pages). A few heads of laboratories had reverted to secretaries photocopying contents pages from locally-held journals and a couple had stopped taking current awareness completely.
The problem of precision versus recall in information retrieval systems is familiar to all information professionals and poses a dilemma for users of current awareness services. Specificity increases relevance at the cost of recall but exhaustivity increases recall and decreases relevance. The average number of references received per week by current awareness recipients is shown in Figure 1.8.1. A number of scientists stated that current awareness in their own area was just a backup or safety net for their other means of keeping abreast of developments in their field (see section 7.1). The average number of photocopied articles resulting from CAS references per week is shown in Figure 1.9.1. There is a noticeable increase (from 53.6% in Phase 1 to 60.5% in Phase 3) in those scientists who photocopied 5 papers or fewer, many in a deliberate attempt to become more selective (see section 5.3).

As for the online abstracts facility via the SciSearch Database, during the course of the project there was an increase (from 34% or 33 scientists in Phase 1 to 52.6% or 60 scientists in Phase 3 - see Figure 1.10.1) in those who received current awareness directly utilising it, some for journals not held locally only. There was a corresponding increase (from 22.7% or 22 scientists in Phase 1 to 43% or 49 scientists in Phase 3) in those who stated that this abstracts facility had reduced the number of requests made for the full-text of (what would have been) non-relevant articles, the reduction in number being estimated from between 10% up to 80%, many up to 50%. One senior laboratory scientist claimed that the abstracts facility “has changed my entire way of working”. Reasons for not utilising the abstracts facility included time taken to access the facility, not knowing how to access the facility, aversion to using the central computing system, utilising MEDLINE rather than SciSearch, poor or non-existent network connections; but the majority of current awareness recipients tended to go straight to the article in the journal, if locally-held, and consulted the abstract there. The provision of abstracts with current awareness from January 1994 made the accessing of abstracts a one step process. Figure 1.10.2 shows an uptake of 51.8% by Phase 3 of the 114 scientists receiving current awareness results directly and their options for searching and / or sending them: 37.3% opted for abstracts to be searched and sent, 32.2% for abstracts to be searched but not sent whilst 30.5% selected to have abstracts sent but not searched. As with the sending of journal contents pages, problems of volume of data being received with abstracts sent was a common problem. One senior laboratory scientist who tried abstracts searched and sent commented “it was overwhelming. I had no time to look at it and I became swamped by too much information”. During Phase 3, many mentioned that charging for documents
resulted in confining their choice of articles to locally held journals (the common use of current awareness for journals not held has already been mentioned). A number of senior scientists maintained throughout the project that the provision of the citation was enough as relevance could be ascertained from known authors and titles.

Of those scientists receiving current awareness output (124 in Phase 1 and 128 in Phase 3), currency of data was perceived as increasingly important (4 and above on the 5 point scale - see Figure 1.14.1) by 60.5% (75) of scientists from all categories of staff in Phase 1 to 80.5% (103) in Phase 3. Interestingly, currency decreased in importance for the more senior laboratory and clinical scientists but increased in importance for graduate students and scientific officers, whilst remaining reasonably high for research fellows (see Figure 1.14.2). Increasing interest was expressed too (4 and above on the 5 point scale - see Figure 1.15.1) by 53.5% (100) of the sample population in Phase 1 to 63.6% (119) in Phase 3 in the availability of electronic abstracts before the appearance of the print publication (for example Springer-Verlag's Preview Service). Comments such as "if easy to access" (graduate student) and "for selected journals" (laboratory scientist) were common. It was the laboratory scientists and research fellows whose interest increased the most during this period (see Figure 1.15.2), reflecting the increasing competition and accompanying secrecy between international groups of scientists, on the one hand, and the increasing pressure to collaborate internationally in pursuit of successful grant application funding, on the other. One clinical consultant summarised his reaction to the idea of electronic abstracts as follows:

"That would be brilliant because clearly it influences what you're going to do and it may commit changes in your programme if results come out which are significant. We often come back from meetings, for example, and we say that we've got to change what we're doing or speed up what we're doing".

Graduate students and scientific officers also reported the perceived increased pressure to publish their theses before another scientist pipped them to the post.

During Phase 1 of the project, a number of methodologies were expressed for dealing with the hypothetical demise of the current awareness service. These included regular searches of the SciSearch Database, the BIDS ISI Database and MEDLINE Database on CD, paying for *Current Contents* on Diskette, increased scanning of current journals, arranging for photocopies of contents pages of journals, and relying on other indexing and abstracting services (such as printed *Current Contents*, *Leeds Oncology Information Bulletins* and the *ASH Bulletin*). By Phase 3, the regular searching of the in-house SciSearch Database with
its extended coverage and the networking of MEDLINE to the desktop had grown in popularity. The absence of the service would reportedly still affect the progress of many scientists' research in increased time spent on literature searching, potential missing of relevant references (especially in those journals not held locally) and in general be detrimental to up-to-dateness. One senior laboratory scientist summarised his position as follows:

[its demise] "would cause me serious problems .... at the moment I am using the current awareness service as my source material .... whereas I'd have to go back to the library and shelves of current journals".

Other comments included:

"My access to library facilities is really my main source of literature - take that away and it would cause me great inconvenience" (Phase 1 - laboratory scientist)

"I think your service is much better because you can check it any time of the day or night, you can go into the last six months of SciSearch and look at all the articles you've requested and I quite often use it on the clinical side to see what's happened in the last six months in a particular area. Obviously I could do that on MEDLINE but it's not so up-to-date" (Phase 1 - clinical consultant)

"It would definitely affect one project because it has to do with all published studies of the quality of statistics in medical journals and any of the obscure ones I pick up from the computerised listings" (Phase 1 - senior laboratory scientist)

"It would mean that the scan of the literature I could do would be restricted to the journals at hand or held in the Library here. I would miss those articles which are interesting and relevant, not in the core journals" (Phase 1 - senior scientific officer)

"I don't think it would change my direction - what you read is important in stimulating new ideas - you have to be aware in order to write a paper or give a talk but not necessarily to do an experiment - some alternative would have to be found" (Phase 1 - senior laboratory scientist).

5.2 Personal/Local Holdings, Core Journals and Browsing

The reliance of scientists on personal or laboratory journal holdings varied considerably. Reasons given by scientists for seeing journals on a regular basis (rather than library held copies) were editorial board membership (usually Head of Laboratory), editorship of journal, journal receipt as result of membership of organisation, laboratory subscription, personal subscription, joint personal subscription between laboratory members, other laboratory members' joint personal subscription, and free receipt (often because reviewer for that journal or ex-editorial board member). Figure 2.1.1 illustrates the reported pattern of access to and reliance on personal or laboratory journal holdings by scientists over the project period. Access to journals by all the reported means (except joint personal subscriptions) increased, the most notable being the rises in editorial board copies (104 in Phase 1 and 124 in Phase 3), personal subscription copies (63 in Phase 1 and 90 in Phase 3) and laboratory subscription copies (117 in Phase 1 and 195 in Phase 3). The journal
names of personal or laboratory copies, reported as being regularly scanned over the project period, are included in Appendix 6. Both the laboratory and personal subscription lists for Phases 1 to 3 reflect the growing popularity of review journals, which mirror closely core journal developments (see below). Both lists also reflect the rise in popularity of new journals, such as *Nature Genetics*, *Nature Structural Genetics* and *Structure*, and of specialist journals of interest to minorities of staff in subject areas such as statistics, psychology, pathology and public health.

Throughout the project period the number of core journals identified by scientists ranged from 2 to 48, although most cited 6-10 titles as core to their research area (see Figure 3.1.1). Those who cited more than 20 journals as core were senior clinical or laboratory scientists: the former, often practising clinicians for up to 50% of their time, included clinical titles as well as scientific titles whilst the latter were overseeing a range of research groups and consequently a range of research areas. A small number of scientists were unable to state a number of core journals because of frequently changing research areas and hence changing related journal titles. Names of core journal titles identified over the project period, ranked in order by title, are included in Appendix 7. The rise in importance of review journals such as *Current Opinion in Cell Biology* (rising from 7 votes in Phase 1 to 22 votes in Phase 3), *Bioessays* (rising from 6 votes in Phase 1 to 11 votes in Phase 3) and *Elsevier's Trends in Genetics and Trends in Biochemical Sciences* (rising from 20 and 13 votes respectively in Phase 1 to 25 and 21 votes respectively in Phase 3), and the growing success of relatively new journals such as *Oncogene* (rising from 17 votes in Phase 1 to 30 votes in Phase 3), *Journal of Cell Science* (rising from 18 votes in Phase 1 to 31 votes in Phase 3) and *Nature Genetics* (rising from 14 votes in Phase 1 to 28 votes in Phase 3) is evident from listings A7.1.1, A7.1.2 and A7.1.3 in Appendix 7. The wide subject interests of the sample group (referred to in section 2.2) are also reflected in the number of core journal titles which gained only one vote. The other listings (A7.2.1 to A7.6.3) included in Appendix 7 itemise the top twelve core titles cited by category of staff (although more titles were included if ratings coincided). The mainstream biomedical journals (such as *Cell, Nature, Science, EMBO and Proceedings of the National Academy of Sciences*) are cited by all groups but clinical titles such as *British Medical Journal, New England Journal of Medicine* and *Lancet* are more prevalent, as expected, in the clinical scientist category listing. Moreover, over 44% of scientists (44.9% in Phase 1 and 47.6% by Phase 3 - see Figure 3.2.1) stated that they were referees for some (in a few cases all) of their specified core journals. This increase in refereeing is evident in the clinical research
fellow, research fellow and scientific officer categories of staff who, as they become more senior, referee articles often indirectly on behalf of their head of laboratory or group.

The majority of scientists acknowledged that the amount of time spent browsing or scanning current journals varied considerably from week to week but estimates (from 142 scientists in Phase 1 to 155 scientists in Phase 2) ranged from a quarter of an hour to five hours a week (see Figure 4.1.1). A number of senior laboratory and clinical scientists stated that they no longer had time to scan printed journals, relying instead on scanning contents pages or subject searches delivered electronically or via printed output as current awareness results, or on photocopied contents pages from locally-held journals. Whilst many scientists browsed daily, some conducted their browsing in batches at the weekend or a number of times per month; others confined their browsing to laboratory held journals. A graduate student commented that browsing time varies because "I often take one week off for reading ... I find it difficult to switch between reading and practical".

Browsing tended to focus on core journals and review journals, the number of citations scanned commonly per week numbering between one and two hundred. Over the project period there was a general perception that browsing activity was decreasing: phrases such as "less and less" (laboratory scientist), "smaller and smaller" (clinical scientist), "very little" (senior scientific officer and graduate student) and it "is one of the first things to go" (senior laboratory scientist) were commonly used. This perception is not borne out by the figures illustrated in Figure 4.1.1 although, over the period, the majority of scientists spent less than two hours browsing per week. A number of graduate students and scientific officers mentioned an increase in browsing when writing up their theses. One senior laboratory scientist stated that he had started browsing again because of the introduction of charging for document supply.

The number of journal articles photocopied as a result of browsing varied. In general, those who received current awareness output found it difficult to differentiate between articles copied as a result of being alerted by current awareness and those copied as a result of browsing. Some scientists stated that they had copied articles via browsing before they were subsequently alerted to them by current awareness output; others confined their copying from browsing to broader interest or methodological and technique articles, peripheral subject areas or mini-reviews not covered by current awareness profiles; those who received journals in their laboratories did not copy relevant articles in those titles. During the course of the project, there was a rise (56.2% in Phase 1 to 60.4% in Phase 3 -
see Figure 4.3.1) in the number of scientists who copied less than five articles per week, an increasing number by Phase 3 copying just the front page of the article containing the abstract (the full article to be copied later if necessary).

It is significant that, throughout the period under review, over 75% of scientists rated the browsing activity highly (4 and above on the 5 point scale - see Figure 4.4.1). Figure 4.4.2 indicates that this sustained interest in browsing is evident amongst all categories of staff. Those that did not rate browsing highly tended to rely on current awareness or lacked the time to browse as illustrated by the following comments: “I depend on current awareness” (senior laboratory scientist); “It’s not important at all to browse the printed journal when you’ve a current awareness system like ours” (clinical consultant); “browsing is enjoyable but inefficient” (laboratory scientist); “browsing is not as important as current awareness” (research fellow); “I don’t get time so I rely on current awareness” (graduate student). One senior laboratory scientist summarised his position as follows:

“I do like browsing but that’s the thing that gets squeezed out so, if everything was electronic, I probably wouldn’t notice it at first, but my general education would generally fail (i.e. you wouldn’t ever look at anything that wasn’t your field). In the short term that wouldn’t matter - in the long term it would have a bad effect”.

The time spent by scientists reading the literature each week varied. Figure 4.5.1 summarises responses and indicates that over 50% of the sample group spent less than 4 hours reading the literature each week. A number of senior scientists reported that “not enough” time was devoted to reading or maintained that they spent “more when writing”. Graduate students, clinical research fellows and scientific officers also dedicated more time to reading the literature when writing up their theses.

5.3 Document Supply and Request Modes

The source of photocopied articles in the first instance was usually local collections, 55.1% of scientists in Phase 1 to 52.9% in Phase 3 obtaining articles themselves or via their staff (see Figure 5.1.1), with the LIS Department usually being the second potential source for these ICRF staff outside the central laboratories building (with the exception of some Oxford and London units). Direct usage by scientists of the LIS Department stock for acquiring articles themselves or via their staff rose slightly during the project period, 41.2% in Phase 1 to 44.4% in Phase 3. The slight decrease in usage of local collections and the slight increase in LIS Department stock usage reflects the closure of some ICRF units and the transfer of other unit staff to the main laboratory site in London (see sections 2.4 and 2.5). Figure 5.2.1 shows scientists’ usage of the LIS document supply service.
personally or via their staff over the period and the decrease in personal requests from 72.2% in Phase 1 to 66.8% in Phase 3 is reportedly due, in the main, to the policy of charging for document supply instituted in October 1994.

Despite this variation in the number of scientists utilising the LIS document supply system (153 in Phase 1, 163 in Phase 2 and 143 in Phase 3) Figure 5.3.1 shows an increase in electronic requesting over the period: 42.5% of scientists requested electronically (via the Inter-Library Loan Requests Databases or via e-mail) in Phase 1, 49% in Phase 2 rising to 54.5% in Phase 3, whilst a further 9 or 10 scientists tended to request by phone. Throughout the project, speed, convenience, efficiency and simplicity were the reasons given by scientists for requesting electronically. A few mentioned that electronic requesting ensured fewer transcription errors in citations and others commented that electronic requesting gave a more disciplined structure for dealing with weekly current awareness output on the screen in the laboratory. One senior scientist stated that she requested electronically for LIS’ staff sake rather than her own and another thought that electronic requesting was the only method available to make a request. Although there was general agreement over the efficiency of electronic requesting, several scientists stated that it took longer than filling in cards (a few regularly filled in cards whilst travelling on public transport). Figure 5.5.1 shows a decrease in the perceived benefits arising from electronic requesting, falling from 76.9% of scientists in Phase 1 to 74.4% in Phase 3. The majority reported that this was due to the charging policy for document supply: because of the cost element, scientists had to be more selective, which resulted in fewer requests and this detracted from the convenience of electronic requesting. In short, with fewer requests, time was not such an important factor and it was often easier to fill in cards for one or two requests than to go through the electronic requesting process.

Overall (i.e. taking entire sample population), 24.1% in Phase 1 and 26.2% in Phase 2 claimed that the rate of acquisition (whether through personal photocopying or via LIS’ document supply service) of photocopied articles over the previous twelve months had increased (see Figure 5.6.1) due to expanding subject areas, divergence of personal or laboratory interests or changes in project direction, increase in number of relevant journals published, and the writing of PhD theses (in the case of graduate students, scientific officers and clinical research fellows), reviews, books or grant applications.

"... increased because of the increase in the volume of material being published. It's difficult to stay on top of even your specialist sub-areas within a field - you have to be selective" (Phase 1 - senior laboratory scientist).
"When you start, you don't know anything so you do a lot of photocopying to learn. That's just your own subject and then you continue to photocopy to keep abreast. There is also all the other different subjects within your laboratory, so the number of photocopies increases because you're broadening your subject area" (Phase 1 - graduate student).

"I'm spending more and more time now refereeing, doing site visits for theses and so forth and, because of that, I feel that I have to have a broader background, so I think I'm asking for more information than I had previously. In other words previously I was very specialised and that meant you can get away with a smaller breadth of literature but now I feel that I'm actually trying to cover more aspects of cancer than I have previously and, as a result, I want more information" (Phase 1 - senior laboratory scientist).

"There has been an increase [in photocopying] as the interests of the laboratory have become more diverse" (Phase 1 - senior scientific officer)

"... increased because there are more journals in the field [human genetics] and I am editor of the 'x' chromosome" (Phase 1 - laboratory scientist)

"... photocopying has increased by about 25% because of more diverse research and the number of papers in the area has increased. When we started, there were only two groups working on ovarian cancer - now there are twenty groups working on it" (Phase 2 - clinical scientist)

"... increased as the area [microbial genetics] is vast and there's a lot happening” (Phase 2 - graduate student)

"... increased because of the speed with which the field [cell adhesion] is developing - developments every two weeks!” (Phase 2 - graduate student)

"... increased because every result throws up more questions” (Phase 2 - clinical research fellow)

"... increased as I'm getting more into the field [transcription] and going off in new directions” (Phase 2 - research fellow)

"... increased because more people working in the field [developmental genetics] and publishing more and because more journals are targeted at developmental biologists” (Phase 2 - senior scientific officer)

"... increased because writing reviews and moving into new fields” (Phase 2 - clinical consultant)

"... increased substantially because of tamoxifen trial” (Phase 2 - senior laboratory scientist).

"... increased because moving into lateral fields and writing my thesis” (Phase 2 - senior scientific officer)

"... increased because I'm writing reviews for TIGS [Trends in Genetics]” (Phase 3 - research fellow)

"... increased, reflecting an exploding, expanding field [cell genetics]” (Phase 3 - graduate student)

"... increased in bursts because of grant applications and writing thesis” (Phase 3 - clinical research fellow)

"... increased because looking for post-doc positions” (Phase 3 - graduate student)

"... increased because looking for jobs and moving into other fields” (Phase 3 - research fellow)

During Phase 3, there was a decrease to 19.3%, which is reinforced by the large percentage rise (13.9% in Phase 1, 12.3% in Phase 2 to 31% in Phase 3) of those scientists who reported that their acquisition rate of photocopied articles had declined. Reasons given included the introduction of charging for document supply, increasing use of abstracts,
easier access to databases for identification of references, increasing number of laboratory
held journals, and growing selectivity.

"...decreased. I'm being more radical because I'm overloaded with so much paper
these days. I just get rid of it provided I know how to retrieve it from other sources
quickly if necessary. It's really a personal storage issue - I'm hoarding less and less as
the years go on" (Phase 2 - clinical consultant)

"...decreased with the abstracts service" (Phase 2 - clinical consultant)

"...decreased dramatically because of charging. I've become more selective and have
taken out more laboratory subscriptions to journals" (Phase 3 - senior laboratory
scientist)

"...decreased largely due to charging" (Phase 3 - laboratory scientist)

The rest reported that their acquisition rate of photocopied articles had remained constant,
reasons given included intentionally becoming more selective, becoming more selective
because of charging or pressure of time, levelling off after effects of provision of abstracts,
and retaining the abstract of the article for possible future reference rather than acquiring
article now.

5.4 Use of Reference Handling Packages

Reference handling packages were in use by 52.4% (98) of scientists in Phase 1 of the
project, this figure rising to 72.7% (136) by Phase 3 (see Figure 6.1.1). There was a
corresponding decrease in the number of scientists intending to utilise one within the
following twelve months - from 26.2% (49) in Phase 1 to 12.8% (24) in Phase 3. EndNote
was the most popular package in use (partly because it was one of the first reference
handling packages available for Apple Macintosh (Mac) computers and partly because of
the reduced cost of the package resulting from the organisational licence arranged by the
ICRF Central Computing Unit), others being Reference Manager, Archivist, Idealist,
Hypercard, Refer and Xref (the last two in use on UNIX systems). A number of scientists
maintained a reference file in another form throughout the project period, 17 (9.1%) in
Phase 1 to 11 (5.9%) in Phase 3. These were either flat files kept on the central machines
at ICRF (or on their Macs or PCs) or traditional card files. A number of the card filing
systems were no longer updated and had lapsed by Phase 3 because of the manpower effort
required to maintain them. The majority of scientists reportedly kept their photocopied
articles filed by subject or in topic files. Relatively few of them utilised their retrieval
system (whether electronic or manual) to identify publications by a classification or
running serial number. A few scientists stated over the period that they had tried EndNote
and had given it up, either because keying in references had been too time-consuming or
that they felt that the generation of bibliographies via EndNote did not save time over their traditional method which involved, in the main, cutting and pasting from previous papers.

Of the 69 scientists receiving current awareness output in electronic form in Phase 1, 56.5% (39) downloaded their results into their reference handling database, although only 14 (35.9%) of those claimed to store abstracts as well as citations. By Phase 3, of the 84 receiving electronic output, there was a slight decrease to 53.6% (45) in the number of scientists downloading current awareness output (due to file transfer difficulties, the availability of online abstracts from MEDLINE and SciSearch, and the preference of a number of scientists not to add references to their databases until they had read the full-text of the publications referred to) but there was an increase to 53.3% (24 of 45) in the number storing abstracts in their reference handling database, as shown in Figure 6.2.1.

Figure 6.4.1 shows the increase from 78 (of 98 in Phase 1 - 79.6%) to 112 (of 136 in Phase 3 - 82.4%) scientists who loaded data from other sources into their reference handling packages over the project period. Downloading from MEDLINE (initially via CD and later online via ERL software), keying in and copying data from colleagues' databases were the main methods of loading data into reference handling databases, although BIDS and GDB (Genome DataBase) were other sources mentioned. During Phase 1, the size of the reference handling databases ranged from less than 100 references for personal databases to over 16,000 references for laboratory databases. During Phases 2 and 3 many laboratories maintained a subject or series of subject databases plus a database of references for every published paper. The size of databases became a problem also: those laboratory databases in excess of 15,000 entries were either split, put onto optical media or discontinued in that form. Maintenance of databases varied between Head of Laboratory, laboratory secretary, joint maintenance by a few or all laboratory staff members, problems often arising when the premier maintainer (often a research fellow on a three year contract) left the laboratory. By Phase 3, many reported that their EndNote databases were only updated when a paper was written by laboratory members. As one senior laboratory scientist reported: .... "the big database is static at present because it is impossible to maintain because of the time element .... we now have a database for each of our papers."

Of the 98 scientists in Phase 1, 125 in Phase 2 and 136 in Phase 3 who utilised reference handling packages personally or via their staff, an increasing number of them (70.4%, 76% and 78.7%, respectively - see Figure 6.7.1), were using the package in conjunction with a word processing package (usually Microsoft Word) to produce bibliographies at the end of
papers for submission to journals, or for book or thesis production. Taking the whole (187) sample population, throughout the project period over 25% (25.7% in Phase 1, 26.2% in Phase 2, and 25.1% in Phase 3) keyed in references or cut and pasted references from previous papers to produce bibliographies for their published papers. During the project also, 7 (3.7%) wrote their papers longhand and 4 (2.1%) dictated their papers, both for their secretaries to wordprocess subsequently. Figure 6.8.1 shows the reported publishing patterns of the sample population over the period under review. A number of scientists were unable to estimate a figure for their papers. The number of “not applicable” responses decreased as the project progressed as scientists' (graduate students, research fellows and clinical research fellows) contract periods drew to a close. The multi-authoring convention in biomedical publications makes the identification of trends difficult but, of those who responded (87 in Phase 1, 118 in Phase 2 and 139 in Phase 3) it is clear that the majority of scientists publish less than 10 papers per year, the largest proportion (48%) by Phase 3 publishing 5 or less papers per year. Those scientists who published more than 10 papers per year were mainly senior laboratory and clinical scientists. Throughout the project period, scientists' main motivation for utilising a reference handling package was for formatting references rather than as a database but by Phase 3 many used their reference handling package for both purposes, 80.6% in Phase 1 to 76.5% in Phase 3 (of those utilising a reference handling package) stating that their perceived benefits of utilising the package had been realised (see Figure 6.10.1)

5.5 CD/In-House/Remote Database Usage

CD databases were utilised decreasingly over the project duration from 75.9% (142) of scientists (70% personally and 6% via their staff) in Phase 1 to 72.7% (65% personally and 8% via their staff) in Phase 3, as shown in Figure 7.1.1. The main CD database in use was MEDLINE but Cancer CD and Psychological Abstracts were utilised also. During Phase 1, those scientists who did not use the CD facility stated their intention to do so in the future or had access to Data-Star MEDLINE instead. By Phase 3, online MEDLINE via ERL was increasing in popularity (being to the desktop rather than stand alone somewhere in the building) whilst one scientist had switched to using EMBASE via BIDS at the university in which he was based.

The availability of CD-ROM drives in laboratories increased over the period from 17% in Phase 1 to 40% in Phase 3, as shown by Figure 7.3.1. Much of this increase is accounted for by the fact that CD-ROM drives became standard on the delivery of new machines,
whether Apple Macs or Sun workstations, rather than an increase in the range of CD databases/databanks available. Some held the operating system for Sun workstations or molecular biology software (such as DNASTar, GeneWorks, Brookhaven, SwissProt, MacVector or Entrez), but other databases included OMIM (Online Mendelian Inheritance in Man), Sigma Aldrich's catalogues, Current Protocols in Molecular Biology, Standard Nomenclature of Pathology, the full-text of the *Journal of Biological Chemistry* and the *Oxford Textbook of Medicine*. Erasible optical discs were in use in a few laboratories for image analysis and the storage of photographic images, datasets and software.

As for usage of the resources held on the main computing facility, there was an increase in the use of the LIS and molecular biology programs and databanks over the project period - from 52.4% (98) in Phase 1 to 68.5% (128) in Phase 3, in the case of the LIS Databases, and from 46.5% (87) in Phase 1 to 48.7% (91) in Phase 3, in the case of the molecular biology databases (see Figure 8.1.1). The SciSearch Database was the most popular of the LIS Databases and its extension back to 1992 in January 1994 accounted for the large increase in usage, being viewed by scientists as a much more useful resource. The Inter-Library Loans Database was the second most popular LIS Database but its use lessened with the introduction of charging for documents in October 1994. Usage of the molecular biology programs and databanks (mostly GCG, Intelligenetics, Staden and SHarQ - Sequence Homology Alignment Remote Query for protein or DNA sequence similarity search) initially increased and then slightly decreased with the proliferation of e-mail molecular biology servers. During Phase 2 one scientist stated “it is usually quicker to e-mail EMBL (European Molecular Biology Laboratory) in Heidelberg if searching for a particular sequence than to use the search facility on the Vax ... and you can do something else whilst you’re waiting”. During Phases 2 and 3, there was an increased uptake of gopher and WWW tools for accessing both LIS and molecular biology resources. Throughout the project period, a number of scientists spoke of their apprehensiveness about using the central computing systems and the remark below is typical.

“I’m not very good at using software on the Vax so I don’t use it much” (Phase 2 - senior laboratory scientist).

The remarkable rise from 23.5% (44) in Phase 1 to 46% (86) in Phase 3 in end-user searching of remote databases/databanks and the demise from 26.7% (50) in Phase 1 to 6.4% (12) in Phase 3 of mediated searching via LIS staff is shown in Figure 9.3.1. Remote databases/databanks accessed by scientists themselves in Phase 1 included databanks such as GDB, EMBL, GENBANK, PIR (Protein Information Resources), and
BLAST (Basic Local Alignment Search Tool) and databases such as Data-Star MEDLINE, BIDS ISI Databases and UK university catalogues. This range expanded during Phases 2 and 3 to include EUROCODE (European Computerised Oncology Data Exchange), PDQ (Physicians’ Data Query), EORTC (European Organisation for Research and Treatment of Cancer), Genome Resource Centre, HGMP (Human Gene Mapping Resources) and OMIM at Harrow, EMBL and NIH (National Institutes of Health) via gopher, Grail Database, Entrez, mouse databases at Jackson University, ESRC (Economic and Social Research Council) Data Archive, Pombee Database, and Wisdom (Wellcome Information Service Databases on Medicine) Databases among others.

5.6 Network Usage and Electronic Journals

Throughout the project, usage of networks was measured by the use scientists made of electronic mail facilities, electronic bulletin boards and remote login and file transfer facilities. Figure 10.1.1 shows scientists’ increased usage of electronic mail from 61% (114) in Phase 1 to 84.5% (158) in Phase 3. Figure 10.1.2 shows the breakdown by category of staff, the largest increase in usage being amongst the scientific officer category. Reasons given for scientists growing use of electronic mail over the project period included: corresponding with members of family or personal friends or ex-colleagues at universities and institutes worldwide; increasing number of collaborations and co-authoring of papers (including communicating with publishers); increasing usage by the human genome community, including the transfer of sequences with the mushrooming of molecular biology electronic mail servers; subscription by individual scientists to more mailing lists; the heightened awareness and usage of electronic mail by the university and research communities generally; symposium organisation; and the introduction of more user-friendly electronic mail programs such as Eudora for the Apple Macintosh computer and PINE for Digital UNIX on the DEC Alphas. Scientists’ motivations for increased usage are elaborated on below.

“... increased for sending files and messages, now that I know how to do it. Once I’d learnt how to compress Word files and squirt them across the network, it really is very good and very cheap”. - (Phase 2 - senior laboratory scientist)

“... increased massively. There are more people using it, it’s easy to use, it’s non-interactive (unlike the phone), and you can send attachments” (Phase 3 - as above)

“... increased. I’ve been using Eudora for a month or so - you can edit much more easily with it and you can cut and paste like a Mac document” (Phase 2 - senior laboratory scientist)

“... increased tremendously. It’s so easy and quick and especially good for writing grant applications collaboratively” (Phase 3 - senior laboratory scientist)
increased because I'm involved in more projects, there are more people on e-mail and I've subscribed to more e-mail lists" (Phase 3 - clinical scientist)
“... increased mainly because of ICRF people leaving” (Phase 3 - graduate student)
“... it's increased internationally because of collaborations” (Phase 3 - research fellow)
“... collaborations were the catalyst for starting and corresponding with left colleagues” (Phase 3 - scientific officer)
“... increased. I'm now hooked as it's increasingly easy to get hold of people” (Phase 3 - scientific officer)

Figure 10.2.1 illustrates that this increased electronic mail activity exhibited by ICRF scientists is pervasive internally within ICRF, nationally within the UK and internationally. During Phase 1 of the project, eighteen laboratory and clinical scientists stated that electronic current awareness receipt was their only use of electronic mail within ICRF. By Phase 3 of the project, sixteen laboratory and clinical scientists still maintained this position, although most utilised electronic mail nationally or internationally as well. The greatest increase over the project period was in international traffic, reflecting the reported acceleration of international collaborations and co-authoring of papers, the popularity of molecular biology electronic mail servers and the growth in professional and personal correspondence. Figure 10.2.2 shows scientists’ frequency of use of electronic mail over the period. Besides an upward trend in the number of messages sent and received daily, weekly, monthly and occasionally, it is difficult to extract more detailed observations from the data. The information conveyed in Figure 10.3.1, which records scientists’ perceptions of their electronic mail activity each year of the project’s duration, reinforces the difficulty of establishing a pattern of use from these fast moving developments. With an increasing percentage of scientists claiming that their usage of electronic mail was growing (over 70% of those utilising electronic mail by Phase 3), continued monitoring of scientists’ activities will be necessary to establish whether routines of dealing with this mode of communication are established and trends thereby become discernible. It was mainly contract staff who reported a decrease in their usage of electronic mail during the project period: reasons given included “end of collaborations” (graduate student), “takes too much time in the day” (graduate student), “I'm being more anti-social” (research fellow), “because I'm doing less searches” (graduate student), and “I lost my contacts because they moved” (scientific officer).

There was a rise also in usage of electronic list servers and bulletin boards (internal ones such as Information Technology News or external ones such as USENET News) from 29.4% (55) in Phase 1 to 44.9% (84) in Phase 3 (see Figure 11.1.1). This growth over the project period is reflected in all categories of staff, as shown in Figure 11.1.2, although
increased usage is greatest in the laboratory scientist, graduate student and scientific officer categories. Reference has already been made (see section 2.7.3) to the fact that a subset of the USENET News Service was available as an in-house facility. Specific lists or sources which were regularly accessed, or from which messages were received, over the period included Bionet (particularly molecular biology ones and Methods and Reagents Bulletin Board), NISS, GCG, Daresbury, EMBL, GenBank, NCBI (National Center for Biotechnology Information), ESRC, Artificial Intelligence in Medicine, MedStat (medical statistics subset of AllStat), Medical Decision Making, National Library of Medicine, Cochrane collaboration (evidence based medicine list), european and worldwide grants, image processing, and hardware and software suppliers. A few scientists mentioned their use for personal interests or hobbies (for example, computer games or ornithology bulletin boards). Figure 11.2.1 shows scientists’ frequency of use of bulletin boards whether by direct access or receipt of messages over the project period. There was a general upward trend in the number of daily, weekly, monthly and occasional accesses or receipts but the monthly and occasional accesses or receipts predominated. Although an increasing percentage of scientists claimed that their usage of electronic list servers and bulletin boards was increasing over the period, by Phase 3 over 50% (53.6%) of scientists using these facilities stated that their usage remained constant. An increasing percentage of scientists (11.9% by Phase 3) stated that their usage of these facilities had decreased over the project period, reasons given included “lack of time” (graduate student), “I found them so unhelpful” (a number of laboratory scientists), “had found nothing useful” (graduate student) and “decreased because of increased use of web servers” (research fellow). Reasons given for not using these facilities at all were lack of time (graduate student, scientific officer), network connection problems (clinical research fellow), and “I never got into it” (research fellow). Scepticism of the value of such facilities was expressed throughout the project period by a number of senior laboratory scientists, as shown by the following comments.

“The only way that I would look at a bulletin board is if it came up for me to look at. What I don’t need at this time of my life is access to more information - I’ve got enough garbage coming my way already”. (Phase 1 - senior laboratory scientist)

“It would take great activation and energy to use something new” (Phase 2 - senior laboratory scientist)

During the course of the project, scientists’ use of remote login rose only slowly from 16.6% (31) in Phase 1 to 20.9% (39) in Phase 3 whereas scientists’ use of file transfer rose significantly from 15% (28) in Phase 1 to 34.2% (64) in Phase 3 (see Figure 12.1.1). Interactive sessions were reported with genome, molecular biology, bibliographic, clinical
and family databases and datasets (for example, GDB, Genome Resources Centre, HGMP, Drosophila Database, ESRC Data Archive, EORTC, PDQ Database, Data-Star MEDLINE, BIDS, EMBL GenBank, OMIM, Grail Database, US protein databases, Brookhaven Database, Cambridge Crystallography Database, Wellcome Genetics Centre, and Daresbury Databases). Other interactive sources mentioned related to software acquisition (for example Imperial College) and collaborative or personal computer accounts at other national or international universities and institutes. A number of scientists mentioned that, during the course of the project, their mode of access to some of these resources changed from telnet in Phase 1, to gopher in Phase 2 and finally to web access by Phase 3. As for remote file transfer, the majority of activity in Phase 1 related to transfer of sequences from molecular biology databanks, other material mentioned being public domain software, family data, genetic markers and collaborative texts. Sequence transfer continued throughout the project (although electronic mail delivery of sequences increased in popularity as well) but Phases 2 and 3 also saw increases in transfers of software, documents, genetic and image data from ftp servers and archives; transfers of text, documents and data between collaborating institutions; and transfers of conference information and full text of journal articles, some of which included added value items (for example, statistical programs available when scientists publish papers that have software with them). Many scientists, who did not remotely transfer files, did transfer files internally within ICRF, for example, “only between Macs in the lab” or “only Vax to Mac” or “only from GCG using the fetch facility” or “only with the Photographic Department". A few epidemiologists stated that they exchanged discs between collaborating groups and sent statistical datasets on discs to OPCS (Office of Population Censuses & Surveys) and the ESRC Data Archive. Other scientists commented that they “did not know how to ftp remotely” or that they “highlighted the screen and copied and pasted instead of file transferring”. By Phase 3, the growth in the use of the electronic mail package Eudora meant that collaborative manuscripts and grant applications plus papers to journals such as Current Biology were increasingly being sent as attachments to electronic mail. A few scientists commented on file compression technique problems with intended recipients, for example, “some contacts don’t know how to cope with binhexed files”. Figure 12.6.1 illustrates that although scientists’ perceived usage of remote login and remote file transfer actually increased or was anticipated, a growing number of them perceived a decrease in those activities. This partly relates back to the growing use of gopher and, more importantly, world-wide web services where file transfer is an easy and implicit part of the
protocol - so easy and transparent to save or print from remote files that scientists are often unaware that it is technically a file transfer transaction.

An impressive 82.9% (155) of scientists stated that they would utilise the full-text of published journals in electronic form (including graphics) in Phase 1, particularly for titles not held, but only 34.2% (53) would use the electronic form as a replacement for the hard copy journal. A typical apprehensive comment concerning graphics from one senior laboratory scientist during Phase 1 is illustrated below:

"I'm very sceptical about it purely on technical grounds when you see how much disc space a single gel scan occupies. There is also the dynamic range problem".

The majority stated that they would use the electronic version as a supplement to the hard copy journal. By Phase 3, interest had grown to 93.6% (175) (see Figure 14.1.1), amongst all categories of staff (see Figure 14.1.2), with 46.9% (82) stating that they would use the electronic form as a replacement for the hard copy journal. The main qualification to this was that the graphics quality was acceptable (for example, the quality of microscopy images), with ease of use, speed of printing, colour printing and comprehensiveness being other important considerations. By Phase 3, the possibility of storing papers electronically was viewed as an ideal future scenario, although comprehensiveness was mentioned in this context too. In addition, support for the extension of the electronic version to the back years of journals increased from 87.7% (136) in Phase 1 to 90.3% (158) in Phase 3. By Phase 3, less than 10% (8.6% or 15) supported the electronic form of current journals only. In Phase 1, only 16% were aware of the Online Journal of Current Clinical Trials, the first refereed electronic journal of interest to a proportion of ICRF staff. Unfortunately, during the course of the project this journal failed to capture its market partly because it could not attract enough good papers and partly because of its requirement to have a dedicated client program “Guidon” to access it. It was eventually bought from the American Association for the Advancement of Science by Chapman and Hall but this move failed to revive its fortunes. A number of clinical scientists, one of whom was an Associate Editor of the OJCCT, reported their disappointment in the journal’s performance - even though two had personally submitted papers to the journal and had refereed other papers for the journal.

5.7 Other Information Gathering / Communication Activities
A number of other information gathering activities were monitored during the project period and their importance rated by scientists on the five point scale, as reported below.
5.7.1 Verbal Communication

Figure 13.1.1A shows that verbal communication (face to face or via telephone) was rated highly (4 and over on the five point scale) by scientists throughout the project’s duration - 90.4% in Phase 1 to 89.3% in Phase 3. Figure 13.1.1B shows the breakdown by category of staff, the research fellow and clinical scientist categories demonstrating sustained growth in the importance of verbal dialogue. Many laboratory scientists stressed that verbal dialogue was the most important information gathering activity of all; some clinical scientists rated information gathering by verbal dialogue highly when it happened but stressed that it did not happen very often; whilst a number of graduate students emphasised the difference between the amount of verbal dialogue with internal as opposed to external colleagues, the former being high (especially from the head of his/her laboratory) and the latter being low.

5.7.2 Written Communication

There was a substantial increase in the importance of written communication (including electronic mail and fax) over the project period. Figure 13.1.2A shows that whereas 39% (73) of scientists rated it 4 and over on the five point scale in Phase 1, this had increased to 57.8% (108) in Phase 3. This growth in importance of written communication, particularly electronic mail and fax, was reported by all categories of staff, but is most evident in the research fellow and graduate student categories, as shown in Figure 13.1.2B. Over the period under review, scientists from all categories of staff stressed the importance of written communication, especially in relation to collaborations. Scientists tended to concentrate on their fax usage (as shown below) as they had already spoken at length about their use of electronic mail (see section 5.6).

“Yes fax traffic has increased hugely. It’s the single most important factor - and I’ve had a fax machine in my office since Spring 1992” (Phase 1 - senior laboratory scientist)

“Yes fax has had a great impact - it’s an essential way of interacting and traffic will increase with my fax modem on my computer” (Phase 1 - senior laboratory scientist)

“Yes fax has increased a lot. It’s my main mode of communication, even more than e-mail” (Phase 1 - senior scientific officer)

“Yes fax is increasing for reviewing articles, sending reviews to editors and I’ve become an editor myself” (Phase 2 - senior laboratory scientist)
"Yes fax has increased partly because of collaborations and partly for communicating with journals. I’m thinking of having a fax machine in my office” (Phase 2 - senior clinical scientist)

"Yes fax has increased partly because of collaborations and partly because I’ve become secretary of EORTC Quality of Life Study Group” (Phase 2 - senior clinical scientist)

"Yes fax has increased for joint papers with colleagues abroad and writing standard guidelines for pathologists” (Phase 2 - senior clinical scientist)

"Yes fax has increased. It’s become more useful because my conversations are becoming more complex and it’s better to write them down” (Phase 2 - clinical research fellow)

"... fax is increasing because of collaborations with supplying people with reagents” (Phase 2 - scientific officer)

"Yes fax has increased massively - it’s fax madness” (Phase 3 - senior laboratory scientist)

"Yes fax has increased mainly for job applications” (Phase 3 - research fellow)

"Yes fax has increased in collaborations and for job applications” (Phase 3 - clinical research fellow)

"Yes my use of fax is increasingly heavy because of collaborations and I live in London, so I fax to my office a lot” (Phase 3 - senior clinical scientist)

"Yes fax is increasing especially for paper generation and for providing information to other laboratories” (Phase 3 - research fellow)

"Yes fax is increasing partly because of collaborations and partly for communicating with companies” (Phase 3 - graduate student)

"My use of fax has increased for arranging visits to labs in the US” (Phase 3 - graduate student)

Besides collaborations, co-authoring of papers and joint grant applications, editorial or committee correspondence, obtaining data from or sending information to other laboratories, reviewing articles and communicating with journals, discussions with laboratory members when off-site, forwarding job applications, correspondence with professional contacts and companies, and arranging visits or obtaining meeting attendance details were the main activities for which fax, and to a lesser extent e-mail, were employed. Figures 13.3.1 and 13.3.2 show the perceived impact of fax and e-mail as factors in their increasing information gathering or communication activities. The decrease from 62.6% in Phase 1 to 35.3% in Phase 3 suggests that the effect of both fax and electronic mail had begun to plateau and had become routine communication modes. Ease and speed of communication offered by both modes, particularly fax, was commented on by many, especially when deadlines for submission of documents needed to be adhered to. A number of scientists mentioned the decline in their postal mail, the replacement of telephone calls with faxes, or the relationship between their e-mail and fax usage: for example, “fax has increased but e-mail has increased more”
(graduate student) or "fax has decreased relative to e-mail" (research fellow) or "fax has increased and e-mail has increased to a lesser extent but that will change" (senior laboratory scientist) or "I prefer fax to e-mail" (clinical research fellow).

By Phase 3, decreased usage of fax was reportedly because of the ending of collaborations or the increased use of electronic mail.

5.7.3 Meetings / Conferences / Seminars

There was a decrease in the importance of attending meetings, seminars and conferences over the project period. Figure 13.1.3A shows that whereas 69% (129) of scientists rated it 4 and over on the five point scale in Phase 1, this had decreased to 66.3% (124) in Phase 3. This decrease in the importance of attending meetings, seminars and conferences is reflected in all categories of staff except the research fellow and graduate student categories, as shown in Figure 13.1.3B. A selection of views on the importance of meetings are given below.

- "Meetings are increasing in importance as I become more well known" (Phase 1 - clinical research fellow)
- "Meetings have decreased for me - now it's via my staff" (Phase 1 - laboratory scientist)
- "Conferences have become more important from the scientific point of view - finding out over coffee what they are working on now as opposed to what they were working on two years ago which is what they are presenting now" (Phase 2 - laboratory scientist)
- "Meetings have decreased in importance because we have already heard what other people are working on and because a lot of people know what we're working on now" (Phase 2 - graduate student)
- "Meetings have increased in importance because I've changed my field" (Phase 2 - research fellow)
- "Often what's said at meetings does not match up with what is said in the published articles" (Phase 2 - scientific officer)
- "Meetings are less importance because I have a new job" (Phase 2 - senior laboratory scientist)
- "Verbal communication is more important than content at meetings" (Phase 3 - graduate student)
- "Meetings are increasing in importance because I've been to more" (Phase 3 - research fellow)
- "I'm moving away from meetings and conferences because often what you hear is unreliable" (Phase 3 - senior laboratory scientist)

Factors influencing scientists' perceptions of the relative importance of meetings include frequency of attendance, changes in role or field, informal verbal dialogue with meeting participants and maturity/seniority in post. During Phases 2 and 3 of the project, a number of scientists mentioned that shortage of funding had restricted attendance at external conferences and meetings (see below). The effect
of attendance at less external meetings is evident in Figure 13.2.1, although this perceived decline may also relate to the fact that contract staff's period of employment at ICRF expired by the end of Phase 3.

"Being able to visit people or attend conferences is harder because there are less funds. It's got to a point here that unless people have outside travel money you cannot do that aspect of things at a reasonable level" (Phase 3 - research fellow)

5.7.4 Receipt of Reprints From Colleagues / Competitors
There was an increase in the importance of receipt of preprints from colleagues or competitors over the project period. Figure 13.1.4A shows that whereas 21.9% (41) of scientists rated it 4 and over on the five point scale in Phase 1, this had increased to 27.3% (51) in Phase 3. This growth in importance of receiving preprints is reflected in all categories of staff except the clinical scientist and graduate student categories, as shown in Figure 13.1.4B. Many graduate students, scientific officers and research fellows mentioned that they received these preprints via their head of laboratory, whilst a number of senior scientists commented that "preprint receipt hardly ever happens".

5.7.5 Unpublished Research Papers and Results
There was a substantial increase in the importance of refereeing unpublished research papers and results over the project period. Figure 13.1.5A shows that whereas 17.7% (33) of scientists rated it 4 and over on the five point scale in Phase 1, this had increased to 27.3% (51) in Phase 3. In general, refereeing of papers was restricted to laboratory and clinical scientists, but research fellows and senior scientific officers often refereed via or jointly with their laboratory head, as shown in Figure 13.1.5B. A selection of comments on refereeing are listed below.

"In different fields, different things are becoming more important. In my work on screening, cervical cancer and melanoma, I don't do any refereeing whereas with the statistical material, refereeing is becoming more important" (Phase 1 - laboratory scientist)

"I have a heavy reviewing schedule with my refereeing workload, which is very important" (Phase 2 - senior laboratory scientist)

"The importance of reviewing has increased because you get more information that way" (Phase 2 - scientific officer)

"Refereeing is becoming more important because I've had more significant papers to referee" (Phase 3 - laboratory scientist)

"I'm reviewing more relevant material" (Phase 3 - senior laboratory scientist)
A number of scientists commented that much of the material they received for reviewing was not directly relevant to their work.

5.7.6 ICRF Current Awareness Service
There was a slight decrease in the importance of the ICRF current awareness service over the project period. Figure 13.1.6A shows that whereas 51.9% (97) of scientists rated it 4 and over on the five point scale in Phase 1, this had decreased to 50.8% (95) in Phase 3. This diminution in the importance of current awareness is evident in the laboratory and clinical scientist categories, as shown by Figure 13.1.6B. Comments supporting the importance of the current awareness service to individual scientists abounded throughout the project period: “current awareness is my mainstay” (clinical research fellow), “distinctly more useful than anything else” (graduate student), “most important source” (clinical scientist), “main source” (senior laboratory scientist), and “… this is my major way of keeping on top of what’s happening” (senior laboratory scientist). Figure 13.2.1 tracks the reported perceived importance of the in-house current awareness service over the project period. By Phase 3, conflicting views of the relative importance of the current awareness service were apparent.

“Current awareness and SciSearch are dominant in everything now” (senior laboratory scientist)
“Current awareness is less important because of charging for documents” (laboratory scientist)
“Current awareness and SciSearch are less important because I’ve lost my network connection. Browsing has become more important as a result” (clinical research fellow)
“Current awareness is less important than when I was doing my PhD” (scientific officer)

Factors such as loss of network connectivity and charging for documents obviously affected scientists’ attitudes towards the in-house current awareness service. Contract staff, who have either gained their PhD or are applying for post-doctoral posts may also regard their current awareness profile as less important by Phase 3.

5.7.7 Commercial Current Awareness Services
A relatively small number of scientists 9 (4.8%) in Phase 1 decreasing to 7 (3.7%) in Phase 3 relied on commercial (rather than in-house run) current awareness services, which they rated 4 and over on the five point scale, over the project period. Sources included electronic services, such as Data-Star, Reference Update, peers abstracts bulletin (cellular differentiation area) and drug companies'
databases, on the one hand, to printed sources, such as *The Breast, ASH Bulletin, Leeds Oncology Bulletin* and (during Phase 1) British Library sectional lists, on the other.

### 5.7.8 Online Databases / Electronic Bulletin Boards

There was a substantial increase in the importance of accessing information from online databases and electronic bulletin boards over the project period. Figure 13.1.8A shows that whereas 5.9% (11) of scientists rated these facilities 4 and over on the five point scale in Phase 1, this had increased to 33% (62) in Phase 3. This growth in the importance of accessing online databases and electronic bulletin boards is reflected in all categories of staff, but is especially marked in the laboratory and clinical scientist categories, as shown in Figure 13.1.8B.

Online databases such as the in-house SciSearch Database tended to be utilised by most for one-off searches rather than for keeping up to date, although a few scientists had given up the current awareness service using the SciSearch Database interactively each week instead. Similarly, in general, the MEDLINE CD database, which had been replaced with SilverPlatter’s ERL MEDLINE service to the desktop during Phase 3, tended to be utilised for retrospective searches when going into new areas or when writing papers, especially reviews. Other online sources specifically mentioned by scientists in this context included GDB and an array of Internet sources, the latter increasingly accessed via web browsers by Phase 3. As for bulletin boards, Information Technology News and USENET news were the main ones utilised.

During Phase 1 of the project, 25.7% (48) of scientists felt that the BIDS ISI service would be potentially useful (or was useful if utilising it) by rating it 4 and over on the five point scale but by Phase 3 its actual usefulness had decreased to 12.3% (23) of the sample population, as shown in Figure 15.5.1. Moreover, the usefulness of BIDS declined over the period under review for all categories of staff except the graduate student category (as shown in Figure 15.5.2), perhaps because they had used BIDS at university and were familiar with it prior to coming to ICRF. A selection of scientists’ comments about BIDS over the project period is listed below:

"It [BIDS] would be useful because six months [of SciSearch] is frustrating at times" (Phase 1 - senior clinical scientist)
"It [BIDS] would be useful because I could do it from the lab" (Phase 1 - research fellow)  
"I've used BIDS a little. The citation searching is the bit of interest but I need more instruction on using it" (Phase 1 - senior laboratory scientist)  
"I use MEDLINE now although I used BIDS previously at university" (Phase 1 - graduate student)  
"I use SciSearch now that it goes back two years" (Phase 2 - clinical research fellow)  
"I just found BIDS intolerable to tell you the truth" (Phase 2 - senior laboratory scientist)  
"I use it [BIDS] rarely now that MEDLINE is on the network" (Phase 3 - laboratory scientist)  
"It's [BIDS's] more useful now that it's got abstracts" (Phase 3 - scientific officer).

The consistent complaint against the BIDS ISI service was that it was slow and cumbersome, the majority stating that MEDLINE sufficed for their retrospective requirements.

5.7.9 Other Sources of Information  
A small number of scientists (2 - 1.1% in Phase 1, rising to 6 - 3.2% in Phase 2 and falling to 3 - 1.6% in Phase 3) relied on other sources of information, which they rated 4 and over on the five point scale, during the course of the project. The main sources were contact with commercial companies such as CellMark and CellTech, and internal technical reports produced by collaborators.

5.8 Perceived Impact of Developments and Potential Increased Usage of Facilities  
In Phase 1 of the project, 66.9% (125) of scientists claimed that they were comfortable (rated 4 and over on the five point scale) accessing electronic information, although a number relied on colleagues for help with infrequently utilised programs and databases. By Phase 3, this figure had risen to 78.1% (146) as shown in Figure 16.1.1 and is apparent in all categories of staff as shown in Figure 16.1.2, reflecting scientists increasing use of and confidence in utilising electronic information sources. Furthermore, in Phase 1, 44.9% (84) of scientists claimed that information technology developments, such as electronic current awareness, MEDLINE CD database, use of EndNote for formatting of references for bibliographies of scientific papers, the Databases Service and the electronic requesting system for document supply, had already affected their information handling techniques positively (4 and over on the five point scale).
“It’s [current awareness service] changed completely my habits of information gathering. Three years ago I would have spent an afternoon in the Library. I now get my secretary to put everything on disc for me and I take it home to work on” (Phase 1 - senior laboratory scientist).

“... MEDLINE .... the way I do it now is completely different from the way I did it two years ago. I used to go to the Library and systematically look through all the journals. This way is more efficient” (Phase 1 - senior laboratory scientist)

“... CAS, electronic requesting ... it’s certainly impacted quantitatively. I’ve been able to access a great deal more information and that’s important ... thus I can access it quicker and much more conveniently” (Phase 1 - laboratory scientist)

“... current awareness and MEDLINE have changed my approach - I depend on both as first line resort before going to the Library” (Phase 1 - senior laboratory scientist)

“... current awareness, electronic requesting and the Databases’ Service have completely replaced the way I get hold of things” (Phase 1 - graduate student).

“If I didn’t have current awareness or access to Databases Service, then I would have to go to the Library regularly to consult the journals which I don’t do now. It has improved dramatically” (Phase 1 - clinical consultant)

“MEDLINE has had the greatest impact. I’d rather lose my car than MEDLINE!” (Phase 1 - senior laboratory scientist)

“... current awareness, CD MEDLINE and SciSearch on Databases Service... it is very difficult to manage without them now” (Phase 1 - senior scientific officer).

By Phase 3, this figure had risen to 62.6% (117 - see Figure 15.4.1) and sources included the gopher and world-wide web developments, mentioned previously, with their accompanying access to vast Internet resources. This more pervasive impact is evident in all categories of staff except the clinical scientist group, where impact was sustained (see Figure 15.4.2).

“enormous impact” (Phase 3 - graduate student)

“major impact, saves time, so much easier to search and select” (Phase 3 - graduate student)

“made life easier and extra filtering of requests with abstracts” (Phase 3 - research fellow)

“more efficient, more directed and more extensive” (Phase 3 - senior scientific officer)

“current awareness, SciSearch and e-mail have had a massive impact” (Phase 3 - laboratory scientist)

“extremely positive impact” (Phase 3 - senior laboratory scientist)

“not much impact over three years because already used Data-Star MEDLINE” (Phase 2 - senior laboratory scientist)

“... impacted in a very big way - I’m browsing less with journals and browsing with directed electronic searches more (Phase 3 - senior laboratory scientist)

“It’s totally changed the way I get my references. I wish this system had been around when I was doing my degree. It would have been a lot easier” (Phase 1 - graduate student)

“It’s definitely put me in touch with things I would never have seen otherwise” (Phase 1 - senior laboratory scientist)

“SciSearch and current awareness have had a major affect on information gathering. We’ve changed the way the laboratory deals with information - it tends to be in the laboratory and on the Mac rather than trekking around. Only five years ago, we constantly used the Bodleian and Cairns Libraries: it’s rare for anyone to use the Cairns now” (Phase 3 - senior laboratory scientist)
"It's completely changed the way I do things. I spend much less time in the Library than I did before I came here - a combination of being able to do searches through MEDLINE, not in the Library, and having current awareness, which means that I don't have to browse every single journal in the Library" (Phase 3 - senior laboratory scientist)

"It's totally revolutionised the way I work. In days gone by I used to book a session down at the Library. Now I'm rarely in the Library and the current awareness gives me portability as I download onto disc and view and select at home. There is no doubt that without you my life would be much more difficult. It's fantastic" (Phase 3 - senior laboratory scientist)

"It's made a vast difference in that information is brought to you almost rather than you having to go to it and you have access to more information electronically as there is a limit to the number of journals you can hold" (Phase 3 - senior scientific officer)

"Over these past three years I've been moving towards using the electronic form (electronic browsing) as my main source of information. I think it's a fantastic service" (Phase 3 - clinical consultant)

Among the factors mentioned for increasing their use of electronic information in Phase 1 were: increased user-friendliness of the central computer system (including a good graphical user interface for the LIS Databases Service); increased speed of performance of LIS software; more training and backup documentation for all software; the facility to access MEDLINE online via ICNet; access to other databases online such as INSPEC and Psychological Abstracts; connections to ICNet for those at units without access from their laboratories; more computers in laboratories to enable more frequent access to central system; availability of the full-text of journals online; and more information on what services were available. By Phase 3 some requests on this wish list had been fulfilled, for example, MEDLINE to the desktop via SilverPlatter's ERL software, graphical user interface for all of LIS' resources via the web software except the BASIS databases (in development with implementation of BASISWeb software), increased speed of performance of LIS software with two upgrades of the central computing hardware, connection of more sites to ICNet, more computers in many of the laboratories enabling more frequent access to the central system, and the availability of some online journals. However, by Phase 3 there were still demands for more computers in laboratories (reported examples include two machines between ten people in one laboratory and two machines between fifteen in another), more full-text journals, more information about what services are available, more training especially on the Internet resources and use of the world-wide web browsers, connections to ICNet for those units (or parts of units) still without them, restoration of ICNet links for one unit that had lost its link, and upgrading of remote login system so that scientists could access all ICRF information resources from home (this facility was introduced at the end of Phase 3 of the project).
CHAPTER 6
6. Results of the External Comparison Group Sample

6.1 Current Awareness

Over the three year period, there was a slight decrease (from 54.4% or 37 scientists in Phase 1 to 58.8% or 40 scientists in Phase 2 to 52.9% or 36 scientists in Phase 3) in the total number of scientists who were in receipt of current awareness results directly (see Figure E1.1.1). Only one scientist in the cancer group admitted receiving current awareness results indirectly (indirectly meaning one scientist seeing another scientist's current awareness output regularly every week) and this low score is not included as it is not considered statistically significant. Figure E1.1.2 shows the breakdown of current awareness recipients by sector. It indicates that over the period all groups are responsible for the decrease in direct receipt of current awareness results, the exception being the MRC group whose usage increased.

Figure E1.4.1 gives a breakdown by search profile type of those in direct receipt of current awareness. Over the three year period, the subject profile group (which included some author name searches) decreased slightly from 51.4% (19 profiles) to 50% (18 profiles), the journal contents component increased slightly from 37.8% (14 profiles) to 41.7% (15 profiles), whilst receipt of both subject and journal contents decreased slightly from 10.8% (4 profiles) to 8.3% (3 profiles).

Of those scientists receiving current awareness output directly (37 in Phase 1 and 36 in Phase 3), there was a substantial increase from 18.9% (7 scientists) to 36.1% (13 scientists) in the number receiving output in electronic form (mainly via e-mail or on disc), as shown in Figure E1.5.1. The increase in delivery by e-mail was largely confined to the MRC and cancer research groups where, in the case of the former, this mode of delivery was introduced by the Library staff utilising Current Contents on Diskette and, in the case of the latter, scientists' usage of the UnCover Reveal service to generate the contents pages of journals replaced the Library's photocopied contents pages. In this external comparison group, those receiving output both in electronic and hard copy format refers not, as in the ICRF group, to receipt of the same weekly output in both formats, but to receipt of different current awareness outputs. This mixture of current awareness outputs (examples of electronic output being in-house Current Contents searches and, of printed output, CAS subject Bulletins) was confined to members of the industrial group and receipt of this mixed output was sustained throughout the project period. By Phase 3 the number
of scientists still receiving output in print format only had decreased considerably (75.7% in Phase 1 to 55.6% in Phase 3) but still remained surprisingly high overall. This is accounted for by the large number of cancer research group staff who remained with, or returned to, photocopied contents pages when the UnCover Reveal service introduced a charge for journal contents by electronic mail.

Of those who did not receive current awareness directly during Phase 1, a number in the MRC group stated that they were unaware of the service, a few in the MRC and university groups reported their intention of taking it in the near future, a few in the cancer research and industrial groups said that they had no need to use it because of their role specifications (one was concerned with manufacturers' applications and the other supporting IT systems for research staff rather than undertaking research himself), and a number in the cancer research group had stopped contents pages because there were "too many to cope with". Alternative (or additional) methodologies to current awareness receipt included manual scanning of hard copy Current Contents, regular searching of external BIDS ISI and EMBASE Databases and regular searching of MEDLINE CD-ROM Database (despite lack of currency problem), but many relied on regular scanning of current journals in locally-held collections. This last methodology still persisted in Phase 3, although the regular searching of MEDLINE (now networked to the desktop) had grown in popularity in all groups. By Phase 3 also, the regular searching of BIDS ISI and EMBASE had increased, one member of the industrial group had started to search Dialog databases regularly, one member of the MRC group had started to use the Entrez Database, and a number of members of the MRC had started to do their own Current Contents searches rather than receive their results via the Library. Throughout the period, other publications, such as Aids Information, Current Aids List, and Notre Dame biweekly lists were utilised by some scientists in the cancer and MRC groups as a supplement to, or replacement for current awareness output, whilst a number of members of the industrial group received Chemical Abstracts hard copy Bulletins on specified subjects. As at ICRF, the manual scanning of hard copy Current Contents had been abandoned by Phase 3.

During Phase 1 of the project, electronic receipt of current awareness was confined to scientists in the industrial group and their motivation for receiving current awareness output electronically centred on the downloading into reference handling packages like Reference Manager. During Phases 2 and 3, members of the MRC and cancer research groups stated additionally that e-mail receipt was easier, more convenient or quicker.
Whatever their initial motivation, during the course of the project the majority of these scientists (84.6% - 11 out of 13) claimed that their perceived benefits of receiving their current awareness results electronically had been realised. The exceptions were two members of the cancer group who complained that the UnCover Reveal service (utilised to generate the contents pages of journals which replaced the Library's photocopied contents pages), which had initially been a free service, had subsequently introduced a charge for it.

Many scientists found it difficult to estimate the number of references received from their current awareness output, probably because so many of them received photocopied contents pages or printed bulletins. The average weekly number of photocopied articles resulting from current awareness references is shown in Figure E1.9.1. There was a considerable increase (54.1% to 75%) in those scientists who photocopied 5 papers or fewer, many in an attempt to become more selective. The provision of abstracts with current awareness output varied considerably within the component groups, but predominated from Phase 1 in the industrial group and, to a lesser extent, in the cancer research group where Data-Star output was the alerting means. By Phase 3, members of the MRC and university groups received abstracts electronically as part of their current awareness output. A number of scientists stated that current awareness in their own area was just a backup or safety net for their other means of keeping abreast of developments in their field.

Of those scientists receiving current awareness output directly, currency of data was perceived as increasingly important (4 and above on the 5 point scale - see Figure E1.14.1) by 62.2% (23) of scientists in Phase 1 to 83.3% (30) in Phase 3. Interestingly, currency increased in importance for groups from all sectors except the university group (see Figure E1.14.2), perhaps because their current awareness service was not a managed central service.

"5 - it's vital because it's the only way of really locating things that appear in remote papers, which appear in journals I don't really go through" (Phase 1 - MRC group member).

"We scientists at the sharp end get a great deal of comfort knowing that there is a safety net where Information Services would bring to our attention references which might have a major bearing on the strategic development of our projects. The alternative would be to scan the raw literature ourselves - and we just don't have enough time to do that" (Phase 1 - industrial group member).

"As far as the scientific literature is concerned - it's very important to me that my staff are as up-to-date as possible" (Phase 2 - cancer research group member).

"5 - I have to rate it 5 although that doesn't tally with what I've said about the number of follow-ups. The reason for the discrepancy is because I need the awareness. There could be a crucial paper which could alter the course of the work which we're doing."
That may happen once a year or once every 5 years but I need that awareness - I would feel almost naked without it” (Phase 2 - industrial group member).

Taking the whole sample population (68), increasing interest was expressed too (4 and above on the 5 point scale - see Figure E1.15.1) by 38.2% (26) of the sample population in Phase 1 to 67.7% (46) in Phase 3 in the availability of electronic abstracts before the appearance of the print publication (for example Springer-Verlag's Preview Service). It was the cancer research and MRC groups whose interest increased the most during this period (see Figure E1.15.2), whilst the university and industrial groups’ interest was sustained. Reasons given included awareness, competition, articles in obscure journals, filtering mechanism, useful record until full paper required, and time saved going to the Library.

“Not because of the speed but because I tend to read the abstract more than the paper just to get a feel for what is happening - then go back to paper for specific details” (Phase 1 - cancer research group member).

“It would be easy to trawl and would be effective” (Phase 1 - cancer research group member)

“To have it on your desk with abstracts too would be great” (Phase 2 - cancer research group member)

“Awareness and competition” (Phase 2 - cancer research group member)

“The top journals for most of the people here is pretty quick so I'm not sure if it would really make a difference - but for me it would make a difference because I read a number of obscure journals” (Phase 1 - MRC group member)

“No interest because of time - I have difficulty keeping up with what is already published” (Phase 1 - MRC group member)

“Awareness although the abstract might promise more than it delivers” (Phase 1 - university group member)

“Extremely useful if it were sub-structure and transformation searchable” (Phase 1 - industrial group member)

“How indexed and how easy to scan would be the key issues. It would have to be an advantage to going down to the Library and scanning the literature” (Phase 2 - industrial group member)

“Very interested - I'm in favour of delivering all information electronically provided it can deal with structural information” (Phase 2 - industrial group member)

During Phase 1 of the project, a number of methodologies were expressed for dealing with the hypothetical demise of the various current awareness services. These included regular searches of the BIDS ISI Database and MEDLINE Database on CD, utilising Current Contents on Diskette oneself, increased scanning of current journals, photocopying contents pages of journals oneself, and relying on other indexing and abstracting services (such as printed Current Contents, Notre Dame listings, Aids Information and Current Aids List). By Phase 3, the networking of MEDLINE to the desktop had grown in popularity in all groups, BIDS had increased in importance for scientists in the cancer and
MRC groups and *Current Contents* on Diskette was relied on by scientists in the MRC and university groups. The absence of the service would reportedly still affect the progress of many scientists' research in increased time spent on literature searching, potential missing of relevant references (especially in those journals not held locally) and in general be detrimental to up-to-dateness.

### 6.2 Personal/Local Holdings, Core Journals and Browsing

The reliance of scientists on personal or laboratory holdings differed depending on the organisation from which they came. The purchase of laboratory-held journals in the "cancer research" group was centralised in the Library and their location advertised in the Library catalogue for the benefit of all. One part of the industrial group changed systems over the project period from circulated journals to departmental subscriptions to core journals (as evidenced below).

"I have 1 or 2 journals circulated to me via the company - but that's just about to change. Within the division, we've just had approval to change the system whereby departments will subscribe to those journals that they consider to be core to their business. So, as a department, we shall shortly be receiving 15 or 20 journals and, hopefully, that will mean that I'll actually get to see them - because currently my reading of journals (even those closely related to my work) is pretty poor because the only place you get them on the whole is the Library". (Phase 1 - industrial group member).

The university group had a departmental Library, which held a selection of core journals, whereas the MRC group regarded the IMM and Cairns as their main libraries (and they are treated as such in this project).

Throughout the project the number of core journals identified by scientists ranged from 1 to 22, although most cited 6-10 titles as core to their research area (see Figure E3.1.1). Those who cited more than 15 journals as core were predominantly senior laboratory or clinical scientists in the cancer research, MRC, university and industrial groups. A small number of scientists were unable to state a number of core journals because of frequently changing research areas and hence changing related journal titles. Moreover, over 47% of scientists (47.1% in Phase 1 and 51.5% by Phase 3 - see Figure E3.2.1) stated that they were referees for some (in a few cases all) of their specified core journals. This increase in refereeing is most evident in the MRC group where clinical research fellow and research fellow categories of staff, as they become more senior, referee articles often indirectly on behalf of their head of laboratory or group.
The majority of scientists acknowledged that the amount of time spent browsing or scanning current journals varied considerably from week to week, but estimates (from 50 scientists in Phase 1 to 49 scientists in Phase 3) ranged from half an hour to five hours a week (see Figure E4.1.1). A number of scientists stated that they no longer had time to scan printed journals, relying instead on scanning contents pages or subject searches delivered electronically or via printed output as current awareness results, or on photocopied contents pages from locally-held journals. Whilst many scientists browsed daily, some conducted their browsing in batches at the weekend or a number of times per month; others confined their browsing to laboratory held journals or relied on their post-doctorate “bosses” (in the case of some scientific officers).

Browsing tended to focus on specific journals, core journals and review journals, although very few would estimate the number of citations scanned commonly per week. Over the project period there was a general perception that browsing activity was decreasing but this perception is not borne out by the figures illustrated in Figure E4.1.1 which indicate that, over the period, the majority of scientists spent between one and two hours browsing per week.

Many scientists had difficulty in specifying the number of journal articles photocopied as a result of browsing. In general, those who received current awareness output found it difficult to differentiate between articles copied as a result of being alerted by current awareness and those copied as a result of browsing. A number of scientists stated that they had copied articles via browsing before they were subsequently alerted to them by current awareness output, whilst others confined their copying from browsing to broader interest or methodological and technique articles, peripheral subject areas or mini-reviews not covered by current awareness profile. During the course of the project, over 48% of scientists (48.5% in Phase 1, 55.9% in Phase 2 and 61.8% in Phase 3) copied fewer than five articles per week (see Figure E4.3.1), an increasing number by Phase 3 copying just the front page of the article containing the abstract (the full article to be copied later if necessary).

There was a decrease (51.5% in Phase 1 to 45.6% in Phase 3) over the project period in the number of scientists who rated the browsing activity highly (4 and above on the 5 point scale - see Figure E4.4.1). Figure E4.4.2 indicates that this decline in the importance of browsing is confined to the MRC and university groups. Those that did not rate browsing highly tended to rely on current awareness or MEDLINE or lacked the time to browse as illustrated by the following comments:
"I rarely have time to do it [browsing]" (Phase 3 - university group member) 
"... I would give browsing a 2 for practical benefit to work, but higher for general awareness" (Phase 3 - university group member) 
"... [browsing] is less important because of online abstracts" (Phase 3 - cancer research group member) 
"I can't give it [browsing] a 5 because I'm not doing it and I seem to be able to manage - but I do think it's important and I'm missing not finding the time to do it" (Phase 1 - industrial group member). 
"... really it [browsing] should be a 5 but in terms of how often I do it, it's a 2" (Phase 1 - MRC group member) 
"... [browsing] is becoming less important because computer searching is becoming more proficient" (Phase 3 - MRC group member) 
"... "I'm relying on MEDLINE searching" (Phase 3 - MRC group member) 
"... browsing electronically is more effective" (Phase 3 - industrial group member). 

A few scientific officers in the cancer research group stated that they "did not need to [browse] to do their job".

The time spent by scientists reading the literature each week varied, as one might predict. Figure E4.5.1 summarises responses and indicates that, over the project period, a growing number (between 59% and 71%) of the composite external comparison group spent less than 4 hours reading the literature each week. A number of scientists reported that "not enough" time was devoted to reading or maintained that they spent "more when writing". One member of the industrial group explained "... again, lack of time - although I do try to keep up with what's going on, it's really quite difficult". Writing of theses also resulted in more time being dedicated to reading the literature.

6.3 Document Supply and Request Modes

The source of photocopied articles was usually the organisation's main library collection, 77.9% of scientists in Phase 1 to 79.4% in Phase 3 obtaining articles themselves or via their staff (see Figure E5.1.1), with local departmental or laboratory collections providing a supplementary source mainly for staff in the university and industrial groups, with sustained usage (14.7%) throughout the project period. Figure E5.2.1 shows scientists' usage of their LIS' document supply service personally or via their staff over the period and the decrease in personal requests from 82.4% in Phase 1 to 77.9% in Phase 3 is reportedly due, in the main, to the increasing use of abstracts and to scientists intentionally becoming more selective.

Despite this variation in the number of scientists utilising their LIS document supply system (60 in Phase 1, 55 in Phase 2 and 57 in Phase 3), Figure E5.3.1 shows an increase
in electronic requesting over the period: 5% of scientists requested electronically (via the Inter-Library Loan Requests Databases or via e-mail) in Phase 1, 10.9% in Phase 2 rising to 36.8% in Phase 3. In Phase 1 electronic requesting was dominated by scientists from the industrial group, but during Phases 2 and 3, members of the cancer research group increasingly utilised this mode of requesting. Throughout the project, speed, ease and convenience were the reasons given by scientists for requesting electronically. Figure E5.5.1 shows a decrease in the perceived benefits arising from electronic requesting, falling from 75% of scientists in Phase 1 to 59.1% in Phase 3.

Overall (i.e. taking entire sample population), 41.2% in Phase 1 claimed that the rate of acquisition (whether through personal photocopying or via their LIS' document supply service) of photocopied articles over the previous twelve months had increased (see Figure E5.6.1) due to expanding or changing subject areas, divergence of personal or laboratory interests or changes in project direction, increase in number of relevant, specialist or derivative journals published, the collecting for teaching as well as research, collaborations outside main subject areas, the writing of big reviews, systematic reviews and grant applications, preparation for site visits, and the writing of PhD theses.

"... increased. We're involved in broader fields of research and the programme is expanding" (Phase 1 - cancer research group).
"There is the general feeling that there are an increasing number of journals but you can only cope with a certain number so you tend to be more and more specific for what you are going for all the time - you just get swamped otherwise" (Phase 1 - cancer research group member).
"... increased because haemopoesis is becoming a wider and broader area, an expanding field" (Phase 2 - cancer research group member).
"... my field (molecular haematology) is increasing, my interests are increasing because I'm involved in related projects and people are under pressure to publish, so there are a lot of journals now" (Phase 1 - MRC group member)
"... increasing varied interests and the amount of literature is increasing" (Phase 2 - MRC group member)
"... my suspicion is that there are more things published - there are more relevant journals, there are more derivative journals (e.g. opinions journals, which are quite useful) ... the advantages and disadvantages are there. If the rate of research, which in this department is reasonably fast, is such that one can find oneself in a position whereby you had to become an expert in something overnight and read up in more detail - to see an article whereby there are about 40 references which have been graded by somebody else who is an expert in the field, who immediately gets you into the area and know what people think and where all the good papers are - it's very important actually. In that regard there has definitely been a real increase in the number of these derivative journals, but also relevant journals have increased in the last 12 months". (Phase 1 - university group member)
"... increased. The scope and size of the literature is increasing plus, for personal convenience, copy of references to read at home" (Phase 1 - university group member)
"... increased - it's nearly doubled - mainly because the area of research that I'm interested in has taken off. I probably wouldn't request so many papers if I had access to the abstracts of Current Contents online - at present the Current Contents searches that come through don't have abstracts" (Phase 2 - industrial group member).
".. increased slightly because of collaboration outside the main cancer research area" (Phase 3 - cancer research group member)
"... increased because of site visit" (Phase 3 - cancer research group member)
"... increased because more projects and more systematic reviews" (Phase 3 - cancer research group member)
"increased because of a big review" (Phase 3 - MRC group member)
"increased because writing more papers and grant applications" (Phase 3 - MRC group member)
"more people are publishing so there are more papers" (Phase 3 - university group member)
".. increased because more relevant papers in my field (cell biology)" (Phase 3 - industrial group member)
".. increased - directly associated with my new product responsibility" (Phase 3 - industrial group member)

During Phases 2 and 3, there was a decrease to 32.4% in increased rate of acquisition, which was complemented by the steady percentage rise (5.9% in Phase 1, 11.8% in Phase 2 to 14.7% in Phase 3) of those scientists who reported that their acquisition rate of photocopied articles had declined, mainly because of their increasing use of abstracts.

"decreased because of abstracts" (Phase 3 - cancer research group member)
"decreased because of change in my role" (Phase 3 - industrial group member)

The rest reported that their acquisition rate of photocopied articles had remained constant: reasons given included intentionally becoming more selective, easier access to MEDLINE and Internet resources, becoming more selective because of pressure of time, levelling off after effects of provision of abstracts, and retaining the abstract of the article for possible future reference rather than acquiring article now.

"... in my field, there are more journals and a greater number of publications because more and more people than ever are working in the human genetics field. The number that I keep, however, is pretty constant so the quality hasn’t improved. I have a pile of arts which if I haven’t read in about 6-7 months, unless they are key arts for my field, I put them in the bin. It’s a sort of selection system" (Phase 1 - MRC group member).

6.4 Use of Reference Handling Packages

Reference handling packages were in use by 30.9% (21) of scientists in Phase 1 of the project, this figure rising to 47.1% (32) by Phase 3 (see Figure E6.1.1). There was a corresponding decrease in the number of scientists intending to utilise one within the following twelve months - from 13.2% (9) in Phase 1 to 8.8% (6) in Phase 3. A variety of reference handling packages was in use in Phase 1 of the project: EndNote, SciMate and
Get-A-Ref in the cancer research group; EndNote and Reference Manager in the MRC group; EndNote in the university group; and Reference Manager and ProCite in the industrial group. EndNote tended to be popular where Apple Mac computers predominated, mainly in the MRC and university groups. One scientist from the MRC group explained his transition as shown below:

"... card index fell by the wayside. I had card index with subjects and abstracts photocopied on the back of the cards - but I found that was time-consuming - so I'm using EndNote now and cross-referencing them by keywords - using it for about a month. So I'm in the process of cataloguing previously read papers" (Phase 2 - MRC group member).

By Phase 3, Paradox and Papyrus were also in use by scientists in the cancer research group, Papyrus being the selected reference handling package made available to the academic community as one of the CHEST deals. Just over 10% (7) of scientists maintained a reference file in another form throughout the project period. These were either flat files kept on their Macs or PCs or traditional card files. The majority of scientists reportedly kept their photocopied articles filed by subject or in topic files. The difficulty of filing by first author was explained by one MRC laboratory scientist in that "the last author may be that most familiar to you if a paper is written by one of their students for example". Only a few scientists utilised their retrieval system (whether electronic or manual) to identify publications by a classification or running serial number. One MRC scientist reported over the period that he had tried EndNote and had given it up "because it had proved to be quite difficult". A few scientists from the industrial group bemoaned the fact that structural data was not available electronically. One kept a graphical record, cut out from the printed *Current Chemical Reactions*, in a notebook whilst another observed "if it (i.e. structural data) was available electronically, I'd collect it electronically".

Of the 7 scientists receiving current awareness output in electronic form in Phase 1, 57.1% (4) downloaded their results into their reference handling database, and they all claimed to store abstracts as well as citations (see Figure 6.2.1). By Phase 3, there was only a slight decrease to 5 (of the 13 receiving electronic output) in the number of scientists downloading current awareness output (due to the availability of online abstracts from MEDLINE and SciSearch, and the preference of a number of scientists not to add references to their databases until they had read the full-text of the publications referred to), and there was a slight increase to 5 in the number storing abstracts in their reference handling database. Downloading of current awareness output received in electronic form
was confined throughout the project period to members of the industrial group, although one member of the MRC group was included by Phase 3. It should be noted that, in addition, a few scientists from the MRC and university groups downloaded references into their reference handling packages from regular searching themselves of *Current Contents* on Diskette.

Figure E6.4.1 shows the increase from 18 (of 21 in Phase 1 - 85.7%) to 25 (of 32 in Phase 3 - 78%) scientists who loaded data from other sources into their reference handling packages over the project period. Downloading from MEDLINE (initially via CD and later online via networking software), keying in and copying data from colleagues' databases were the main methods of loading data into reference handling databases, although BIDS, *Current Contents* on Diskette and Dialog were other sources mentioned. During Phase 1, the size of the reference handling databases ranged from fewer than 50 references for personal databases to over 8,000 references for laboratory databases. During Phases 2 and 3 some scientists maintained a series of subject databases plus a database of references for every published paper. Maintenance of databases varied between Head of Laboratory, laboratory secretary, joint maintenance by a few laboratory staff members, or student helpers. One industrial group member, who had personal access to Dialog by Phase 3 commented as follows:

"... still using Reference Manager but not as much as before. I tend to keep my Dialog searches on discs because specific rather than updates. My Reference Manager database tends to be used for company documents now" (Phase 3 - industrial group member).

Of the 21 scientists in Phase 1, 25 in Phase 2 and 32 in Phase 3 who utilised reference handling packages personally or via their staff, a decreasing number of them (81%, 72% and 65.7%, respectively - see Figure E6.7.1), were using the package in conjunction with a word processing package (either Microsoft Word or Word Perfect) to produce bibliographies at the end of papers for submission to journals, or for book or thesis production. Taking the whole (68) sample population, throughout the project period at least 50% (54.4% in Phase 1, 55.9% in Phase 2, and 50% in Phase 3) keyed in references or cut and pasted references from previous papers to produce bibliographies for their published papers. Throughout the period also, 7 (10.3%) wrote their papers longhand or dictated their papers for their secretaries to wordprocess subsequently. A few scientific officers in the cancer research group mentioned that they submitted figures rather than text to papers or produced internal reports or made presentations requiring no cited references, whilst a number of scientists in the industrial group emphasised that they published rarely.
Figure E6.8.1 shows the reported publishing patterns of the sample population over the project period. Some scientists were unable to estimate a figure for their papers, but of those who responded (51 in Phase 1, 57 in Phase 2 and 56 in Phase 3), the majority published fewer than 10 papers per year, the largest proportion (48.5%) by Phase 3 publishing 5 or less papers per year. Those who published more than 10 papers per year were senior laboratory and clinical scientists. Throughout the project period, scientists’ main motivation for utilising a reference handling package was for formatting references rather than as a database but by Phase 3 over 20% (21.9%) used their reference handling package for both purposes, 76.2% in Phase 1 to 87.5% in Phase 3 (of those utilising a reference handling package) stating that their perceived benefits of utilising the package had been realised (see Figure E6.10.1) Reasons cited for partial realisation of benefits were “lack of duplicate checking” (cancer research group member), “slow processing” (cancer research group member) and problems of handling large numbers of references and difficulties in data transfer. “I was told transfer from SciMate to ProCite would be easy but it wasn’t .... it rearranged the order of the elements” (industrial group member).

6.5 CD/In-House/Remote Database Usage
CD databases were utilised decreasingly over the project duration from 80.9% (55) of scientists (73.5% personally and 7.4% via their staff) in Phase 1 to 77.9% (53 - 70.6% personally and 7.4% via their staff) in Phase 3, as shown in Figure E7.1.1. The main CD database in use was MEDLINE, but other CD databases such as Bookbank, ToxLine, Cancer CD, Sigma Aldrich Data Sheets, Hazardous Chemicals Database and Handbook of Injectable Drugs were utilised also. During the period (see Figure E7.1.2), a number of scientists in the cancer research and MRC groups had abandoned the MEDLINE CD facility for the BIDS ISI or EMBASE databases. A few scientists in the university and industrial groups complained about the coverage of MEDLINE, whilst one scientist in the industrial group had started using Dialog databases instead. By Phase 3, online MEDLINE to the desktop (rather than stand alone) was the norm in all sectors. The availability of CD-ROM drives in laboratories and departments increased over the period from 23.5% in Phase 1 to 30.9% in Phase 3, as shown by Figure E7.3.1. This increase is evident in all sectors (see Figure E7.3.2). Much of this increase is accounted for by the fact that CD-ROM drives became standard on the delivery of new machines, rather than an increase in the range of CD databases/databanks available. Some held operating system software; databases included Sigma Aldrich’s catalogues, Current Protocols in Molecular
Biology, the full-text of the *Journal of Biological Chemistry* and the *Journal of Bacteriology*. Erasible optical discs were in use in a few laboratories for image analysis and the storage of software and laboratory data.

The resources held on the main computing facility of each institution whose staff comprised the external comparison group varied, and this obviously dictated usage within groups. During Phase 1 of the project, the cancer research group had centralised access to word processing facilities (the same software as on their PCs), graphics packages (e.g. UniGraph and Uniras), statistics packages (e.g. Minitab) and relational database facilities (e.g. Ingress running toxicity and microplasma databases); the MRC group had access to the University of Oxford's Vaxs for library databases and molecular biology programs and databanks; a few of the university group had access to their library's catalogue; and many of the industrial group had access (either on Vaxs or IBM mainframes) to library databases (e.g. library catalogues or ReportLine), statistics packages (e.g. SAS or RS1), *Current Contents* (on Diskette or on leased tapes), published information databases leased for in-house use (e.g. SCRIP, REACCS and MACCS chemical structure databases), plus in-house databases of literature on their products (e.g. CBBio - all the company's products, Cebis Database - collection of company's chemical entities registered and used as compounds). Two members of the cancer research group and two members of the university group complained that they had no access yet to their central facilities because of lack of network links. By Phase 3 of the project, facilities had improved (library catalogue available via gopher or web for all groups), programs had been upgraded or replaced (RS1 being used less because of the increase in usage of Excel at the desktop and ISISBase taking over from CBBio in the case of the industrial group), and network links were still a problem for only one member of the cancer research group (because of lack of funds). This clinical scientist commented that because of the on-going saga of connection, the number of PCs in his unit had increased from two at the start of the project to ten by the end of the project.

The remarkable rise from 39.7% (27) in Phase 1 to 60.3% (41) in Phase 3 in end-user searching of remote databases/databanks and the demise from 25% (17) in Phase 1 to 13.2% (9) in Phase 3 of mediated searching via LIS staff is shown in Figure E9.3.1. This decline in mediated searching was mainly confined to the cancer research and industrial groups where mediated searching via LIS staff had been an established practice (see Figure E9.3.2). The increase in end-user searching is reflected in all sectors (see Figure E9.3.3).
Remote databases/databanks accessed by scientists themselves in Phase 1 included databanks such as GDB, EMBL, HGMP and OMIM at Harrow, Sequenet at Daresbury, GenBank, and Chemical Abstracts Online, and databases such as BIDS ISI, BIDS EMBASE, ATCC catalogues on MSDN (STN system), Compuserve, NISS resources and UK university catalogues. This range expanded during Phases 2 and 3 to include the Genome Resource Centre at the Sanger Centre, Genethon Database, Yeast Genome Project at Stanford, Lancaster, NCBI, Entrez, Dialog, UnCover and SciFinder among others. Access to many of these resources was via gopher during Phase 2 and via web browsers during Phase 3.

6.6 Network Usage and Electronic Journals

As previously mentioned, throughout the project, usage of networks was measured by the use scientists made of electronic mail facilities, electronic bulletin boards and remote login and file transfer facilities. Figure E10.1.1 shows scientists’ increased usage of electronic mail from 45.6% (31) in Phase 1 to 88.2% (60) in Phase 3. Figure E10.1.2 shows the breakdown by sector, significant increases in usage being evident amongst all groups except the industrial group where usage was at a high level from Phase 1, although not without its problems as evidenced below. Reasons given for scientists’ growing use of electronic mail over the project period included: increasing number of collaborations and co-authoring of papers; growing use of molecular biology electronic mail servers, including transfer of sequences; involvement with Yeast Genome Project (MRC group); subscription by individual scientists to more mailing lists; correspondence with personal friends and ex-colleagues at universities and institutes worldwide and publishing contacts; the heightened awareness and usage of electronic mail by the university and research communities generally; symposium organisation; searching and downloading from BIDS and UnCover (cancer research group); more user-friendly electronic mail programs such as Eudora for the Apple Mac computer and CC mail; and more links internationally within and outside the company, sharing of electronic company reports and protocols, changing roles, and merger activities (industrial group).

"... I don't have a network link but I would like to have one. I use fax a lot at the moment and I suspect that e-mail would replace a lot of that - and it's cheaper" (Phase 1 - university group member)

"... I have now started to use electronic mail with the Pegasus program. I'm only using it internally at the moment - we're hoping to do away with internal memoranda altogether" (Phase 2 - same university group member)

"I have not used e-mail here, although I used it previously in Edinburgh. I don't anticipate using it here. Most of the people I know are not only sitting next to me
but also there’s nobody in the group that knows how to use e-mail” (Phase 1 - MRC group member)
“... increased - easier and cheaper than contacting people by phone” (Phase 3 - MRC group member)
“... I use e-mail occasionally for transferring sequences in collaborations” (Phase 3 - as above)
“... increased - mainly collaborations and publisher contacts” (Phase 3 - university group member)
“... increased because more institutes on e-mail now” (Phase 3 - cancer research group member)
“... increased because transferring sequence files internationally” (Phase 3 - cancer research group member)
“... increased with BIDS and UnCover” (Phase 3 - cancer research group member)
“... using CC mail and PROFS for e-mail, CC mail for the larger documents. I communicate with France but they don’t have CC mail, so you have to send a disc or a fax which can be a bit irritating” (Phase 3 - industrial group member)
“I’m still using PROFS for e-mail. We’ll be moving to CC mail next week. The advantages are that you can send more documents via CC mail than PROFS and CC mail is compatible with Word” (Phase 3 - industrial group member)
“I’ve started to use CC mail this past year and it’s now a major means of communication. In the last few months I’ve also had a connection to the Internet. I have only sent a few messages but it takes a long time and I can’t send attached files at present. Another problem is that you don’t know if the person has received and read the message when it’s sent outside. Internally (with the advent of CC mail) you have the option to send back a message to say that the message has been received and opened up” (Phase 3 - industrial group member)
“Aspen has gone but I don’t think we’ll get CC mail for a while - not until after the restructure. Our department has about 6 people out of 80 that have a CC mail connection. It is very difficult because the area I work in has a lot of technical data, graphical data etc - all you want to do with it is to send the file off to colleagues in the States and to say to do with it what you will. At the moment the only option, apart from finding a colleague with a CC mail connection, is to send them a crossnote to say that the information is in the post - and then of course they have a hard copy which they can’t manipulate” (Phase 3 - industrial group member)
“... increased vastly with CC mail because the PROFS system was so poor - but I can’t send attachments outside the company, only text messages” (Phase 3 - industrial group member)
“... increased, especially incoming, which will accelerate with the merger” (Phase 3 - industrial group member)
“... increased - it’s a general increase in use of the system and my changing role” (Phase 3 - industrial group member)

Figure E10.2.1 illustrates that this increased electronic mail activity of the composite external comparison group occurred within institutions, nationally within the UK and internationally over the project period. This reflected the reported growth in national and international collaborations, increasing use of molecular biology electronic mail servers and expanding professional and personal correspondence. During Phase 1, one member of the industrial group complained of the receipt of a large amount of junk mail, but was able
to report by Phase 2 that junk mail had declined "as a result of a few high-level warnings about sending indiscriminately to large numbers of people which has had some effect". Figure E10.2.2 shows scientists' frequency of use of electronic mail over the project period. Besides an upward trend in messages sent and received daily, weekly, monthly and occasionally, it is difficult to infer more from the data. Figure E10.3.1 records scientists' perceptions of their electronic mail activity. By Phase 3, over 70% of those utilising electronic mail claimed that their usage of electronic mail was growing, but continued monitoring will be necessary for more detailed comments to be made about possible established trends. The few who reported a decrease in their usage of electronic mail stated that "collaborations had finished" (MRC group member) or that "usage had decreased personally because of a change of role" (university group member).

There was a rise also in usage of electronic list servers and bulletin boards from 19.1% (13) in Phase 1 to 36.8% (25) in Phase 3 (see Figure E11.1.1). Figure E11.1.2 shows a breakdown by sector: remote bulletin boards (such as Bionet for Methods & Reagents Newsgroup, NISS, Hensa, Compuserve, hardware and software suppliers etc.) were accessed by the cancer research, MRC and to a much lesser extent (partly due to lack of network facilities) by the university groups whilst the industrial group from Phase 1 had a strong internal bulletin board system, as did the MRC group from Phase 2 onwards. In the case of the industrial group, the internal bulletin boards contained a variety of information such as company notices, corporate headlines, training and personnel issues, IT information, the share price, SCRIP (see below) and by Phase 3 merger details, whilst the MRC's local systems concentrated on current events, seminars, laboratory meeting details, molecular biology news etc.

"... increasingly SCRIP is picking up things that the scientific literature doesn't, things of a corporate nature that ultimately will affect what we do and how well we do it" (Phase 2 - industrial group member)

A few scientists mentioned their use for personal interests or hobbies (for example, rugby, music and Celtic culture). Figure E11.2.1 shows scientists' frequency of use of bulletin boards whether by direct access or receipt of messages over the project period. There was a general upward trend in the number of daily, weekly, monthly and occasional accesses or receipts. Although an increasing percentage of scientists claimed that their usage of electronic list servers and bulletin boards was increasing over the period, by Phase 3, 48% of scientists using these facilities stated that their usage had remained constant. An increasing percentage of scientists (16% by Phase 3) stated that their usage of these
facilities had decreased over the project period, reasons given included lack of time, sophistication of the system, too many messages, duplication or irrelevant material, decline in the novelty value and the increased use of web systems, as evidenced below:

"lack of time - not because not interesting or not useful" (Phase 1 - industrial group member)
"... part of PROFS. The problem with PROFS is that it doesn’t alert you. Another problem with PROFS is that it is not via a Windows-based system" (Phase 1 - industrial group member)
".. I subscribed to the Word Perfect for Windows one, but eventually I was receiving 20-50 messages per day - so I cancelled because it was too much (Phase 2 - cancer research group member)
".. I’ve been told the Yeast Bulletin Board wasn’t worth it - because mostly the same questions come up over and over again - so it’s not helpful" (Phase 3 - MRC group member)
"... bulletin board usage has tailed off because the novelty value has gone. My use of MacWeb has increased over last 12 months" (Phase 3 - MRC group member).

Continuing monitoring of scientists’ activities will be necessary to establish whether trends become discernible because, more than electronic mail, there appears to be a great deal of intermittent rather than regular use of electronic list server and bulletin board systems, as illustrated below:

"... using bulletin boards more than last year but not regularly. I still access the molecular biology and reagents ones but sometimes more specialised ones, for example the Biomathematics one (Phase 3 - MRC group member).

During the course of the project, scientists’ use of remote login remained fairly constant at 23.5% (16) in Phases 1 and 3 whereas scientists’ use of remote file transfer rose significantly from 22.1% (15) in Phase 1 to 33.8% (23) in Phase 3 (see Figure E12.1.1). Figures E12.1.2 and E12.1.3 show a breakdown by sector of remote login and file transfer activities. The cancer research, MRC and university groups increasingly access resources at Daresbury, EMBL, GenBank, Seff (Paris), Lancaster, HENSA, Compuserve, BIDS, the Yeast Genome Project, and HGMP and GDB (first at Harrow and then at Hinxton Hall, Cambridge). The industrial group do not, generally, have access to remote login facilities. Much of the file transfer activity of the cancer research, MRC and university groups was the downloading of data of the sequence and software variety from the sites already mentioned. Initially the file transfer protocol was used but from Phase 2 gopher and e-mail were increasingly being utilised as was the world-wide web protocol (firstly Mosaic and then the Netscape browser) by Phase 3. Increasingly from Phase 2 also, manuscripts were being exchanged by authors in collaborative projects, e-mail securing the bulk of this text traffic by Phase 3 as an increasing number of word processing packages offered the file attachment facility. The following quotes illustrate these developments:
"I used to access PDSoft with ftp. With ftp you need to know exactly where you’re going, whereas with gopher you get choices" (Phase 2 - cancer research group member)

"One isn’t ftping documents any longer because they are on the web" (Phase 3 - MRC group member)

"I remote ftp via Netscape now and I send collaborative manuscripts via e-mail. I only ftp for software updates occasionally" (Phase 3 - MRC group member)

"I send collaborative drafts of papers via e-mail. There are still problems with different e-mail systems and maintaining formats of documents but it will get easier" (Phase 3 - university group member).

Figure E12.6.1 shows that although scientists’ perceived usage of remote login and remote file transfer actually increased over the project period, a growing number of them perceived a decrease in those activities. This is exemplified by a graduate student from the MRC group who stated in Phase 2 that “I envisage that ftp activity will stay the same but that gopher activity will increase” but by Phase 3 he found that “ftp and gopher activity have decreased - web clients have taken over”. Although the industrial group were not generally active in remote login activity, there was increased file transfer and communication within the companies on an international basis from Phase 1, as shown by the following comments:

“Now I’m networked, I can transfer a word processed file to a shared local area for my secretary to work on the formatting. Via the documentation group, we transfer all submission documentation to the US” (Phase 1 - industrial group member)

“File transfer is increasing. We have tried to be a bit more international in the way we do things. We’ve been through a standardisation process which has worked to a certain extent, so there’s a lot more communication now between the different sites and documents being passed around for comment” (Phase 2 - same industrial group member)

“File transferring activities have increased enormously” (Phase 3 - another industrial group member).

An impressive 86.8% (59) of scientists stated that they would utilise the full-text of published journals in electronic form (including graphics) in Phase 1 and 66.1% (39) would use the electronic form as a replacement for the hard copy journal. By Phase 3, interest had grown to 97.1% (66) (see Figure E14.1.1), this interest being registered by scientists in all sectors (see Figure E14.1.2), with 66.7% (44) stating that they would use the electronic form as a replacement for the hard copy journal. The main qualification to this was that the graphics quality was acceptable, preferably with colour, with ease of use, ease of printing, comprehensiveness and reasonable cost being the other main criteria, as illustrated below:

“Yes - but depends on availability and easy access. Copying from the Cairns is a pain and most of the back issues I need are in the Bodleian and are even more of a hassle to acquire” (Phase 1 - MRC group member)
"Yes - but it would have to be quick and have a graphics capability" (Phase 1 - industrial group member)

"I would use it, but I would print it off" (Phase 3 - industrial group member)

"It’s becoming easier to work at the desktop with more powerful desktop machines" (Phase 3 - industrial group member)

"Yes - depending on cost" (Phase 3 - cancer research group member)

"Yes - if complete" (Phase 3 - cancer research group member)

"Yes - anything that would save me having to go down to the Library" (Phase 3 - university group member)

"It would be wonderful. I’d use it as a replacement because you would always know it was there. The disadvantage with printed journals is that they get dog-eared (with use) and they get pinched" (Phase 3 - university group member)

"Yes - I find it very difficult to get engrossed reading off a screen but very good for quick reading" (Phase 3 - university group member)

"If I could print out from the electronic version, I would imagine that I would end up using that in preference to going down to the Library and taking photocopies" (Phase 3 - MRC group member)

"Yes - I’d use it as a replacement. You can look at it whilst you’ve got an experiment running, whereas if you have to go to the Library you have to take a break in order to go down" (Phase 3 - MRC group member).

Interestingly, support for the extension of the electronic version to the back years of journals decreased slightly from 96.6% (57 of 59) in Phase 1 to 93.9% (62 of 66) in Phase 3. Even amongst the supporters of back years, opinions were divided: "not so important" (cancer research group members), "excellent" (cancer research group member), "greatest use" (cancer research group member), "would be tremendous" (university group member), "in some ways more important partly for storage and partly for missing issues" (MRC group member), "not high priority" (industrial group member), "not so crucial" (industrial group member), and "vast majority of information is from previous literature" (industrial group member). In Phase 1, only 7.4% were aware of the *Online Journal of Current Clinical Trials*, the first refereed electronic journal of interest to an even smaller proportion of scientists than those at ICRF. By Phase 3, the journal had not prospered, as reported earlier.

### 6.7 Other Information Gathering / Communication Activities

A number of other information gathering activities were monitored during the course of the project and their importance rated by scientists on the five point scale, as reported below.

#### 6.7.1 Verbal Communication

Figure E13.1.1A shows that verbal communication (face to face or via telephone) was rated highly (4 and over on the five point scale) by scientists throughout the project’s duration - 80.9% in Phase 1 to 88.2% in Phase 3. Figure E13.1.1B
shows the breakdown by sector, the cancer and university groups demonstrating sustained growth in the importance of verbal dialogue.

6.7.2 Written Communication

There was a substantial increase in the importance of written communication (including e-mail and fax) over the project period. Figure E13.1.2A shows that whereas 48.5% (33) of scientists rated it 4 and over on the five point scale in Phase 1, this had increased to 54.4% (37) in Phase 3. This growth in importance of written communication, particularly via electronic mail and fax, was reported by groups from all sectors, but is most evident in the cancer research and university groups, as shown in Figure E13.1.2B. Over the period under review, scientists from all sectors stressed the importance of written communication, especially in relation to collaborations. Scientists tended to concentrate on their fax usage (as shown below) as they had already spoken at length about their use of electronic mail (see section 6.6).

"Yes, fax has increased for grant applications and for corresponding with journals" (Phase 1 - cancer research group member)
"Fax is increasing for general scientific correspondence" (Phase 1 - MRC group member)
"Yes, fax is increasing enormously, especially replacing short telephone calls (Phase 1 - university group member)
"My use of fax has increased vastly - it's now an essential part of life" (Phase 1 - industrial group member)
"Fax is increasing as we are engaged in more collaborative and parallel experiments" (Phase 2 - cancer research group member)
"Yes, fax is increasing for grant applications and for refereeing" (Phase 2 - cancer research group member)
"Fax is increasing in collaborations and for requests for cell lines and for acknowledgements when received" (Phase 2 - MRC group member)
"My use of fax is increasing because of collaborations, organising meetings and enquiries to companies" (Phase 2 - MRC group member)
"Fax is increasing to communicate with two collaborative groups in Europe" (Phase 2 - university group member)
"Yes, my use of fax has increased partly because there is much more of a requirement to get rapid signatures and agreement for a log of the work we are doing and, secondly, because of that we have a fax machine in the department (and if it's available you tend to use it for other things as well)" (Phase 2 - industrial group member)
"Fax usage has increased because I want to get a document with diagrams and signatures etc there quickly and, ironically, e-mail inter-company isn't as reliable as intra-company" (Phase 2 - industrial group member)
"Yes, my use of fax has doubled, mainly because of collaborations" (Phase 3 - cancer research group member)
"Yes, fax usage has increased because of refereeing for journals" (Phase 3 - cancer research group member)
"Yes, fax has increased because I can now fax from my computer" (Phase 3 - MRC group member)
"Fax usage has increased because of collaborations and the Yeast Genome Project" (Phase 3 - MRC group member)
"Yes, fax usage has increased because I now have a fax card in my computer and there have been more requests for toxin information" (Phase 3 - university group member)
"My fax usage has increased because I am moving into a different area" (Phase 3 - industrial group member)

Besides collaborations, co-authoring of papers and joint grant applications, editorial or committee correspondence, obtaining data from or sending information to other laboratories, reviewing articles and communicating with journals, correspondence with professional contacts or companies, and arranging visits or obtaining/confirming meeting details were the main activities for which fax, and, to a lesser extent, e-mail were employed. Figures E13.3.1 and E13.3.2 show the perceived impact of fax and, to a lesser extent, e-mail as factors in their increasing information gathering or communication activities. The decrease from 83.8% in Phase 1 to 42.7% in Phase 3 suggests that the effect of both fax and electronic mail facilities had begun to plateau and had become routine communication modes. Ease and speed of communication offered by both modes, particularly fax, was commented on by many, especially when deadlines for submission of documents needed to be adhered to. A number of scientists mentioned the replacement of telephone calls with faxes and the relationship of a fax modem card to an increase in fax usage. By Phase 3, decreased usage of fax was reportedly because of the termination of collaborations or the increased use of electronic mail.

6.7.3 Meetings / Conferences / Seminars
The importance of attending meetings, seminars and conferences decreased slightly over the project period. Figure E13.1.3A shows that whereas 54.4% (37) of scientists rated it 4 and over on the five point scale in Phase 1, this had decreased to 51.5% (35) in Phase 3. Figure E13.1.3B indicates that this decrease in importance is most evident in the university group and it is only the MRC group which demonstrated an increase in importance. A selection of views on the importance of meetings is given below.

"Conferences have increased in importance. I am participating in them more, especially the workshop type" (Phase 1 - university group member)
"Meetings are becoming more important. Because there's so much information, when you hear someone give an overview of a subject, you are able to put it into context" (Phase 1 - university group member)
"Workshop type meetings are the most informative" (Phase 1 - MRC group member)
"Meetings have increased in importance, especially internal ones" (Phase 2 - cancer research group member)
"Meetings have decreased in importance because I have been to none" (Phase 2 - university group member)
"Conferences have decreased in importance because I've moved into a different field" (Phase 3 - industrial group member)
"Conferences have decreased in importance because of lack of funding" (Phase 3 - industrial group member)

The perceived declining impact of conferences, meetings and seminars as factors in information gathering or communication activities is evident in Figure E13.2.1. Reported factors influencing scientists' perceptions of the relative importance of meetings included frequency of attendance, changes in field, verbal dialogue with meeting participants, type of meeting and maturity/seniority in post.

6.7.4 Receipt of Reprints From Colleagues / Competitors
The importance of receipt of preprints from colleagues or competitors increased slightly over the project period. Figure E13.1.4A shows that whereas 14.7% (10) of scientists rated it 4 and over on the five point scale in Phase 1, this had increased to 16.2% (11) in Phase 3. This slight growth in the importance of receiving preprints is confined to the MRC group, as shown in Figure E13.1.4B, with decreasing importance being registered by the cancer research and university groups. The industrial component, which consisted of development as well as research staff, is generally not as involved as the other components in publishing papers and this phenomenon explains the lack of importance of preprints to its members. A number of scientists in the cancer research, MRC and university groups mentioned that they received these preprints via their head of laboratory or supervisor and others claimed that receipt of preprints did not happen very often.

6.7.5 Unpublished Research Papers and Results
There was a slight increase in the importance of refereeing unpublished research papers and results over the project period. Figure E13.1.5A shows that whereas 16.2% (11) of scientists rated it 4 and over on the five point scale in Phase 1, this had increased to 17.7% (12) in Phase 3. In general, refereeing of papers was restricted to laboratory and clinical scientists and a number commented that this was "infrequent", or "low by definition", or "interesting but not crucial". On the other hand, a member of the MRC group stated:
“Competition is so high in the human genetics field that refereeing is a definite plus - and quite a tightrope to walk because you can't remember if it's something you've refereed or something someone has told you” (Phase 1 - MRC group member).

The industrial group did not rate this particular activity highly because of their lack of involvement in published papers and, like the ICRF sample, some scientists in the other groups often refereed via or jointly with their laboratory head, as shown in Figure E13.1.5B.

6.7.6 In-House Current Awareness Service

There was a slight decrease in the importance of in-house current awareness services over the project period. Figure E13.1.6A shows that whereas 45.6% (31) of scientists rated it 4 and over on the five point scale in Phase 1, this had decreased to 44% (30) in Phase 3. This decrease in the importance of current awareness is most marked in the cancer research and university groups, as shown by Figure E13.1.6B. Reasons included some members of the cancer research group giving up contents pages, the university group had found the cost of networking Current Contents within the department too expensive; and one industrial group member had started to use Dialog interactively. However, comments supporting the importance of in-house current awareness services to individual scientists occurred throughout the project period, as illustrated below:

“Current awareness is more important because of the increase in the number of papers and the number of journals” (Phase 1 - industrial group member)

“The abstracting service provided by Information Services is increasing in importance ... it helps us to manage the information explosion” (Phase 1 - industrial group member)

“BIDS is becoming less important because of access to Current Contents” (Phase 1 - MRC group member)

“I rely more on the delivery of contents pages of journals” (Phase 2 - cancer research group member)

“Current Contents and database searching are becoming more important” (Phase 3 - MRC group member).

Figure E13.2.1 shows the perceived declining impact of in-house current awareness services as a factor in information gathering activities over the project period.

6.7.7 Commercial Current Awareness Services

A small number of scientists, 8.8% (6) in Phase 1 increasing to 11.8% (8) in Phase 3, relied on commercial (rather than in-house run) current awareness services,
which they rated 4 and over on the five point scale, over the project period. Sources included electronic services, such as *Chemical Abstracts* Bulletins, *Current Contents* on Diskette and drug companies’ databases, on the one hand, to printed sources, such as newsletters from commercial suppliers and product companies, companies’ update leaflets on product methods and equipment, *Leeds Oncology Bulletin*, *Notre Dame Lists*, *CABIOS* (*Computer Applications in the Biosciences*), *Free Radicals Research Communication*, *Aids Information* and *Sheffield SUBIS* (*Sheffield University Biomedical Information Service*) lists (Phases 1 and 2 only), on the other.

### 6.7.8 Online Databases / Electronic Bulletin Boards

There was a substantial increase in the importance of accessing information from online databases and electronic bulletin boards over the project period. Figure E13.1.8A shows that whereas 22.1% (15) of scientists rated these facilities 4 and over on the five point scale in Phase 1, this had increased to 51.5% (35) in Phase 3. This growth in the importance of accessing online databases and electronic bulletin boards is especially marked in the cancer and MRC groups, as shown in Figure E13.1.8B.

The main online databases utilised throughout the project period were MEDLINE, BIDS GDB, OMIM and *Chemical Abstracts* for sub-structure searches, although UnCover and Dialog databases were mentioned as well. In the case of the cancer and university groups, a few scientists used the MEDLINE Database interactively each week as a current awareness service. Externally, the Bionet bulletin boards were most often rated highly whereas internally in the industrial group, SCRIP was cited as essential. As at ICRF, in general, the MEDLINE CD database tended to be a service to the desktop by Phase 3, an MRC group member commenting during Phase 3 that “online MEDLINE is more important than current awareness”.

During Phase 1 of the project (with the exclusion of the industrial group who had no access to BIDS), 24% (14 of 58) of scientists felt that the BIDS ISI service would be potentially useful (or was useful if utilising it) by rating it 4 and over on the five point scale and, in contrast to the ICRF sample, by Phase 3 its actual usefulness had increased slightly to 27.6% (16) of the sample population, as shown in Figure E15.5.1. This increase was confined to the cancer research group only (see Figure E15.5.2). During Phase 1, a few scientists commented that they had
“not heard of it [BIDS]”, and an MRC group member stated that “BIDS is becoming less important because of access to Current Contents”. During Phase 2, a number of scientists commented that BIDS was “more useful with abstracts” and, during Phase 3, an MRC group member stated that “I still find BIDS useful for citation searches” and a university group member claimed that “BIDS has become more important because it covers the plant biochemistry field, which MEDLINE doesn’t”. However, the consistent complaint against the BIDS service was that it was slow, cumbersome and user unfriendly (as evidenced below), a number of scientists stating that MEDLINE sufficed for their retrospective requirements

“... response time slow during the day and tedious to search back years” (Phase 2 - MRC group member)
“... speed is variable and it [BIDS] hangs regularly” (Phase 2 - cancer research group member)
“... BIDS will be replaced by networked MEDLINE” (Phase 3 - cancer research group member)
“... I used to use BIDS a lot before we had a more user-friendly MEDLINE. Now I tend to use MEDLINE more than BIDS” (Phase 3 - MRC group member)

6.7.9 Other Sources of Information
A small number of scientists 4.4% (3) from Phases 1 to 3 relied on other sources of information, which they rated 4 and over on the five point scale, during the course of the project. The main sources were contact with commercial companies, manufacturers’ literature, the International Times and newspapers generally, textbooks, and internal technical reports produced by collaborators.

6.8 Perceived Impact of Developments and Potential Increased Usage of Facilities
In Phase 1 of the project, 77.9% (53) of scientists claimed that they were comfortable (rated 4 and over on the five point scale) accessing electronic information, although a number relied on colleagues for help with infrequently utilised programs and databases. By Phase 3, this figure had risen to 85.3% (58) (see Figure E16.1.1) and is evident in all sectors (see Figure E16.1.2), reflecting scientists increasing use of and confidence in utilising electronic information sources. Furthermore, in Phase 1, 54.4% (37) of scientists claimed that information technology developments, such as electronic current awareness, MEDLINE CD database, BIDS databases, use of reference handling packages for formatting of references for bibliographies of scientific papers, in-house databases (where
present), LIS' database resources and the electronic requesting system for document supply (where extant), had already affected their information handling techniques positively (4 and over on the five point scale).

“CD has had major impact. I used to be quite religious about browsing Current Contents. In fact I found myself spending at least one evening a week, a very boring evening, but I felt I had to do this. One of the impacts of the electronic CD is that it’s done away with a lot of browsing and you’re much more focused in your reading - as long as you do it reasonably regularly” (Phase 1 - cancer research group member)

“4/5 - SCRIP and CD MEDLINE have made quite a big impact. Previously I used to sit with Index Medicus - so simplified that process considerably. I had no way of gathering general information about the pharmaceutical industry”. (Phase 1 - industrial group member)

“CD and BIDS have had a dramatic impact actually. I guess it means I feel I’m less behind than I otherwise was. It’s definitely more flexible. I can access a range of things in depth and I like to do it late at night - so I can work when I feel like it” (Phase 1 - university group member)

By Phase 3, this figure had risen to 66.2% (45 - see Figure E15.4.1) and included networked MEDLINE, the gopher and world-wide web developments, mentioned previously, with their accompanying access to a range of Internet resources.

“... it’s completely changed the way I gather information. Before coming here I was at university and I would go down to the Library and I would look through the journals and physically do it all manually by hand. I don’t have the time to do that now. So from that point of view it’s invaluable to have that electronic service - but then it’s not essential for my job. My situation has changed so much - it’s not a decision I’ve made to move over, it’s just that circumstances have changed”. (Phase 3 - industrial group member)

“When one browses electronically, you are less likely to see unrelated articles that may grab your attention but, on the other hand, you do see related articles that you wouldn’t otherwise see. I don’t know whether or not it’s better or worse. - but it’s different” (Phase 3 - university group member)

“... yes, since departmental network has been installed” (Phase 3 - university group member).

“... e-mail communication and fax made life easier. Access to databases and databanks is vital”. (Phase 3 - university group member)

“They haven’t made a big impact. The biggest difference is having people to ask to do things for me but not impacted on me personally. I think the big difference would come with being able to read papers with easy accessibility electronically. Everything else helps but not big impact”. (Phase 3 - university group member)

“yes, the impact of facilities, such as current awareness, Knowledge Server and HGMP, is increasing all the time. - it’s quicker and it’s easier” (Phase 3 - MRC group member)

“... sources, such as current awareness, GDB and MEDLINE - it’s quicker now I’m familiar with them (Phase 3 - MRC group member)

“... current awareness via Current Contents, MEDLINE and Knowledge Server - I probably do more literature searches than I used to do” (Phase 3 - MRC group member)
".. Knowledge Server and MEDLINE ... yes - before I used to print off loads of irrelevant things - whereas now with abstracts you can decide what you want - so it saves time" (Phase 3 - MRC group member)

"MEDLINE particularly has made things so much easier - to be able to access information straight. The web I don't think in its current form and what it holds has had any impact at all other than filling in blank moments whilst you’re waiting for something to cook as it were” (Phase 3 - MRC group member).

"... over the 3 years further definite impact ... made me much more efficient in keeping up with database searches” (Phase 3 - MRC group member)

"... cumulatively made impact on way I information gather - although my role has changed over the 3 years too (Phase 3 - industrial group member)

"... current awareness has cumulatively made an impact - but more than anything I’ve realised how limited what we do at the moment really is. Having contacted colleagues in other companies I realise how connected they are e.g. the Internet, how they can get data e.g. student at Loughborough University has to put data on a disc to send it” (Phase 3 - industrial group member)

"I use the systems but mostly helping others. Biggest problem is not accessing the data - it’s getting the desktops configured to access the data - i.e. getting the tool to work” (Phase 3 - industrial group member)

"... made life a lot easier in general - haven’t had to tramp over to the Library so often. Current Contents delivered via e-mail is useful” (Phase 3 - industrial group member)

Among the factors mentioned for increasing their use of electronic information in Phase 1 were: increased user-friendliness of central computer systems; intuitive interfaces generally; increased speed of performance of BIDS software; more training and backup documentation for all software including search strategies; the facility to access MEDLINE online via local area networks; the addition of abstracts to BIDS and better interface; end-user access to other databases online such as Chemical Abstracts (cancer research group member and industrial group member) and DIALOG’s databases (industrial group member); access to Current Contents centrally within own institution at reasonable cost (university group member); electronic access to pre-1966 data; better indexing of databases; easier editing and downloading of references; the introduction of the same word processing package for electronic mail as for documents; network connections for those without access from their laboratories or offices; more computers in laboratories and on desks to enable more frequent access to systems; access to networked resources from home, need for high resolution monitors for display of graphics; availability of the full-text of journals online; and more information on what resources were available. By Phase 3 some requests on this wish list had been fulfilled, for example, MEDLINE networked to the desktop; graphical user interface for many resources via web software; the addition of abstracts to BIDS; access to Chemical Abstracts and DIALOG databases for some industrial group members; access to networked resources from home for MRC group;
increased networked connections locally; more computers in many laboratories and offices enabling more frequent access to resources; and the availability of some online journals. However, by Phase 3 there were still demands for: more computers in laboratories and offices (reported examples of two machines between ten people in one laboratory as well as frequent sharing of machines); more full-text journals; more information about what services are available; more training especially on the Internet resources and use of the world-wide web browsers; easier Internet access (members of the industrial group); network connections for those units still without them; high resolution monitors for display of graphics; ability to transfer structures electronically and communicate with other chemists both internally and externally (members of industrial group); the same word processing package for electronic mail as for documents; and remote login facilities from home (all except MRC group).
CHAPTER 7
7. Discussion

7.1 Current Awareness

Both ICRF and composite external comparison groups demonstrated a percentage increase (66.3% to 71.7% in the case of the ICRF group and 54.4% to 58.8% in the case of the composite external comparison group) in the use of current awareness services in Phase 2 of the project and then a decrease (to 68.4% in the case of the ICRF group and 52.9% in the case of the composite external comparison group) in Phase 3, the final percentage usage being less than in Phase 1 in the case of the latter. The completion of PhD projects by graduate students, clinical research fellows and scientific officers accounted for the decrease by Phase 3 in ICRF current awareness profiles, comments such as “current awareness was less important now” being typical. The reasons for the decrease in current awareness usage in the external comparison group varied: a number in the cancer group had stopped contents pages because there were “too many to cope with”, the university group had found the cost of networking Current Contents on Diskette “ridiculously expensive”, and one member of the industrial group had started to use Dialog interactively himself rather than receive current awareness as a central service.

Of those scientists receiving current awareness output directly, there was an increase in the number in both groups receiving output in electronic form over the project period (71.1% to 73.7% in the case of the ICRF group and 18.9% to 36.1% in the case of the composite external comparison group). By Phase 3 of the project, the number of scientists still receiving output in print format only had decreased considerably but still remained surprisingly high overall (26.3% in the case of the ICRF group and 55.6% in the case of the composite external comparison group). Most of the ICRF group were in units where there was no network connection or, more importantly, no connection to their desktop. Reasons in the composite external comparison group varied, for example, many members of the cancer research group still received photocopies of contents pages and a MRC group member commented “we still get our group Current Contents search results on printout not e-mail because of insufficient memory in our computer system”. For both groups, the main motivation for electronic receipt of current awareness was downloading into reference handling packages like EndNote and Reference Manager. Both groups also stressed that e-mail receipt was easier, more convenient or quicker.
Of those scientists receiving current awareness output directly, currency of data was perceived as increasingly important by both groups over the project period (from 60.5% to 80.5% in the case of the ICRF group and from 62.2% to 83.3% in the case of the composite external comparison group). One member of the university group summarised the position in Phase 3 of the project: "I still rate the currency 5 - otherwise I wouldn’t bother with Current Contents - I’d use MEDLINE instead".

This concern with currency was reinforced by the increasing interest expressed by both groups over the period under review in the availability of electronic abstracts before the appearance of the print publication (53.5% to 63.6% in the case of the ICRF group and 38.2% to 67.7% in the case of the composite external comparison group). Although a number of scientists in both groups regarded this development as "frustrating" or "irritating" or a "two-edged sword" and stressed that the full paper would be required for proper evaluation, many felt that the increased awareness would be worth having. The change in attitude of a large number of scientists over the project period is exemplified below.

“I’d find that very frustrating - if you can’t have the full paper, it wouldn’t be very much help” (MRC group member - Phase 1)

“I’d be very interested now. The field I’m working in is changing very rapidly and I’m aware that papers are about to be published but, it’s often a while before they’re actually published, so it would be very useful to have an idea sometime before” (same MRC group member - Phase 2)

Scientists' concern with currency, evident in the perceived importance of current awareness and pre-publication data, reflects the increasing competition and accompanying secrecy between international groups, on the one hand, and the increasing pressure to collaborate internationally in pursuit of successful grant application funding, on the other.

These results have implications for information practitioners who run, or who are considering running, current awareness services either with or without accompanying document supply services. The copying of articles as a result of browsing before being alerted by current awareness output was a common source of frustration to both sample groups (see section 7.2). The criteria that information practitioners should consider when evaluating new or existing services were noted earlier (see section 1.3.3) as well as the necessity to keep abreast of pre-publication services, and to consider the range of resources required to run in-house systems (for example, machine processing power, staff time, and electronic mail loadings, particularly if abstracts are included).
Brunskill (1996) in her report on CAS-IAS services stated that any such CAS-IAS provision involved assessing the needs and preferences of users, assessing the performance of current awareness and document delivery services, and finding the right mix as this issue is central to the access versus holdings debate. In the assessment of users’ needs context, this current project has revealed that, in the sample groups, there are three main groups of current awareness users. The first group consists of those who rely on their LIS’ current awareness service entirely. They have ceased going to the Library and have abandoned browsing because of shortage of time, as exemplified below:

“"It's [ICRF Current Awareness Service] my main means of current awareness rather than browsing” (ICRF senior laboratory scientist)

"Main source" (ICRF graduate student)

"Wouldn't want to be more than a few weeks behind" (ICRF clinical consultant)

"The purpose of current awareness is to flash up those references that I should be aware of because I don't have time to look myself" (ICRF senior laboratory scientist)

"It [current awareness] matters more at the moment because of the nature of the work we are doing. We've got into psychological aspects of genetic risk - it's very new, it's very hot and we're competing with others - so it's important" (ICRF clinical scientist)

"Current awareness is not a safety net for me. I'm happy to take the electronic contents of specified journals as the main source of information and I'm very reliant on other people saying that you've missed so and so in this Russian journal for example.” (ICRF senior laboratory scientist)

"It's my main way of keeping up-to-date. I don't go to the Library and look through journals, I wait for the current awareness” (ICRF senior laboratory scientist)

"... I still depend on current awareness rather than browsing” (industrial group member).

The second group encompasses those who rely on current awareness greatly but browse peripheral journals for methodological papers and / or review articles, which are not covered in current awareness profiles.

"Browsing is more for the techniques applied to another area which wouldn't be picked up [in current awareness] - current awareness is more targeted" (industrial group member)

"Browsing tends to make you think laterally as well rather than focusing on your own keywords. You might see something that perhaps you wouldn't have picked out in a keyword search, something on the periphery of your own interests, maybe a new technique or something that you see could be applied to your own work” (cancer research group member)

"I do think that these articles which are not of direct relevance to your field are often very important - and that often you get ideas from some of the most unlikely places” (ICRF research fellow)

The third group uses current awareness as a safety net whilst browsing is the main method of information gathering. Current awareness is either used for covering journals not held locally and / or to confirm that nothing has been missed by browsing.
“Current awareness is a safeguard for not missing something” (ICRF senior laboratory scientist)
“I use current awareness as a safety net for journals browsed in Library and for those articles from journals not held” (MRC group member)
“The idea of the current awareness is to make sure that I haven’t missed anything from what I scan regularly and to cover everything else that I don’t scan regularly. So current awareness is a backup for me” (industrial group member)

The remainder of the sample groups had either never tried a current awareness service and did not perceive the need or had tried and cancelled, as exemplified below:

“I don’t have a card index and I don’t have any logical means by which I file papers but I have an excellent memory. I take a number of journals which keep me broadly in touch with what’s going on. Somehow or other I know instinctively what’s going on because I talk to the right people” (Phase 1 - cancer research group member).
“I used to work at ICI where I used to do all my searching on Dialog. It was something that I was keen to set up in our group but at the moment my manager is not too keen on that as she’s concerned about the potential cost and the budget’s a bit stretched this year, so the situation will be reviewed in September. .... But I’ve had 5 years experience in searching Dialog - and I was a bit frustrated with the searches I had had done here in the number of misses that came through - whereas when you’re doing it yourself, you can do a much more polished search.” (Phase 1 - industrial group member)
“I am not still getting monthly MEDLINE because I’ve got Dialog now (had it for six months). I tend to use it to get specific information as and when I need it rather than as a current awareness service” (Phase 3 - same industrial group member).

A number of scientists commented that reliance on browsing depended on one’s research area and worked best where articles of interest were confined to a small number of journal titles.

7.2 Personal/Local Holdings, Core Journals and Browsing

The reliance of scientists on personal or laboratory journal holdings varied considerably. Detailed analysis was only carried out on the ICRF group (because of the centralised purchasing arrangements of a number of the components and the spread of interests of the composite external comparison group). Over the project period, access to journals increased most via editorial board copies (104 in Phase 1 and 124 in Phase 3), personal subscription copies (63 in Phase 1 and 90 in Phase 3) and laboratory subscription copies (117 in Phase 1 and 195 in Phase 3). Undoubtedly, the number of core journals increased for most scientists over the period (even if only reflecting the growth of review journals), particularly for non-tenured ICRF staff (research fellows, clinical research fellows and graduate students) who were often new to their particular specialism. However, even
allowing for these factors, the growth in personal and laboratory subscriptions to journals are clear trends.

Both the ICRF and composite external comparison groups cited 6 to 10 titles as core to their research area. A number of scientists in both groups were unable to state a number of core journals because of frequently changing research areas and hence changing related journal titles. An analysis of the ICRF group’s core titles over the project period showed a rise in the importance of review journals such as the *Current Opinion* and *Trends* series and the impact of newer titles such as *Nature Genetics*, *Oncogene* and *Journal of Cell Science*. An increasing percentage of scientists in both groups (44.9% to 47.6% in the case of the ICRF group and 47.1% to 51.5% in the case of the composite external comparison group) stated that they were referees for some (in a few cases all) of their specified core journals.

Both groups reported that browsing focused on core and review journals, ICRF scientists specifying that between one and two hundred citations were usually scanned per week. The varied pattern of browsing was reported in both groups: some browsed daily, others at weekends or a number of times per month, whilst some confined their browsing to laboratory held journals or, in the case of some scientific officers in the composite external comparison group, relied on their post-doctorate “bosses”. Both groups perceived that their browsing activity decreased over the project period but this is not borne out by the figures (see Figures 4.1.1 and E4.1.1), which indicate that the majority of scientists spend fewer than two hours browsing per week. With the ICRF group, theses writing was a reported catalyst for increasing time spent browsing, as was the introduction of charging for document supply for one senior laboratory scientist.

Over the project period, those who received current awareness output in both groups found it difficult to differentiate between articles copied as a result of being alerted via current awareness and those copied as a result of browsing. The copying of articles as a result of browsing before alerting by current awareness output was a common factor identified by both groups.

“Current awareness should be at the same time as the journal is published” (ICRF senior laboratory scientist)
“... references often on *Current Contents* search when the journal hasn’t actually arrived in the Library. That works against it [the current awareness] because you have the reference and have to remember to refer to the journal when it arrives” (member of MRC group).
"The biggest frustration is the problem of the difference in the rate that different journals are abstracted and the rate at which we receive hard copy of the journal. It's quite difficult to match up references to reprints because I have a lot of references on Reference Manager which haven't arrived yet and a lot of hard copy references that haven't been abstracted yet - difficult therefore to match up reference with hard copies" (industrial group member)

"... 5 for browsing - the reason being some journals like *Cell* and *EMBO* arrive in the Library before *Current Contents* (as opposed to those that don't)" (MRC group member)

" ... 4 for browsing - difficult because I use the *Current Contents* as a safety net for articles that I miss going through the main journals in the Library. But because the *Current Contents* printout tends to come out usually after the journals have been published, I have already seen most of the major titles on the browsing. So from that point of view, browsing the printed journal is very important. But if I didn't browse, I would find that most of the titles would appear in the *Current Contents* search - plus the ones I miss in browsing. So the browsing is very important - and, if we didn't have the *Current Contents*, it would be vital" (MRC group member)

Despite the difficulties involved in identifying the method of alerting, an increasing percentage in both groups (56.2% to 60.4% in the case of the ICRF group and 48.5% to 61.8% in the case of the composite external comparison group) copied fewer than five articles per week (see Figures 4.3.1 and E4.3.1). By the final phase of the project, an increasing number in both groups were copying only the front page of the article containing the abstract (the full article to be copied later if necessary).

In the period under review, whereas an increasing percentage of ICRF scientists (75.4% to 77.5%) rated browsing highly (4 and above on the five point scale), a decreasing percentage (51.5% to 45.6%) of the composite external comparison group rated it highly. Those that did not rate browsing highly either lacked time or tended to rely on current awareness. Besides the psychological satisfaction and serendipity aspects of browsing, the truth of the matter is that, throughout the project period, the latest issue of a journal on the library shelf was often more current or as current as any of the available current awareness services. A series of surveys, undertaken by ICRF LIS and ex-LIS staff, recorded developments as they unfolded. One survey, undertaken in September 1993 (at the end of Phase 1 of this project), comparing the currency of the latest shelf issue of fourteen scientific journal titles with a selection of current awareness services, showed that: in 50% of cases, the shelf issue was the most current; in 36% of cases, the current awareness services equated to the shelf issue; and in only 14% of cases were the current awareness services ahead of the shelf issue (see Figure 0.5.2). Another survey, undertaken in October 1995 (just after the completion of Phase 3 of this project), comparing the currency of the latest shelf issue of nineteen scientific journal titles with a selection of current awareness services, showed that: in 60% of cases, the shelf issue was the most current; in 30% of cases, the current awareness services equated to the shelf issue; and in only 10% of cases were the current awareness services ahead of the shelf issue (see Figure 0.5.3).
services, showed that: in 11% of cases, the shelf issue was the most current; in 68% of cases, the current awareness services equated to the shelf issue; and in only 21% of cases were the current awareness services ahead of the shelf issue (see Figure 0.5.3). This lack of a viable, comprehensive, easily accessible alternative to the latest shelf issue and the growing importance of currency to both groups (reported in section 7.1) accounted for the sustained interest of both groups in browsing current journals.

As for the time spent reading the literature each week, over the period more than 50% of scientists in both groups spent fewer than 4 hours on this activity. In the case of the composite external comparison group, a growing percentage (59% to 71%) reported this trend of spending less time reading. This result is at slight variance with the findings of the recently reported study of four sets of biologists from different institutions (Rolinson et al., 1996) where it was found that in three of the surveyed organisations, 50% spent more than 4 hours per week reading. In this current project, members of both groups mentioned the lack of time factor and that more time was spent reading when they were writing. Those tasked with producing theses also dedicated more time to reading the literature during the writing up period, probably updating their literature surveys prior to submission.

7.3 Document Supply and Request Modes

Both ICRF and composite external comparison groups agreed that the main source of photocopied articles was usually the “local” collection, whether this be the organisation’s main Library collection or departmental or unit collection.

Both groups displayed an increase in electronic requesting (via their LIS’ Inter-Library Loans request system or via e-mail) over the project period (42.5% to 54.5% in the case of the ICRF group and 5% to 36.8% in the case of the composite external comparison group). Convenience, efficiency and simplicity were the reasons given by scientists in both groups for requesting electronically. Despite agreement over the efficiency of electronic requesting, both groups showed a decrease (from 76.9% to 74.4% in the case of the ICRF group and from 75% to 59.1% in the case of the composite external comparison group) in the perceived benefits arising from electronic requesting. In the case of the ICRF group this was reportedly due to the charging policy for document supply but, in the case of both groups may well be related to the trend of copying fewer articles.

Both ICRF and composite external comparison groups claimed that during Phase 1 the rate of acquisition (whether through personal photocopying or via their LIS’ document supply
service) had increased (24.1% in the case of the ICRF group and 41.2% in the case of the composite external comparison group). Reasons given included:

- expanding or changing subject areas (including collaborations);
- divergence of personal or laboratory interests or changes in project direction;
- increase in number of relevant journals published;
- and the writing of PhD theses, reviews, books or grant applications.

The composite external comparison group also mentioned the requirements of teaching, and preparation for site visits. During Phase 3 there was a decrease to 19.3%, in the case of the ICRF group, and to 32.4%, in the case of the composite external comparison group, in increased rate of acquisition. This was complemented by the substantial (13.9% to 31%), in the case of ICRF, and the steady (5.9% to 14.7%), in the case of the composite external comparison group, percentage rise of scientists who reported that their acquisition rate of photocopied articles had declined. A large proportion of each group reported that their acquisition rate of photocopied articles had remained constant. Reasons given by both groups were:

- intentionally becoming more selective;
- becoming more selective because of pressure of time;
- levelling off after provision of abstracts;
- and retaining the abstract of an article for possible future reference rather than acquiring article now.

Other reasons given by the ICRF group included becoming more selective because of charging for document supply and access to more laboratory held journals and, by the composite external comparison group, easier access to MEDLINE and Internet resources.

### 7.4 Use of Reference Handling Packages

Both ICRF and composite external comparison groups demonstrated a percentage increase in the use of reference handling packages over the project period (52.4% to 72.7% in the case of the ICRF group and 30.9% to 47.1% in the case of the composite external comparison group).

EndNote was the most popular package in use by the ICRF group, partly because it was one of the first reference handling packages available for the Apple Mac computers and partly because of the discounted organisational licence arrangements. EndNote was popular amongst Apple Mac users in the MRC, university and cancer research sectors of the composite external comparison group, whilst Reference Manager was preferred by
other scientists in the MRC and industrial groups. Additional packages in use amongst the composite external comparison group were ProCite (some industrial group members) and SciMate, Get-A-Ref, Paradox and Papyrus (cancer research group members).

A number of scientists in both groups maintained a reference file in another form over the project period (9.1% in Phase 1 to 5.9% in Phase 3 in the case of the ICRF group and 10.3% throughout in the case of the composite external comparison group). In both cases these were either flat files kept on central or local (PC or Apple Mac) machines or traditional card files. By Phase 3, a number of card filing systems had lapsed because of the manpower effort required to maintain them. The majority of scientists in both groups reportedly kept their photocopied articles filed by subject or in topic files. Relatively few scientists in either group utilised their retrieval system (whether electronic or manual) to identify publications by a classification or running serial number scheme.

Of those scientists receiving current awareness output in electronic form, there was a slight decrease in both groups over the project period in the number of scientists downloading current awareness output due to the availability of online abstracts from MEDLINE and SciSearch and the preference of a number of scientists not to add references to their databases until they had read the full-text of the publications referred to. Many of the ICRF group mentioned file transfer difficulties also. In addition, both groups reported an increase in the storage of abstracts in their reference handling databases. In the case of the composite external comparison group, downloading of current awareness output received in electronic form was confined throughout the project period to members of the industrial and MRC groups, although a few scientists in the MRC and university groups downloaded references into their reference handling databases from regular searching themselves of Current Contents on Diskette.

Both groups reported an increase in the number of scientists who loaded data from other sources into their reference handling databases over the project period. Downloading from MEDLINE (initially via CD and, later, online via networking software such as ERL), keying in and copying data from colleagues’ databases were the main methods of loading data into reference handling databases, although BIDS was another common source. Additional sources were GDB, in the case of the ICRF group, and Current Contents on Diskette and Dialog, in the case of the composite external comparison group.
The reported size of personal and laboratory reference handling databases varied considerably but Phases 2 and 3 were characterised by laboratories and individual scientists maintaining a series of subject databases plus a database of references for every published paper. In the case of ICRF, very large laboratory databases were either split, put onto optical media or were discontinued in that form. Maintenance of these databases varied also between Head of Laboratory/Department, laboratory secretary, students (in the case of the industrial group), and joint maintenance by a few or all laboratory members, problems often arising (in the case of ICRF) when the principal maintainer (often a research fellow on a three year contract) left the laboratory. By Phase 3, a number of ICRF scientists reported that their EndNote databases were only updated when a paper was written by laboratory members.

Over the project period, of those scientists who utilised reference handling packages personally or via their staff, an increasing number of the ICRF group were using the package in conjunction with a word processing package to produce bibliographies at the end of papers for submission to journals, or for book or thesis production, whilst the reverse was the case in the composite external comparison group. Taking the whole sample population, there was a correspondingly greater (at least 50%) proportion of the composite external comparison group who keyed in references or cut and pasted references from previous papers to produce bibliographies for their published papers, whilst the ICRF proportion was much smaller (between 25% and 27%). An interesting factor, which emerged during the course of the project, was that a number of scientists (5.8% in the case of the ICRF group and 10.3% in the case of the composite external comparison group) continued to dictate or to write their papers longhand.

The majority of scientists in both groups published 10 or fewer papers per year, the larger proportion (48% in the case of the ICRF group and 48.5% in the case of the composite external comparison group) by Phase 3 publishing 5 or fewer papers per year. Those scientists who published more than 10 papers per year were mainly senior laboratory and clinical scientists. Throughout the project period, scientists' main motivation for utilising a reference handling package was for formatting references rather than as a database but by Phase 3 many scientists from both groups used their reference handling package for both purposes, the majority (80.6% in Phase 1 to 76.5% in Phase 3 in the case of the ICRF group and 76.2% in Phase 1 to 87.5% in Phase 3 in the case of the composite external
comparison group) stating that their perceived benefits of utilising the package had been realised.

7.5 CD/In-House/Remote Database Usage

Both the ICRF and the composite external comparison groups demonstrated a percentage decrease in the use of CD databases over the project period (75.9% to 72.7% in the case of the ICRF group and 80.9% to 77.9% in the case of the composite external comparison group). By the latter half of Phase 3, online MEDLINE (the main CD database utilised by all scientists) to the desktop was the norm in both groups, although there were still performance, connection or coverage problems for some scientists.

"... I access MEDLINE from my laboratory but the MEDLINE service crashes a lot" (Phase 3 - MRC group member)

"... my MEDLINE usage has declined because I can now access the Knowledge Server from my laboratory easier than MEDLINE" (Phase 3 - MRC group member)

"... I tend to use the Knowledge Server. It's much better than MEDLINE. It gives you a percentage relevance and has a wider database to draw on" (Phase 3 - MRC group member)

"... MEDLINE has now been networked but my system can't be configured to access it because of the way it has been set up. I have to go to the Library to use it still. I've spoken to my PC support people but they have too much on to address this problem so I don't think it's being pursued" (Phase 3 - industrial group member)

"... I've had MEDLINE for three months. When the BMA [British Medical Association] started its MEDLINE service back to 1966, we started pestering our IT people for a modem. We had a standalone machine that we could have used, a dedicated machine that would not have compromised security. It took ages but we have it back to 1989 now - so it's enough to get started" (Phase 3 - industrial group member)

"... MEDLINE is now available from my laboratory but ToxLine is still on CD" (Phase 3 - industrial group member)

A few scientists in the university and industrial groups complained about the lack of plant biochemistry coverage of MEDLINE whilst one scientist in the industrial group had started using Dialog databases instead. One ICRF scientist had switched to using EMBASE via BIDS at the university in which he was based.

The availability of CD-ROM drives in laboratories and departments increased in both groups over the period under review (16.6% to 39.6% in the case of the ICRF group and 23.5% to 30.9% in the case of the composite external comparison group). Much of this increase was accounted for by the fact that CD-ROM drives became standard on the delivery of new machines (whether PC, Apple Mac or Sun workstations) rather than an
increase in the range of databases/databanks available. In both groups, CD material included operating system software, Sigma Aldrich’s catalogues, Current Protocols in Molecular Biology and full-text journals. Many ICRF scientists held a variety of molecular biology software also. In addition, erasible optical discs were utilised by laboratories in both groups for image analysis and the storage of software and laboratory data.

Usage of the resources (mainly relating to LIS and molecular biology) held on the main computing facility at ICRF increased over the period, whereas the facilities available amongst the components of the composite external comparison group varied. Only the cancer research group had access to the same word processing package on their centralised facility as on their PCs. The ICRF, cancer research and MRC groups had access to local molecular biology databanks, statistical and graphics packages whilst, by Phase 3, all groups had access to LIS’ electronic facilities. Only ICRF and the industrial group had access to leased commercial databases (SciSearch or Current Contents), although the industrial group had SCRIP and chemical structure databases also, plus in-house databases of literature on their products.

Besides the lack of network connections, the main complaint against use of the central computing facilities was the user unfriendly nature of the software interfaces. This sometimes led to an aversion to using the central facility by many (see below) and led them to opt for building up local computing provision. This, in turn, was facilitated by the increasing processing power and storage facilities of desktop PCs and Macs. The advent of gopher and, more importantly, web interfaces to programs helped to make centrally based resources easier to access.

"My own use of the Vax cluster is minimal - I avoid it like the plague" (ICRF senior laboratory scientist)

Both groups exhibited a considerable percentage increase (23.5% to 46% in the case of the ICRF group and 39.7% to 60.3% in the case of the composite external comparison group) in end-user searching of remote databases/databanks and a correspondingly large decrease (from 26.7% to 6.4% in the case of the ICRF group and 25% to 13.2% in the case of the composite external comparison group) in mediated searching via LIS staff. This decline in mediated online searching has been observed in other studies, for example: “.... one librarian estimated that mediated online searching had shrunk from 600-800 searches per year to just 2-3 per month” (Dyer and Bouchet, 1995, 47).
7.6 Network Usage and Electronic Journals

As previously mentioned, throughout the project, usage of networks was measured by the use scientists made of electronic mail facilities, electronic bulletin boards, remote login and remote file transfer facilities.

Both ICRF and composite external comparison groups demonstrated percentage increases in the usage of electronic mail (61% to 84.5% in the case of the ICRF group and 45.6% to 88.2% in the case of the composite external comparison group) over the project period. This increase in electronic mail usage was evident in all categories of staff in the ICRF group and in all sectors of the composite external comparison group, although usage was at a high level in the industrial group from Phase 1. These results update previous findings (Rolinson et al., 1995) on the use of information technology by biological researchers where it was stated that "... the generally low level of networked activities (including electronic mail), except at the pharmaceutical laboratory, is worth noting". Common reasons given by scientists in both groups for their growing use of electronic mail over the project period included:

- correspondence with family, personal friends and ex-colleagues at universities and institutes worldwide;
- communications with publishers, including papers sent as attachments
- increasing number of collaborations and co-authoring of papers (including communications with publishers;
- increasing usage by the human and yeast genome communities, including the transfer of sequences with the mushrooming of molecular biology electronic mail servers;
- subscription by individual scientists to mailing lists;
- the heightened awareness and usage of electronic mail by the university and research communities generally;
- symposium organisation;
- and the introduction of more user-friendly and sophisticated electronic mail programs.

The cancer research group also mentioned downloading references from bibliographic databases (e.g. BIDS and UnCover), and the industrial group reported increasing international links within and outside the company, the sharing of electronic company reports and protocols, changing roles and merger activities.
The increased electronic mail activity of scientists in both groups occurred within institutions, nationally within the UK and internationally over the project period. This reflects the reported growth in national and international collaborations, increasing use of molecular biology electronic mail servers and expanding professional and personal correspondence. There was an upward trend over the project period in the number of messages sent and received on a daily, weekly, monthly and occasional basis. By Phase 3, over 70% of scientists utilising electronic mail in both groups claimed that their usage of electronic mail was growing but continued monitoring will be required to determine whether an established pattern of behaviour becomes discernible.

Both ICRF and composite external comparison groups exhibited percentage increases in the usage of electronic list servers and bulletin boards (29.4% to 44.9% in the case of the ICRF group and 19.1% to 36.8% in the case of the composite external comparison group) over the project period. This increase in usage of electronic list servers and bulletin boards is evident in all categories of staff in the ICRF group and in all sectors of the composite external comparison group, although usage was at a high level in the industrial group from Phase 1. This was because established internal bulletin board systems were already in place in the industrial sector at the start of this research project and they contained company notices, full-text publications (for example SCRIP) and management news which encouraged scientists to access daily or to receive daily output from distribution lists associated with these systems. The use of internal electronic bulletin boards became more established in the ICRF group and in other sectors of the composite external comparison group (particularly the MRC sector) during the course of the project. Lists and sources (accessed remotely or mounted in-house) commonly accessed by both groups included the Bionet molecular biology range (particularly the Methods and Reagents bulletin board), NISS, GCG, ESRC, and hardware and software suppliers.

There was an upward trend in both groups over the project period in the number of daily, monthly, and occasional accesses or receipts. Although an increasing percentage of scientists in both groups claimed that their usage of electronic list servers and bulletin boards was increasing over the period, by Phase 3 over 47% (53.6% in the case of ICRF and 48% in the case of the composite external comparison group) of scientists using these facilities stated that their usage had remained constant. An increasing percentage of scientists stated that their usage of these facilities had decreased over the project period whilst others had not used them at all; reasons given included lack of time, large quantities
of useless information, and the increasing use of web systems. In addition, the ICRF group mentioned network connection problems and scepticism of the value of such systems and the composite external comparison group complained of too many messages, duplication of material and the loss of novelty value of such systems. These reported problems are significant because, by the end of the project period, more than 55% of the ICRF group and over 60% of the composite external comparison group did not utilise these facilities.

The ICRF group showed a slight increase (from 16.6% to 20.9%) in the use of remote login whereas the composite external comparison group’s use remained fairly constant (23.5%) over the project period. With the exception of the industrial component of the composite external comparison group, both groups increasingly conducted interactive sessions with genome, molecular biology, bibliographic, clinical and family databases and datasets. In the case of the ICRF group, other interactive sources mentioned related to software acquisition and collaborative or personal computer accounts at other national or international universities and institutes. In both cases the mode of access to some of these resources changed from telnet in Phase 1, to gopher in Phase 2 and to web access by Phase 3.

Both groups demonstrated a percentage increase (from 15% to 34.2% in the case of the ICRF group and 22.1% to 33.8% in the case of the composite external comparison group) in remote file transfer over the project period. Again, with the exception of the industrial component of the composite external comparison group, much of the file transfer activity of both groups involved sequences from molecular biology databanks and public domain software from a variety of sites. Over the period under review, both groups also increasingly transferred text and data with collaborating institutions, particularly of a co-authored paper or of a joint grant application nature. The ICRF group mentioned the downloading of full text of journal articles as well. The transfer of text and data was decreasingly effected by use of the file transfer protocol but rather was increasingly sent as attachments to electronic mail. Although the industrial component of the composite external comparison group was not generally active in remote login and remote file transfer activities via JANET or the Internet, there was increased file transfer and communication within the companies on an international basis via their own private networks.

Both groups showed an increasing percentage interest (from 82.9% to 93.6% in the case of the ICRF group and 86.8% to 97.1% in the case of the composite external comparison group) in utilising the full-text of journals in electronic form (including graphics) over the
project period. This interest was apparent amongst all categories of staff in the ICRF group and across all sectors in the composite external comparison group. However, the groups differed in their inclination to utilise the electronic form as a replacement for the hard copy journal: the ICRF group’s percentage rose from 34.2% in Phase 1 to 46.9% by Phase 3 whereas the composite external comparison group’s percentage rose from 66.1% in Phase 1 to 66.7% in Phase 3. So, whereas the majority of the composite external comparison group were strongly in favour of utilising the electronic form as a replacement for the hard copy journal throughout the project period, the majority of the ICRF sample stated that they would use the electronic version as a supplement to the hard copy journal. Both groups maintained that the electronic version would be utilised provided that the graphics quality was acceptable, preferably with colour printing, with ease of use, speed of printing and comprehensiveness being the other criteria. The composite external comparison group also mentioned reasonable cost as a requirement, whereas the ICRF group envisaged the storage of papers electronically as the ideal scenario, provided that a comprehensive collection of titles was available. Both groups strongly supported the extension of the electronic version to the back years of journals (90.3% and 93.9% in the case of ICRF and the composite external comparison groups, respectively, by Phase 3), although there was a difference of opinion between scientists over whether this was of greater or lesser importance than electronic current issues.

7.7 Other Information Gathering / Communication Activities

7.7.1 Verbal Communication

Both ICRF and composite external comparison groups rated verbal communication (face to face or via telephone) highly throughout the project’s duration. The composite external comparison group’s rating increased (80.9% to 88.2%) over the project period whilst the ICRF group sustained its high rating (90.4% to 89.3%). Many senior laboratory and clinical scientists viewed verbal dialogue with internal and external colleagues as the most important information gathering activity of all, whilst for those on fixed term contracts (research fellows, clinical research fellows and graduate students), the importance of verbal dialogue as an information gathering mechanism increased as their experience and/or seniority increased.
7.7.2 Written Communication

Both ICRF and composite external comparison groups agreed on the growing importance of written communication as evidenced by the increased percentage rating (4 and over on the five point scale) over the project period (39% to 57.8% in the case of the ICRF group and 48.5% to 54.4% in the case of the composite external comparison group). This growth in importance of written communication, particularly via electronic mail and fax, was reported by all categories of staff in the ICRF group and by all sectors in the composite external comparison group, particularly in relation to collaborative work. Although scientists’ responses concentrated on their fax usage, other activities for which fax (and to a lesser extent electronic mail) were employed were:

- co-authoring of papers and joint grant applications;
- editorial or committee correspondence;
- obtaining and receiving data and information from other laboratories or institutions;
- reviewing articles and communicating with journals;
- correspondence with professional contacts or companies;
- and arranging visits or obtaining/confirming meeting attendance details.

Several ICRF contract staff (graduate students, research fellows and clinical research fellows) mentioned forwarding job applications, particularly in Phase 3 when their ICRF contracts were drawing to a close. A number of scientists in both groups mentioned the decline in their postal mail, the replacement of telephone calls with faxes or the relationship between their electronic mail and their fax usage. By Phase 3, scientists in both groups reported that decreased usage of fax occurred because collaborations had ended or because their use of electronic mail had increased.

7.7.3 Meetings / Conferences / Seminars

Both ICRF and composite external comparison groups exhibited percentage decreases in the importance of attending meetings, seminars and conferences over the project period (69% to 66.3% in the case of the ICRF group and 54.4% to 51.5% in the case of the composite external comparison group). During the project, shortage of funding, which restricted attendance at external meetings, was mentioned by both groups. Other factors influencing scientists’ perceptions of the relative importance of meetings included frequency of attendance, changes in role
or field, verbal dialogue with meeting participants, the popularity of the workshop type meeting, and maturity/seniority in post. A few scientists from the ICRF group noted that often what is stated at conferences and meetings is unreliable and does not match up with what is written in the published articles.

7.7.4 Receipt of Preprints from Colleagues / Competitors
Both the ICRF and the composite external comparison groups demonstrated percentage increases (21.9% to 27.3% in the case of the ICRF group and 14.7% to 16.2% in the case of the composite external comparison group) in the importance of receipt of preprints from colleagues or competitors over the project period. The ICRF group’s rating increase exceeded that of the composite external comparison group, although the industrial component of the composite external comparison group, consisting of development as well as research staff, was not so involved as the other components in publishing papers, hence the lack of importance of preprints to its members. Some scientists in both groups mentioned that they received preprints via their head of laboratory or supervisor. A number of scientists in both groups also claimed that receipt of reprints did not happen very often.

7.7.5 Unpublished Research Papers and Results
Both ICRF and composite external comparison groups showed percentage increases (17.7% to 27.3% in the case of the ICRF group and 16.2% to 17.7% in the case of the composite external comparison group) in the importance of refereeing unpublished research papers and results over the project period. The ICRF group’s rating increase exceeded that of the composite external comparison group although, again, the industrial component’s relatively small involvement in published papers needs to be borne in mind. In both groups, some scientists refereed via or jointly with their laboratory head and others commented that they did not receive reviewing material relevant to their current work.

7.7.6 In-House Current Awareness Service
Both ICRF and composite external comparison groups demonstrated slight percentage decreases (51.9% to 50.8% in the case of the ICRF group and 45.6% to 44% in the case of the composite external comparison group) in the importance of in-house current awareness services over the project period. Charging for
document supply, completion of PhD projects, and loss of network connections accounted for this decrease in the ICRF sample group, whereas the cancelling of content pages, the cost of networking Current Contents departmentally, and the opting for interactive Dialog searching were the reasons in the case of the composite external comparison group.

7.7.7 Commercial Current Awareness Services
Besides in-house facilities, small numbers of scientists in both groups utilised other (not in-house run) electronic and printed commercial current awareness services. Whereas the numbers decreased in the ICRF group over the project period, the numbers increased in the composite external comparison group (4.8% to 3.7% in the case of the ICRF group and 8.8% to 11.8% in the case of the composite external comparison group). Common electronic sources were drug companies' databases whilst the Leeds Oncology Bulletin was a print source utilised by both groups. Other electronic sources mentioned by the ICRF group were Data-Star, Reference Update and a cellular differentiation bulletin: Chemical Abstracts Bulletins and Current Contents on Diskette were utilised by members of the composite external comparison group. Other print sources reported by the ICRF group were The Breast, ASH Bulletin and, during Phase 1, British Library sectional lists: Notre Dame Lists, CABIOS, Free Radicals Communication, Aids Bulletin and Sheffield SUBIS lists (for Phases 1 and 2 only) were relied on by members of the composite external comparison group.

7.7.8 Online Databases / Electronic Bulletin Boards
Both ICRF and composite external comparison groups showed substantial percentage increases (5.9% to 33% in the case of the ICRF group and 22.1% to 51.5% in the case of the composite external comparison group) in the importance of accessing information from online databases and electronic bulletin boards over the project period. This growth in the importance of accessing information in this manner is reported by all categories of the ICRF group and by all sectors of the composite external comparison group. Moreover, Figures 13.2.1 and E13.2.1 reflect scientists' perceptions that this information gathering mode is the fastest growing mode throughout the project period.
7.7.9 Other Sources of Information

A small number of scientists from both groups (1.1% to 1.6% in the case of the ICRF group and 4.4% to 4.4% in the case of the composite external comparison group) relied on other sources of information throughout the project period. The main sources were commercial companies, manufacturers' literature, newspapers, textbooks and internal technical reports produced by collaborators.

7.8 Perceived Impact of Developments and Potential Increased Usage of Facilities

Over the period, an increasing percentage in both ICRF and composite external comparison groups claimed to be more comfortable (rated 4 and above on the five point scale) accessing electronic information (from 66.9% to 78.1% in the case of the ICRF group and from 77.9% to 85.3% in the case of the composite external comparison group). Moreover, both groups claimed that information technology developments had affected their information handling techniques positively (4 and above on the five point scale) over the project period (from 44.9% to 62.6% in the case of the ICRF group and from 54.4% to 66.2% in the case of the composite external comparison group). Awareness, speed and convenience were stressed in particular by both groups, as illustrated below:

"Scanning the literature electronically has increased my awareness. Previously I covered only 20% of what I now cover, although I have to devote more time to it" (Phase 2 - ICRF clinical consultant)

"Electronic access has speeded up the searching process" (Phase 3 - ICRF senior laboratory scientist)

"... it's made me much more efficient. I am now more prepared to go and look for things than I used to be because it's so much easier - and when I do look for things, I get the relevant things out faster" (Phase 1 - cancer research group member)

"Two or three weeks ago, there was a paper I was reading which was published in 1985 and I decided it would be really good to get this data in this study. I e-mailed one of the statisticians who authored the paper and I had the data within an hour from America from this paper published eight years ago" (Phase 2 - ICRF senior laboratory scientist).

"They [electronic databases] provide information which I wouldn't have got otherwise. I couldn't hand search journals without it being very time consuming" (Phase 2 - ICRF clinical scientist)

"The greatest development this year has been my increased use of the web with its ease of access to resources, not necessarily additional resources but making access to resources easier - for example, the e-mail grapevine whereby web pages are linked in" (Phase 3 - ICRF senior laboratory scientist)

"... very positive impact - it's a very fast way (especially via the web) of getting information together (Phase 3 - MRC group member).

Undoubtedly, increased user-friendliness of interfaces and search tools, exposure to electronic facilities over time (which increases familiarity), and usage becoming habit
Some scientists spoke of a growing reliance on electronic information systems.

"It was only four years ago that I didn't have access to anything like this and I had to rely on the things I read - but now I've got it you come to rely on it more and more" (Phase 2 - ICRF senior laboratory scientist)

"It's impact is increasing all the time. Allowing for when I started off having no real experience of gathering information electronically, as time has gone on I acquire more programs and gather more outlets to acquire information - it's quicker and it's easier. I may be of the generation that I wonder how I managed to get by without it" (Phase 3 - MRC group member)

Among the factors mentioned by both groups for increasing their use of electronic information in Phase 1 were:

- increased user-friendliness of central computer systems
- intuitive interfaces generally (including BIDS);
- increased speed of performance of LIS' and/or BIDS software
- more training and backup documentation for all software including search strategies;
- the facility to access MEDLINE online via local area networks;
- end-user access to other databases online such as Chemical Abstracts;
- network connections for those without access from their laboratories or offices
- more computers in laboratories and on desks to enable more frequent access to systems;
- access to networked resources from home;
- availability of the full-text of journals online;
- and more information on what resources were available.

The composite external comparison group also mentioned the addition of abstracts to BIDS and better interface, access to Current Contents centrally within the parent institution at reasonable cost (university group), electronic access to pre-1966 data, better indexing of databases, easier editing and downloading of references, the introduction of the same word processing package for electronic mail as for documents, and the need for high resolution monitors for display of graphics.

By Phase 3 some requests on these wish lists had been fulfilled, for example:

- MEDLINE networked to the desktop;
- graphical user interface for many resources via web software;
- the addition of abstracts to BIDS;
- access to Chemical Abstracts and DIALOG databases for some industrial group members;
• access to networked resources from home for MRC group;
• increased speed of performance of LIS software with two upgrades of the central computing hardware for ICRF group;
• increased networked connections locally, more computers in many laboratories and offices enabling more frequent access to resources;
• and the availability of some online journals

However, by Phase 3 there were still demands for:
• more computers in laboratories and offices (reported examples of two machines between ten people in one laboratory as well as frequent sharing of machines);
• more full-text journals;
• more information about what services are available;
• more training especially on the Internet resources and use of the world-wide web browsers;
• easier Internet access (members of the industrial group);
• network connections for those units still without them;
• the need for high resolution monitors for display of graphics;
• ability to transfer structures electronically and communicate with other chemists both internally and externally (members of industrial group);
• the need for the same word processing package for electronic mail as for documents;
• and remote login facilities from home (for some members of the composite external comparison group).

The issue of training is complex as it involves the needs of existing as well as new members of staff. Figure 17.2.1 shows the percentage of the ICRF group who had had experience of CD databases (29.9%), in-house databases (39.6%), remote databases (24.6%), electronic mail (22.5%), and electronic bulletin boards (8.6%) prior to joining ICRF. Many included PC or Mac based data collections in the in-house databases category. Over a third (35.3%) had had no pre-ICRF exposure to electronic information sources: Figure 17.2.2 illustrates that most of these were tenured laboratory scientists, scientific officers or clinical scientists, many of whom had been at ICRF for substantial lengths of time.

Overall, of particular interest was the scientists' pecking order (4 and over on the five point scale) of the means of keeping abreast of developments in their own subject areas which
varies over time (see Tables 1 and 2 for the ICRF and composite external comparison group, respectively).

**Table 1: Formal v. Informal Communication Modes - ICRF Sample Group**

<table>
<thead>
<tr>
<th></th>
<th>ICRF Phase 1</th>
<th>ICRF Phase 2</th>
<th>ICRF Phase 3</th>
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<tbody>
<tr>
<td>Verbal Comm.</td>
<td>90%</td>
<td>90%</td>
<td>89%</td>
</tr>
<tr>
<td>Browsing</td>
<td>75%</td>
<td>77%</td>
<td>78%</td>
</tr>
<tr>
<td>Conf.s./Meets.</td>
<td>69%</td>
<td>66%</td>
<td>63%</td>
</tr>
<tr>
<td>In-House CAS</td>
<td>52%</td>
<td>51%</td>
<td>58%</td>
</tr>
<tr>
<td>Written Comm.</td>
<td>39%</td>
<td>49%</td>
<td>51%</td>
</tr>
<tr>
<td>Preprints</td>
<td>22%</td>
<td>28%</td>
<td>33%</td>
</tr>
<tr>
<td>Refereeing Docs.</td>
<td>18%</td>
<td>26%</td>
<td>27%</td>
</tr>
<tr>
<td>Online Dbs/EBB</td>
<td>6%</td>
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<td>Commercial CAS</td>
<td>5%</td>
<td>6%</td>
<td>4%</td>
</tr>
<tr>
<td>Other Sources</td>
<td>1%</td>
<td>3%</td>
<td>2%</td>
</tr>
</tbody>
</table>

**Table 2: Formal v. Informal Communication Modes - Composite External Comparison Group**

<table>
<thead>
<tr>
<th></th>
<th>Ext.Comp.Group Phase 1</th>
<th>Ext.Comp.Group Phase 2</th>
<th>Ext.Comp.Group Phase 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Comm.</td>
<td>81%</td>
<td>84%</td>
<td>88%</td>
</tr>
<tr>
<td>Conf.s./Meets.</td>
<td>54%</td>
<td>52%</td>
<td>54%</td>
</tr>
<tr>
<td>Browsing</td>
<td>52%</td>
<td>49%</td>
<td>52%</td>
</tr>
<tr>
<td>Written Comm.</td>
<td>49%</td>
<td>46%</td>
<td>52%</td>
</tr>
<tr>
<td>In-House CAS</td>
<td>46%</td>
<td>40%</td>
<td>46%</td>
</tr>
<tr>
<td>Online Dbs/EBB</td>
<td>22%</td>
<td>37%</td>
<td>44%</td>
</tr>
<tr>
<td>Refereeing Docs.</td>
<td>16%</td>
<td>27%</td>
<td>18%</td>
</tr>
<tr>
<td>Preprints</td>
<td>15%</td>
<td>19%</td>
<td>16%</td>
</tr>
<tr>
<td>Commercial CAS</td>
<td>9%</td>
<td>9%</td>
<td>12%</td>
</tr>
<tr>
<td>Other Sources</td>
<td>4%</td>
<td>4%</td>
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</tr>
</tbody>
</table>

Throughout the project period, both groups acknowledged the predominance of verbal communication (face to face or via telephone) which is understandable and perennial. The importance of verbal dialogue as an information gathering mechanism increased as scientists' experience and/or seniority increased and this relationship to career progression is illustrated below:

"Verbal is more important as you go up the scale scientifically. Then you depend more on communication and less on paper - you know more people and you know what you're doing and you can generate ideas etc., whereas when you're starting off it's all paperwork" (Phase 2 - cancer research group member).

Much of the verbal dialogue took place at meetings and conferences, although it is the content of the latter which was rated here, hence the sustained popularity of the workshop type approach, particularly in the genetics field (see below). The lack of up-to-date information presented at meetings was also of concern.
"In human genetics, more and more it’s at the big meetings that most of the collating work is actually done - because it’s a culmination of databasing things and communicating with people in groups, especially workshops" (MRC group member)

"Meetings are not worth the effort for the scraps of information you get. The Americans are very reluctant at meetings to stand up and give you their up-to-date stuff". ....... "At meetings you can talk to people but what you get is anecdotal information not backed up by methods, which you can evaluate critically". (Phase 1 - ICRF laboratory scientist)

"The bigger the conference, the less fresh information you get in that people are more defensive about what they present - you just get what they’ve published and you know that already - whereas the small informal conferences, where you make informal contacts, you pick up things that are more useful to you" (Phase 2 - cancer research group member)

The increasing usage of fax and electronic mail (substantial in the case of the ICRF group and significant in the case of the external comparison group) accounted for the rating of written communication, which rose to fourth (from fifth) for the ICRF staff sample, and which became second only to verbal communication for the composite external comparison group. Reasons given for the growth of electronic mail are listed in section 7.6. Activities for which fax (and to a lesser extent electronic mail) were employed are summarised in section 7.7.2. By Phase 3, both fax and electronic mail had become routine communication modes.

The huge increase for both groups in the use of online databases / electronic bulletin boards moved this source’s rating up to fifth (from eighth) in the case of the ICRF group and to fourth (from sixth) in the case of the external comparison group. The value of having access to databases is clearly apparent but barriers to usage included problems encountered with computer connections, operation and user-friendliness of software and, for many, the issue of training. Despite the increase in usage, the jury still appears to be out on the professional usefulness of electronic bulletin boards. Problems encountered by scientists are listed in section 7.6 and the large percentage of the sample groups not utilising these facilities by Phase 3 are noted.

The refereeing of unpublished research papers and results and the receipt of preprints also rose in importance for both groups over the period under review, although the degree of impact varied from specialism to specialism and, in the case of preprints, appeared somewhat unpredictable. Some scientists viewed the preprint as “too late” whilst others had a specific requirement for high quality graphics, as illustrated below:

"... preprints from colleagues - by the time you receive the preprint, you should know about it already" (Phase 3 - ICRF research fellow)
"Because of our requirements for looking at good photographic reproductions, we much prefer reprints but so few people return reprint requests these days, we have to make do with photocopies, which is not optimal" (Phase 3 - cancer research group member).

Refereeing was highly valued by some, despite its confidential nature, and others could see its future potential.

An interesting factor which emerged from the findings, is the effect that collaboration and competition are having on a number of these communication modes. Reference has already been made to the secrecy aspect of meeting presentations, when only published data is forthcoming, but verbal, reprint, and refereeing activities appear to be under pressure too.

"... verbal communication is increasing - because we're doing so much collaborative work and things are happening so fast - word and mouth are crucial" (Phase 2 - ICRF senior laboratory scientist)

"Preprints are becoming more important because of the work we're doing. Now other laboratories are in direct competition with us" (Phase 3 - ICRF senior scientific officer)

"I rate refereeing quite highly, although theoretically confidential - but once you've read it, you've read it" (Phase 3 - ICRF senior laboratory scientist)

"The standard of papers I have had to referee have not been so brilliant - but I can see that that could become important in the future" (Phase 2 - ICRF research fellow)

The industrial component's relatively small involvement in published papers needs to be borne in mind when considering refereeing and receipt of reprints.

Uptake of current awareness was perhaps not as high as expected but this is probably related to the continuing high rating given to the browsing of current journals, which was rated second throughout the period, by the ICRF group, but slipped from third to fifth for the composite external comparison group. Besides the psychological satisfaction and serendipity aspects of browsing (a detailed consideration of which are outside the scope of this research project), the latest issue of a journal on the library shelf is often more current than the available current awareness services (see section 8.7).
CHAPTER 8
8. Conclusions

In 1986, in their chapter on information needs and uses, Dervin and Nilan (1986) pointed to the dichotomy between the system perspective and the user perspective. In 1995, the JISC (1995b) in their guidelines for developing an information strategy observed that often technological investment had been made by academic institutions without the necessary accompanying changes in working practices, attitudes and behaviour. Sugar (1995) endorsed Dervin and Milan's view and concluded that by the mid-1990s there had been a paradigm shift from the system perspective to the user perspective, with a resulting need to design and redesign systems that focus on user needs and that required analyses of users, their needs, and their habits. This research project has attempted to contribute to the overall picture by examining an operational situation via a case study approach.

The aims of this study were:

• to ascertain to what degree new information technology developments are altering the way laboratory and clinical research scientists handle bibliographical and textual information in the conduct of their work
• to explain the nature of any impact
• to develop a framework for the measurement of any impact
• and to assess the implications of these findings within the framework of this case study and briefly to suggest their relevance to library and information services generally.

The extent to which information technology developments are affecting the way research scientists handle bibliographical and textual information, from the perspective of perceived value or benefit based on subjective evaluation by users, is documented in chapters 5 to 7. This chapter assesses the implications of these findings and alludes to their relevance for information practitioners and/or their services.

The results of this study:

• confirm the often intensely personal nature of information handling and its accompanying lack of management
• highlight the effect of rapid change, such as that created by continuing developments in the technology, during longitudinal studies in information science
• update previous research on the uptake of electronic means of identifying references as part of research scientists' information-seeking activities across sectors
• update previous research findings concerning the transfer of research results by electronic means across sectors
• reveal indications of an “upstream learning” phenomenon from junior to senior researchers
• identify the preponderance of systems barriers to effective use of the technology by users
• establish that CAS-IAS services lack the currency required by scientists in fast moving bio-medical fields, hence their continued reliance on browsing current journals
• indicate that an access rather than a holdings provision will not solve the budgetary problems of libraries relating to journals
• endorse the view that more LIS resources need to be invested in user education and information services because of the growth of electronic information sources and the complexity of information skills required to use them effectively
• quantify information overload in terms of the amounts of information scientists generate and receive
• and rank scientists’ perceptions of the importance of informal versus formal modes of communication in keeping abreast of developments in their own subject areas.

8.1 Personal Nature of Information Handling

An individual’s information handling habits and the reasons for them are obviously considered very personal matters by some scientists, and many found difficulty in talking about them. A few responded by confining their answers to the minimum information necessary to sustain the interview, or made off-the-cuff remarks such as “relying mainly on memory”: a number resisted questions relating to a breakdown of their time (classing it all as research) or challenged the terminology used in the questions put to them (which differed from other scientists who genuinely had problems with the terminology used in questions). All these responses were probably self-defensive mechanisms but, in general, the dialogues improved as scientists relaxed over the project period.

Barry (1997) found the same reticence amongst academics in the Information Access Project.

“.... it became clear that the academics are not consciously aware of their information behaviour: it is an unspoken activity in academic research. This manifests itself in methods of information retrieval not being discussed with colleagues and participants finding it difficult to discuss in research interviews”.

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She maintained that there is a low awareness of the increased need for information handling skills once technology is involved, both for the academics themselves and for their students. She concluded that the key reasons for this lack of awareness of necessary change are the lack of the requisite information skills among academics and the degree to which information activity is a tacit skill. Certainly, information professionals are well acquainted with users such as academics, who are experts in their particular subject areas, but have difficulty in admitting insufficient knowledge of sources and searching mechanisms. One ICRF head of laboratory during Phase 1 asked in hushed tones how other heads of laboratories managed [to keep abreast of developments], obviously feeling embarrassed that he felt that he was fighting a losing battle. Responses to such obvious pleas for help need to be handled with care but are synonymous with lawyers’ reluctance to admit unfamiliarity with the workings of Halsbury’s Laws or to a chemist not knowing how to search Chemical Abstracts. The strengths of the semi-structured interview as a research technique are apparent in such user encounters. Interestingly, other scientists commented that they found this annual interview, plus its accompanying in-depth dialogue, useful either as a reminder to make a request (for example, a required change to a subject current awareness profile) or as an opportunity to receive an update on new developments and facilities of potential interest. These varying attitudes to discussing information handling techniques are not confined to dialogues with users in the bio-medical area and information practitioners must remain mindful of them when undertaking research of users’ needs and habits in any subject area.

It was apparent that few heads of laboratories or of groups perceived that it might be necessary to manage their laboratory staff’s access to, and acquisition of, information in the same way as they managed other resources, except when the catalyst was identified as direct cost, such as in the introduction of charging for document supply (see section 8.7). There were, of course, a number of examples of shared laboratory current awareness profiles but very few examples of liaison in the acquisition of photocopies of journal articles or maintenance of a joint store of them. Much of this reluctance had to do with the labour intensive nature of the maintenance involved in such systems. The development of laboratory reference handling databases seemed to indicate a possible way forward but, by the close of the project, many laboratories had reverted to a database of references for each paper rather than a comprehensive database of references, either because of their large size or because of the manpower effort involved in maintaining them. Indeed, with the advent
of MEDLINE to the desktop, some laboratories ceased to maintain a laboratory reference handling database in favour of utilising MEDLINE as a substitute.

8.2 Rapid Change in Longitudinal Studies in Information Science

A key feature of this study was its longitudinal nature which indicated the rate of change over the project period. It has long been recognised that the concept of time has far-reaching implications for information science research. A decade and a half ago, Brember (1982, 200-201) conveyed this well.

"Information-seeking behaviour can be viewed as the result of many factors which are in a continual state of change. This phenomenon applies to any study of humans. ... The significant feature is the rate of change of these factors with time. ... The effect of change means that some facts are only valid in relation to the time at which the research was done".

More recently, Palmquist (1992) has concluded that a partial explanation of why so little research has been undertaken concerning the impact on the individual of the new technologies is that "the impact can only be felt over time". Information technology is definitely a factor which changes quickly and its impact can be dramatic.

One consequence of rapid change during longitudinal research studies is that a questionnaire drawn up in 1992 at the start of a study, can be outdated in some aspects in 1995 at the end of the study. It was difficult in 1992 to predict the quick rise to dominance of one software company in the office software field or the growth of firstly gopher and then world-wide web technologies, and to anticipate what grouping of questions would be appropriate throughout the project period. For example, with hindsight, the importance of accessing information from online databases would not have been coupled with the importance of information gathered from electronic bulletin boards. Similarly, the specific question relating to the impact of information technology developments on the information handling techniques of scientists would have been broken down into the effects of different facilities (for example, current awareness, online databases, electronic requesting of documents etc.); the question on perceived impact of fax and electronic mail as factors in increasing information gathering or communications activities would not have been so close to the electronic mail activities question; and questions 15.1 to 15.3 would have been integrated with other questions. Another consequence of longitudinal studies where rapid change occurs is that any misappropriate grouping of questions or omission of questions is exacerbated by the delay in reporting the studies’ results, particularly when the
researcher is undertaking the study on a part-time basis. In short, five years can be a long time in information science research!

Finally, the collection of quantitative data relating to rapid change during longitudinal studies can also be fraught with difficulties, as reported in section 2.7. Factors such as reliance on the staff of another department, constant upgradings of monitoring software, changing communications technologies, staff turnover, and human error, all of which are outside the researcher's direct control, can contribute to incomplete, inconsistent or unreliable data series. Fortunately, in this project, the statistics included in section 2.7 are intended as background information only.

8.3 Employment of Electronic Means of Information-Seeking

The Royal Society (1993) study (referred to in section 1.4.4) and the follow up studies in the biological sciences (Rolinson et al., 1995; Rolinson et al., 1996) all reported after the start of this research project and utilised overlapping questions within certain parameters to enable comparisons to be made between results. Although the results of the present project are not directly comparable with earlier studies and the institutions involved here are concerned mainly with modern biochemistry, certain developments are clear across sectors. The view that there is a "... generally low level of networked activities (including electronic mail), except at the pharmaceutical laboratory" (Rolinson et al., 1995) is now updated. Findings from this project reveal that:

- of those scientists receiving current awareness output directly, there was an increase in the number in both groups receiving output in electronic form over the project period (71.1% to 73.7% in the case of the ICRF group and 18.9% to 36.1% in the case of the composite external comparison group - a 2.6% and a 17.2% rise respectively);
- both groups displayed an increase in electronic document requesting over the project period (42.5% to 54.5% in the case of the ICRF group and 5% to 36.8% in the case of the composite external comparison group - an 11.7% and a 31.8% rise respectively) - convenience, efficiency and simplicity were the reasons given by scientists in both groups for requesting electronically;
- both groups demonstrated a percentage increase in the use of reference handling packages over the project period (52.4% to 72.7% in the case of the ICRF group and 30.9% to 47.1% in the case of the composite external comparison group - a 20.3% and a 16.2% respectively);
both groups reported an increase in the number of scientists who loaded data from other sources into their reference handling databases over the project period;

both groups exhibited a considerable percentage increase (23.5% to 46% in the case of the ICRF group and 39.7% to 60.3% in the case of the composite external comparison group - a 22.5% and a 20.6% rise respectively) in end-user searching of remote databases/databanks and a correspondingly large decrease (from 26.7% to 6.4% in the case of the ICRF group and 25% to 13.2% in the case of the composite external comparison group - a 20.3% and an 11.8% drop respectively) in mediated searching via LIS staff;

both groups demonstrated percentage increases in the usage of electronic mail (61% to 84.5% in the case of the ICRF group and 45.6% to 88.2% in the case of the composite external comparison group - a 23.5% and a 42.6% rise respectively) over the project period. (This increase in electronic mail usage is evident in all categories of staff in the ICRF group and in all sectors of the composite external comparison group, although usage was at a high level in the industrial group from Phase 1).

both groups showed percentage increases in the usage of electronic list servers and bulletin boards (29.4% to 44.9% in the case of the ICRF group and 19.1% to 36.8% in the case of the composite external comparison group - a 15.5% and a 17.7% rise respectively) over the project period. (This increase in usage of electronic list servers and bulletin boards is evident in all categories of staff in the ICRF group and in all sectors of the composite external comparison group, although usage was at a high level in the industrial group from Phase 1).

both groups demonstrated a percentage increase (from 15% to 34.2% in the case of the ICRF group and 22.1% to 33.8% in the case of the composite external comparison group - a 19.2% and an 11.7% rise respectively) in remote file transfer over the project period;

and the ICRF group exhibited a slight increase (from 16.6% to 20.9%) in the use of remote login whereas the composite external comparison group’s use remained fairly constant (23.5%) over the project period. (With the exception of the industrial component of the composite external comparison group, both groups increasingly conducted interactive sessions with genome, molecular biology, bibliographic, clinical and family databases and datasets. In the case of the ICRF group, other interactive sources mentioned related to software acquisition and collaborative or personal computer accounts at other national or international universities and institutes).
Clearly this trend towards direct retrieval of electronic information (particularly searching online databases and using personal bibliographic indexes) by end-users rather than retrieval via intermediaries, had commenced before the start of this research project and indicates that the conclusions of an earlier study (Bukhari and Meadows, 1992) into the use of IT by scientists in universities underestimated the rate of growth: "... the moderate growth-rate suggests that it will be some time before personal information retrieval of this type becomes the norm". In addition, the mode of access to some of these remote resources changed from telnet in Phase 1, to gopher in Phase 2 and to web access by Phase 3. These results can be related to the growth in usage of the BIDS ISI dataset on JANET, where sessions increased from 2,295 per day in 1992/93 to 4,746 per day in 1994/95 (JISC, 1996), and to the reported expenditure of universities on database access between 1992 and 1994 referred to in section 1.3.2 (East and Tilson, 1993; East et al., 1995). Furthermore, the present project confirms the move away from mediated online searching noted in other studies (see section 7.5).

8.4 Employment of Electronic Communications in the Communication of Research

With the exception of the industrial component of the composite external comparison group, much of the file transfer activity of both groups involved sequences from molecular biology databanks and public domain software from a variety of sites. During the period under review, both groups increasingly transferred text and data with collaborating institutions, particularly of a co-authored paper or of a joint grant application nature. The ICRF group mentioned the transfer of documents, genetic and image data from ftp servers and archives, and the downloading of conference information and the full text of journal articles as well. There was a marked change in the method used for the transfer of text and data. In the early stages, ftp was the preferred mode but latterly this had been overtaken by electronic mail attachments (and now included sending papers, particularly to publishers of review journals). Although the industrial component of the composite external comparison group was not generally active in remote login and remote file transfer activities via JANET or the Internet, there was increased file transfer and communication within the companies on an international basis via their own private networks.

These findings update previous studies (Meadows and Buckle, 1991; Ellis et al., 1993), referred to in section 1.4.4, which found that the impact of electronic communication on the scientific communication of academic research in the UK in the early 1990s was negligible.
The scale of these activities is reflected in the growth in the volume of ICRF network traffic (referred to in section 2.7) and the rise in JANET network traffic from 25 gigabytes per day in 1992-93 to over 100 gigabytes per day in 1994/95 (JISC, 1996). Moreover, this present project highlights interviewees’ growing confusion with which specific facilities they were actually using, as exemplified by an ICRF senior laboratory scientist in Phase 3. He explained how he might find out from a bulletin board that someone had put up a web page on something that he was particularly interested in, so he would then access the web page rather than the bulletin board. He felt that it had become a bit of a “mish-mash”, hard to identify what resources he was actually using. This growing user-friendliness of services increasingly masks the facilities utilised. With firstly gopher, and then world-wide web services, file transfer is an easy and implicit part of the protocol, so easy and transparent to save or print from remote files that scientists are often unaware that it is technically a file transfer transaction.

Information professionals, engaging in dialogues with users, need to bear these points in mind as feedback from users can often be confused or misleading. Continuing monitoring of users’ activities with file transfer, as well as with other electronic forms of communication such as electronic mail and bulletin board access, is necessary in order to establish whether trends become discernible and to aid user education and training.

8.5 Evidence of “Upstream Learning” Phenomenon

There are also indications that previous assertions that “senior staff” are “more information active across the board” (Rolinson et al., 1996) have started to be eroded. This is particularly evident in the growth of usage of electronic mail where senior staff are now much more accessible to junior staff, generating an “upstream learning” phenomenon. In Phase 3, a MRC group member commented that most senior scientists now received and sent electronic mail whereas, previously, it had been mainly post-docs and students. An ICRF senior laboratory scientist maintained that, with electronic mail, it was possible to receive a message from someone unknown to you and engage in a very friendly exchange that one could not do by letter and one would not want to do by telephone. These developments are related to the increase in international electronic mail traffic over the project period, which reflect, for example, the reported acceleration of international collaborations and co-authoring of papers and the growth in professional and personal correspondence.
Another area where peers and senior staff are being led by junior staff is in the area of accessing online databases/databanks and Internet resources. The traditional phenomenon of being shown something, such as a laboratory technique or method, by a laboratory colleague (research fellow, graduate student or scientific officer) is still alive and thriving, for example, being shown how to use a new program, or how to access a database or how to retrieve a clinical image from the Internet. In addition, there were a number of examples of laboratory reference handling databases being set up and maintained by contract research fellows or scientific officers and usage by other laboratory members emanating from induction by them.

8.6 Preponderance of Systems Barriers

It is clear from chapters 5 to 7 that information technology developments did alter the way laboratory and clinical research scientists handled bibliographic and textual information between 1992 and 1995: for example, in end-user searching of remote databases/databanks and in the usage of electronic mail. This increase in electronic usage is integrally linked to the development of more user-friendly interfaces, such as the Eudora and PINE electronic mail programs and Windows-based or web-based interfaces to databases and databanks.

However, throughout the project, it was apparent that scientists emphasised actual or perceived systems barriers to utilising electronic information: these included lack of network connections, network problems, not enough machines, changing file transfer programs, user unfriendly electronic mail programs, and slow or non-existent access to web-based browsers for accessing Internet resources. This emphasis on systems barriers was allied to scientists' perceived lack of information or training (see section 8.9) concerning new facilities, such as utilities programs or Internet access. Examples of reported problems included installation by computing staff of Fetch and/or Gopher on machines without informing scientists or showing them how to use the programs (ICRF and university group members); not having heard of gopher or web servers, but interested in these developments (all groups); eagerness to know more about the Internet and whether it would be useful (all groups); and lack of up-to-date information on web browsers (all groups).

It must be pointed out that the rapid pace of technological and systems development is not only a problem for users, but is also a problem for LIS staff (studies such as the IMPEL2 project should help to identify the LIS issues to be addressed here) and, more generally, for
some of the projects in JISC's Electronic Libraries Programme, as evidenced by extracts from a synthesis of the 1996 project annual reports (Tavistock Institute, 1997, 2, 35).

"...the rapid pace of technology development had already overtaken some projects, prompting them to leap-frog over existing technologies to new web-based solutions".

"The milestone in the second stage has not been reached............with the rapid expansion of use of the WWW....we needed to bring in a web element earlier than had been originally planned. The functionality change caused major disruption to the project timescales...."

The LIS staff aspect is outside the scope of the present project but would be a useful topic for future research.

Supplementary questioning in the course of the research revealed that the following systems issues were common matters of debate across sectors:

- the moves to PathWorks and to TCP/IP protocol (cancer research and industrial groups),
- timing of Windows introduction and Windows environment encouraging use (ICRF, cancer research and industrial groups),
- the move to UNIX (ICRF, cancer research and industrial groups),
- the incorporation of DEC Alpha machines (ICRF and industrial group),
- the move to NT server software (ICRF and industrial group),
- standardisation of hardware and software (all groups),
- CD networking problems (all groups),
- performance of applications problems (ICRF and industrial group),
- and problems of Internet access (all groups).

By Phase 3 of the project, all sectors had standardised to some extent on office software, the majority deciding on the Microsoft Office suite of programs (ICRF, MRC (most) and industrial groups). It might be thought that the industrial group would have fared better with the problems than other sectors but comments do not support this view. Reported issues included the web browser Netscape becoming the preferred option in June 1995 whilst the existing company standard was Mosaic; and the growing problem of preventative maintenance at the desktop with so many systems available on the desktop PC for (example, the installation of Microsoft Office package 4.2 which took out the connectivity of other packages). The merger of the two companies forming the industrial component brought further compatibility problems: one company had networked their CD-ROMs via PathWorks, the other had networked partly via PathWorks and partly via Novell Netware; one company was utilising Documentum for document management
whilst the other was using Interleaf; and one company had a collection of Oracle databases whilst the other possessed Ingress databases.

Undoubtedly, the cost to institutions of networking (often multi-site) buildings, purchasing a growing number of machines (PCs or Macs or both), implementing a hardware replacement strategy, and embracing changing software standards has been phenomenal, both in monetary and manpower terms. Moreover, developments in the academic sector, such as the Funding Councils’ requirement for institutions to produce an Information Strategy to support teaching, learning, research and management, and the increasing convergence of library and computing services, highlighted by Follett (Joint Funding Councils’ Libraries Review Group, 1993), should help the balance of information content versus the delivery mechanism. The skills of information practitioners will be required by institutions if they are to handle these organisational information developments successfully.

In summary, a pragmatic view, endorsed by the findings of this study, is as follows. “Technology moves at a rapid pace; human beings pant along some way behind; and human institutions change at an even slower pace” (IMO, 1994, 5). Information professionals have the opportunity to be facilitators in this organisational management of change. It is yet another challenge and so important a one that it is essential that they seize the initiative before the opportunity passes by.

8.7 CAS-IAS Services and Document Supply

It is clear that any anticipation information practitioners might have had that the mushrooming CAS-IAS choices of the early 1990s would result in a proliferation of services which would offer more choice, would be easier to evaluate and would be cheaper, has not come to fruition - nor is the situation likely to change in the near future.

The principal development since the start of the project period has been the link between document supply (often via full-text journals) and some of the alerting services (see Appendix 5 for a mid-1997 overview of suppliers). Other developments include the proliferation of tables of contents services plus selected abstracts, the move to utilisation of web technology both as an ordering and delivery mechanism, html becoming established as the preferred format for tables of contents and abstracts and PDF the favoured format for full text delivery, and the continued expansion of projects, especially those in JISC’s Electronic Libraries Programme. In fact, the market place remains as fluid as ever with
even established players, such as the British Library and the Institute for Scientific Information, rethinking their strategy and approach.

In this project, the copying of articles as a result of browsing before alerting by current awareness output was a common factor identified by both groups. As mentioned in section 1.3.3, this currency issue is only one aspect information practitioners need to consider when choosing or evaluating CAS-IAS services but remains an important issue in view of the growing importance of currency to scientists expressed over the project period:

- of those scientists receiving current awareness output directly, currency of data was perceived as increasingly important by both groups (from 60.5% to 80.5% in the case of the ICRF group and from 62.2% to 83.3% in the case of the composite external comparison group - a 20% and a 21.1% rise respectively);
- and the increasing interest expressed by both groups in the availability of electronic abstracts before the appearance of the print publication (53.5% to 63.6% in the case of the ICRF group and 38.2% to 67.7% in the case of the composite external comparison group - a 10.1% and a 29.5% rise respectively).

Scientists' growing concern with currency reflects the increasing competition and accompanying secrecy between international groups on the one hand, and the increasing pressure to collaborate internationally in pursuit of successful grant application funding on the other (see section 8.11).

Reference has already been made to the series of CAS-IAS currency surveys undertaken by ICRF LIS staff and ex-staff between September 1993 and March 1997 (see section 7.2). It is apparent from Figure 0.5.1 that the shelf issue reigns supreme in currency terms in a number of cases up until mid-1995. The shelf issue and the services equate in currency for an increasing number of titles up until early 1995. The relatively poor performance of the services in the currency game in the 1993 and 1994 surveys is reversed from late 1995 when, in an increasing number of cases, the services (aided by the publishers' web pages) are ahead of the latest shelf issue in currency terms. Despite fluctuations (for example, shelf issue percentage in March 1995), Figures 0.5.2 to 0.5.4 show this progression from shelf issue strong from 1993 to mid-1995, shelf and services increasingly equally current up to early 1995, and the services improving their performance from late 1995 to date. Over the period September 1993 to March 1997, the shelf issues decline in being more current than the alerting services from 50% to 16% of the sample group of titles; the shelf issues being as current as the alerting services increase from 36% to 68% (in October
1995) and then decline to 37% by March 1997; and the alerting services being more current than the shelf issues increase from 14% to 47% of the sample group of titles.

The inclusion, from the October 1995 survey, of publishers' web pages for titles with table of contents data (plus abstracts or full text of some) greatly assisted the "alerting services" side of the equation. Nine out of nineteen journals in the October 1995 survey were available via the web (of which four showed the latest issue overall); ten out of nineteen journals in the 1996 survey (of which eight showed the latest issue overall); and by the 1997 survey this figure had risen to seventeen out of nineteen journals (of which eight showed the latest issue overall).

Despite these developments, by the first quarter of 1997, in over 50% of cases in the sample group of titles, the shelf issue was more current, or as current, as the alerting services (and this included the publishers' web pages, a number of whom advertise as offering pre-publication details). The relatively slow progress of publishers in making available bibliographic details of articles with abstracts to the academic community in electronic form, in a timely, comprehensive, affordable and easily accessible way, together with the growing importance of currency to many of them (see section 7.1), are major factors in researchers' continued reliance on browsing current journal issues. In addition, because many suppliers operate document supply as well as current awareness services, CAS-IAS services have become part of the access versus holdings debate (see section 8.8).

The issue of charging for document supply is fraught with difficulties for information practitioners and, although a widespread practice now in UK academic institutions (Clinton, 1995), its introduction (full cost recovery for external requests and partial cost recovery for in-house held journal requests) at ICRF during the course of this project caused confusion and concern amongst many ICRF scientists, particularly those based at remote sites. Typical views expressed included: not understanding the logic of charging for some services and not others; displeasure about the extra costs incurred without corresponding increases in laboratories' budgets; annoyance at the implication that if the journal was not held, one could do without it; anger at the increase in secretarial time spent photocopying and the limitations of the copyright legislation (where multiple copies of one paper or more than one article from a journal issue are not permitted); and the lack of cost saving in that in one case, for example, as much was being spent sending secretaries in taxis to the university library on the other side of town with batched requests.
Although the principle of institutions fully recovering the costs of in-house and external document supply services, particularly in times of economic constraint, is understandable, factors such as money coming from the same pot, economies of scale (especially in the case of multi-site institutions), the cost of alternative supply methods, and an evaluation of the effects of, for example, not consulting the wider literature because of cost, need careful consideration by senior management at institutional level. The authors of a study (Dyer and Bouchet, 1995, 50) on the perceived value of information retrieved via end-user searching of CD-ROMs and mediated online searching, published in the final year of this project, made the following observation.

“As budgets for journals continue to get squeezed, it may be important to consider whether the argument, that improved access to indexing systems assists users to locate the best articles for their needs more precisely, still holds true if at the end of the day the full text is no longer at hand for consultation”.

8.8 Access Versus Holdings (including Electronic Journals)

Access models of provision entail reliance on inter-library loan or commercial document suppliers rather than on in-house holdings. Experiments carried out by ICRF LIS staff during the course of this research with various document suppliers proved that this mode of acquisition was too expensive to be depended on entirely and that a balance needed to be struck between access and holdings. Cranfield University's BIODOC (BIotechnology and DOCuments) Project (Evans et al., 1996) found that an unlimited access policy (involving cancellation of all biotechnology journals and reliance on UnCover Reveal current contents service and various document suppliers) cost more than the journal subscription and inter-library loan system it replaced. The FIDDO (Focused Investigation of Document Delivery Options) Project (Morris et al., 1997) concluded that current electronic document delivery provision (to the desktop) is disappointing, that this poor provision by suppliers makes it impossible to conduct “live evaluation work in the context of an ILL facility”, and queries whether services are more a foe than a friend to information practitioners at the present time.

The development of electronic versions of journals is clearly related to this access versus holdings issue. The present project has shown that, by Phase 3, over 90% in both groups would utilise full-text electronic versions of journals, although very few journals in electronic form were available (potentially) to the sample groups in 1995 during the final months of the project (for example, Elsevier’s Immunology Today, Current Science's Current Opinion Series, the Journal of Biological Chemistry, the Online Journal of
Current Clinical Trials, and selected articles from, for example, the British Medical Journal and Protein Science, in the case of the majority of members of both sample groups, and CAS' SciFinder, in the case of some members of the industrial group, who were participating in the beta test of the software). These results confirm Brunskill's findings (based on a survey of academics at Aston University) that "the idea of accessing journals electronically ... is not as unpopular as might be expected" (Brunskill, 1996, 30). Participants in both surveys emphasised the desire for electronic journal systems which were easily accessible (for example, via the web with UK or European mirror sites for required speed of access), and collections which were as comprehensive as possible. The present project has also revealed the general lack of involvement of editorial board members in both groups in the electronic journal debate concerning the journals on whose editorial boards they sat or lack of due consideration being given to the topic, typical comments being "I am not involved in the production side with any of the journals I'm concerned with" (Phase 1 - ICRF senior laboratory scientist) and "There was an editorial board meeting about a month ago where the issue of electronic journals was raised but there was no great enthusiasm for it" (Phase 1 - cancer research group member). However, during Phases 2 and 3, besides the SciFinder trial, a few members of the cancer research group were beta testing Elsevier's Immunology Today and an ICRF editorial board member stated that his new journal would accept ftp'd and electronically mailed papers.

Reference has already been made (see sections 1.3.1 and 1.3.3) to FIGIT's attempts to pump-prime the development of electronic journals, most notably the funding bodies' arrangement for certain publishers to make their printed journals available at discounted prices together with a range of electronic material. Some publishers have been offering electronic versions of their journals directly themselves or via gateways, the electronic version being priced separately or offered at a discounted price, provided both print and electronic versions are subscribed to. Both developments offer little comfort to information practitioners in the academic sphere in that the Funding Councils' subsidy will not last indefinitely and access to electronic versions of journals usually costs more than was paid previously by libraries for access to the printed format.

Line (1995), in his discussion on whether access could be a substitute for holdings, emphasised the reality of the publishers' situation.

"Publishers will not readily surrender the profits they are making from printed journals and books and, although they will welcome an additional source of income from the sale of individual articles (and are already beginning to enjoy such an income), they are unlikely to give up publishing printed versions unless they can make a greater profit
from supply on demand. There is always the possibility that a publisher will offer items on demand at a lower than cost price for a time to capture the market, but only the richest publisher would be able to do this for more than a few months”.

The report (Commonwealth Higher Education Management Service, 1997, 4) on Phase 1 of the evaluation of the UK pilot site licence initiative endorsed this view by identifying three possible options for the future: expanding the present scheme (with some modifications) with more publishers; devising a replacement scheme which requires less financial support from the funding bodies; and terminating the present scheme with some transitional support. The report noted that whatever “exit strategy” is decided upon, “the transition to normality at the end would require considerable care”.

The literature continues to abound with varying views on a way forward. Oppenheim (1996b) warned Naylor (1996) not to give up the exceptions to copyright included in the Copyright Act and recommended that any licence deal concluded with any copyright owner should specifically state this. Friend (1996) claimed that the UK Pilot Site Licence Initiative “is an attempt to remedy one of the problems with the current system, rather than change the [scholarly communication] system itself”. Bainton (1996) argued that the key to scholarly communication is prestige, that excellence in each discipline is controlled by the discipline in the form of editorial boards, and that members of those boards “will not easily declare independence from the prestigious journal from which they themselves gain great prestige”. Nevertheless, it is strongly recommended by this researcher that the case for retention of copyright by the relevant funding or institutional body be re-examined: it is the academic community’s ace card in any negotiation with publishers. The Dearing report’s (National Committee of Inquiry into Higher Education, 1997, 209) recommendation that the Government “should review existing copyright legislation and consider how it might be amended to facilitate greater ease of use of copyright materials in digital form by teachers and researchers” is a positive sign.

8.9 User Training and Education

With the growth of electronic information sources and the increased complexity of information skills required to use them effectively, there is a need to invest more time and effort in user education and information services. A recurring comment from scientists throughout this project, as from other projects (for example, Laribee and Lorber, 1994; Rolinson et al., 1995), was that they did not know what resources were available to them and that they perceived this to be an obvious barrier to usage. On the other hand, the
present project revealed that many scientists, particularly those at remote sites in the case of ICRF, did appreciate the efforts made by their LIS staff to address this problem, one stating that "... of the central services at ICRF, LIS has made more effort than anyone else to get our attention and say what's available".

Nevertheless, most information professionals probably feel that more time is now devoted to user education and training than ever before (including their own continuous updating and evaluation of facilities and resources) and that they are doing this within existing or diminishing resources. Strategies devised by information practitioners to cope include the use of self-help or resource-based learning tools, and the outsourcing of traditional library preparatory processes of classification, labelling, security tagging etc. in efforts to achieve the required re-distribution of staffing resources for training. Projects (many funded by JISC's Electronic Libraries' programme and referred to in section 1.3.2), such as NetSkills, EduLib, TILT (Teaching with Independent Learning Technologies) and TAPin (Training and Awareness Programme in networks), have assisted the situation by: the development of a training skills programme, the organisation of a network of librarians with networked information skills and information teaching skills, the creation of software to assist in the training of end-users, and the development of a training programme for information staff raising awareness of networked information resources appropriate to specific disciplines. Institutions have often responded by introducing charging for document delivery to help control what they perceive to be uncontrollable demand for references retrieved by electronic searching (see section 8.7). This relates to the access versus holdings debate (see section 8.8).

Practitioners are well aware that one-off induction training programmes for new staff or students have long been insufficient to address the training needs of end-users of electronic information systems, and have adopted a range of supplementary measures from one to one or small group sessions to workshop sessions on particular topics (for example, formatting theses and management of references). Appropriate liaison with computing services' colleagues has not always been easy either, hence complicating the training picture. Perhaps the most difficult task of all is to convince end-users of the necessity of training. Many users do not consider their return high enough to warrant their investment in time and effort needed to learn the methods.
Barry (1997) rightly believes that academic staff and students need to take responsibility for their learning in this area and maintains that "The responsibility for training students in information skills should become part of the guidelines for research supervision produced by research bodies and universities". The recently published Dearing report into UK higher education (National Committee of Inquiry into Higher Education, 1997, 133) defines "the use of information technology", which includes information skills, as one of four "key" skills (the others being "communication skills", "numeracy" and "learning how to learn"). The report maintains that these "key" skills are "key to the future success of graduates whatever they intend to do in later life" and (as noted in section 1.1) are related to the UK's ability to compete effectively in the next century and to the country's economic prosperity. Whilst pointing out that schools and colleges also have a responsibility for the development of these skills, the report recommends that institutions of higher education develop admission procedures that value good levels of competence in these skills. Until these developments materialise (and to address the needs of existing tenured or contract staff - see section 7.8), information professionals need to evaluate their training methods, to attempt to gain feedback from users on the most appropriate and successful methods (particularly via regular dialogues with heads of laboratories or departments), and to share results with colleagues so that mutual benefits accrue to users and institutions.

8.10 Information Overload

The increase in the number and size of journals is a reflection of the increase in the amount of research being done and the pressure to publish. The present study illustrates the current situation well where scientists are generators and recipients of this "information overload". As summarised in section 7.2, the majority of scientists in both groups published 10 or fewer papers per year, the larger proportion (48% in the case of the ICRF group and 48.5% in the case of the composite external comparison group) by Phase 3 publishing 5 or fewer papers per year. Both groups cited 6 to 10 titles as core to their research area, an increasing percentage of scientists stating that they were referees for some (in a few cases all) of their specified core journals. Browsing focused on core and review journals (ICRF scientists specifying that between one and two hundred citations were usually scanned per week).

Strategies (such as intentionally becoming more selective, or becoming more selective because of pressure of time or charging for document supply, or levelling off after provision of abstracts or because of desktop access to MEDLINE and Internet resources)
reportedly devised to deal with the amount of information and the perceived lack of time available to do so resulted in:

- an increasing percentage in both groups who copied fewer than five articles per week, whatever the method of alerting (by Phase 3, an increasing number were copying only the front page of the articles containing the abstract);
- and a growth in personal and laboratory subscriptions amongst the ICRF sample group, many scientists reporting that they did not copy articles from journals they held in their laboratories.

The issue of charging for document supply has been discussed in section 8.7.

Many scientists experienced difficulties in separating their browsing and reading activities, and hence their quantification in terms of time. Both groups perceived that their browsing activity decreased over the project period but this is not borne out by the figures: the majority of scientists spent fewer than two hours browsing per week; and over 50% of scientists in both groups spent fewer than 4 hours reading the literature each week (see section 7.2). A cancer research group member summed up the sentiments of many scientists towards “information overload” well when he commented that it was not a case of saying what he should read and what he should not read but, rather, which of the twenty papers that he should read did he absolutely have to read.

Reference was made in section 1.3.1 to rejection rates of articles submitted to journals reported in the literature. This project indicates the rapidly changing picture, as evidenced by the experience of one of the ICRF scientists, who was the editor of a non-commercial journal. During Phase 2 she explained that, as authors are under more and more pressure to publish in good quality journals, the submission rate of her journal had increased unbelievably and the acceptance rate had plummeted that year. She went on to say that the journal was accepting about 55% of papers the previous year, but that currently only 40% were being accepted. She anticipated that the acceptance rate would be under 40% by the end of the current year but that she would not want it to go below about 25%. However, she realised that going from 50% to 40% in under a year was a big change and meant a lot of upset authors. She concluded that when the choice is one paper in a good journal or several papers in less good journals, scientists will often opt for the latter.

This opting for one paper in a “high impact” journal may be reflected in the slight decrease (from 1043 to 891) in the number of papers published by ICRF authors in journals
between 1991 and 1995 (see Figure 0.7.1). Although articles were published in between 300 and 400 different journals each year, Figure 0.7.2 indicates the top twelve journal titles (containing twelve or more papers per title each year) in which ICRF authors published between 1991 and 1995. The impact factors for these titles ranged from 2.0, for the European Journal of Cancer, to 40.4 for Cell (Journal Citation Reports, 1996). Trends reflected over the period include the publishing of more papers in EMBO Journal, Journal of Biological Chemistry and Journal of Cell Science, less papers in European Journal of Immunology and Breast Cancer Research and Treatment, and sustained publication in the mainstream bio-medical journals (Nature, British Medical Journal and Lancet) and in cancer specific journals (British Journal of Cancer, European Journal of Cancer and Cancer Research). The link between an institution's publication record and cited core journals is also clear. Core journals will often be the journals scientists try to publish in (and may referee for), and new journals, which become successful, will also attract publications.

Hamden (Annual Research Report 1994, 1995, 23) emphasised this publication dilemma faced by scientists, as expressed below.

"The quality of work of a research institute is judged largely on the output of published papers in refereed journals or, more specifically, the number of papers in 'high impact' journals". "It must be recognised, however, that it is often more appropriate to publish in a highly specialised journal (where the paper will be refereed by specialists in the field) than to offer it to one of the journals at the top of the 'impact factor' list".

Reference was made in section 1.3.7 to the publish or perish scenario. In this project, a number of radical opinions were expressed concerning journal publication. These included getting rid of all obscure journals and going back to having just ten journals, as articles published in obscure journals are not worth publishing; and limiting all authors to one paper per year as the way people's names get on to papers is rather bizarre and does not show the level of input to a work, even though it is the major means of assessment. More generally, one cancer research group member reflected the view of many authors by stating that the minimum publishing unit is purely a fault of publication counting and CV building but that he was caught in the same trap. He found himself writing papers when he really needed another six months to write them properly - but if he waited, it would be too late for his CV and the work would be written by someone else in this incomplete form. This is related to the controversy about the reportedly high percentage of uncited papers (referred to in section 1.3.7) and to questioning of whether much of the research being done is worthwhile at all. Whilst information practitioners cannot alter this publishing scenario,
they need to keep abreast of their institutional publication record and be aware of the links to core literature identified by users.

This project’s results also update a 1991 preliminary study (Meadow and Buckle, 1991, 27) of the scientific information system in the UK which reported:

"Several respondents noted that most researchers nowadays are subject to information overload. ... Information technology is seen by many as adding to this information overload, rather than alleviating it".

On the contrary, by the mid-1990s many scientists indicated that information technology developments enabled them to cover more ground than previously or speeded up access to information. Scientists (see quotations in section 7.8) spoke of: increased awareness by scanning the literature electronically (covering 80% more literature than previously); increased efficiency because searching electronically is faster and can produce more relevant retrieval; the acquisition of information from electronic databases which would not have been obtained by any other means; the speedy receipt of research data by electronic mail (for example, from research published eight years previously within an hour of requesting it from the US); and increased access to resources resulting from ease of access (for example, web page addresses being embedded in electronic mail).

Obviously, this change is due to a number of factors including the greater availability of equipment, easier access to online databases and Internet resources, more user-friendly interfaces to electronic resources, the growth in professional and personal correspondence resulting from e-mail, and to the habit forming nature of utilising electronic information facilities. Some scientists (see quotations in section 7.8) spoke of coming to rely on electronic facilities more and more, or of wondering how they ever managed without them.

8.11 Importance of Informal Versus Formal Communication Modes

Over a decade and a half ago, Brittain (1982) noted that most user studies have paid far more attention to formal channels of communication than to informal channels. He observed in his work on user studies:

".... one finding that is common to nearly all the studies is that users do not like bibliographic tools for information and document retrieval, do not use them rationally and systematically, and much prefer (often by a factor of 10:1) informal to formal channels of communication".
He went on to say that it has been estimated that between 50 and 80 per cent of the communication of the average researcher and academic take place through informal channels of communication (for example, face-to-face meetings at conferences, telephone calls, seminars, discussion groups).

The present project ranked scientists' perceived pecking order (4 and over on the five point scale) of the means of keeping abreast of developments in their own subject areas. Tables 1 and 2 in section 7.8 illustrate that this pecking order varies over time. Reference has already been made to scientists' growing concern with currency (see section 8.7) regarding current awareness and pre-publication of electronic abstracts over the project period. Competition (with accompanying secrecy) and collaboration appeared to be affecting other modes of scientific communication, such as verbal, meetings, refereeing and preprint receipt (see section 7.8).

Both groups reported a decrease in the importance of attending meetings, seminars and conferences over the project period (see sections 5.7.3, 6.7.3, and 7.7.3), although meetings still ranked second throughout the period, for the ICRF group, and only slipped from second to third for the composite external comparison group. Although shortage of funding, which restricted attendance at external meetings, was mentioned by both groups, other factors influencing scientists' perceptions of the relative importance of meetings included frequency of attendance, changes in role or field, verbal dialogue with meeting participants, the popularity of the workshop type meeting, and maturity/seniority in post. Scientists from both groups deplored the lack of up-to-date material sometimes presented at conferences, and a few scientists from the ICRF group noted that often what is stated at conferences and meetings is unreliable and does not match up with what is written in the published articles.

The time of many information practitioners has been, and still is, being taken up by the evaluation and provision of current awareness services. It is salutary to remember that, even in this often fast-moving area of modern biochemistry, in-house current awareness services ranked fourth (in the case of the ICRF group) and fifth (in the case of the composite external comparison group) at the start of the project, and ranked fifth and sixth, respectively, by the end of the project.

Historically, LIS Departments have been the main (and, in some cases, the only) gateway to published information for researchers, regardless of discipline. One ICRF laboratory
scientist summed up this situation well in claiming that ICRF is a centre of excellence and that part of the reason for this is the LIS facilities - the access to the academic information that is required in order to produce excellent science. Other gateways are now developing but LIS Departments can still remain one of those gateways, not least because of the added value that information professionals can bring as employees of their institution - but much depends on the attitude and responsiveness of those practitioners to the changing scenario.

8.12 Further Research
As with most research studies, the results of this project indicate areas for further work, such as more active, qualitative research being undertaken by information practitioners, the testing of new user education and training techniques and the sharing of results with other information practitioners, and in-depth case studies of information practitioners who are facilitating the management of change within institutions (which will complement the excellent work being conducted by initiatives such as the IMPEL2 Project).

8.12.1 Information Professionals Undertaking Qualitative Research
More information professionals in operational situations should conduct on-going research with their user communities. Obviously most do, to a certain extent, with feedback from user groups or with data collection for reports to Library Committees or to senior management bodies: but much of this material is quantitative rather than qualitative in nature. However, the importance to information practitioners of on-going in-depth dialogue with users about their information handling techniques as an essential aid to strategic planning cannot be overemphasised. Many operational situations will have a mix of tenured and contract user communities. It is recommended that sample groups of different categories of staff be monitored, although contract staff will often change en bloc when contract terms end, and that the semi-structured interview method be used rather than one-off questionnaire surveys. The latter does not encourage elucidation of motives or habits or explanations of barriers to uptake of services: for example, electronic mail usage figures give no indication of the content or the purpose of messages, nor do they pinpoint any problems encountered in usage. In this project, for instance, it was easy to clarify various terminology used in questions, which meant different things to different people, and to remind some scientists about the differences between MEDLINE and the Science Citation Index. Moreover, the value to users of the interview as an updating mechanism is
inestimable, and far exceeds the conveyance of the same updating information by any other means. In short, qualitative research is not a replacement for but rather complementary to quantitative research.

To summarise, studies by information practitioners of their user communities are an important and essential complement to the more theoretical research carried out by full-time researchers. Information professionals should contribute, in however small a way, for the mutual promotion and advancement of our profession. To assist, the BLRIC Research Plan April 1997 to March 1998 (BLRIC, 1997, 1) includes as a priority topic “studying the benefit and impact of new technologies on libraries and information services and the needs of users for leading-edge electronic resources”.

8.12.2 User Training and Education
Reference has been made (see section 8.9) to the problem of convincing end-users that information skills training is a necessity. This will be an on-going difficulty for information practitioners, although it is heartening in this present project that a few scientists were aware that there is a problem but that it is not taken seriously. They realised that they were not sophisticated in the use of keywords and the application of retrieval rules but that it could be all important as to whether or not the correct information is retrieved.

If the recommendations made by the Dearing report concerning the more formal recognition of "key skills" are implemented, then the raised importance of the acquisition of such skills will certainly help. However, information practitioners (particularly those working in post-graduate environments) are still faced with the training of their existing user populations who also, in Dearing's words, "need to develop advanced skills in searching for and selecting valid, relevant and up-to-date information from computer-based storage" and who "will look to institutions to guide them through the information maze" (National Committee of Inquiry into Higher Education, 1997, 120). The continuing development of LIS staff skills is as equally important in this scenario.

For the immediate and medium term future, reports by information practitioners on best practice concerning training methods and skills programmes, feedback from users on most appropriate and successful methods (perhaps addressing information
requirements of a group of users, such as the staff of one laboratory or department, rather than dealing just with individuals), and progress on upskilling LIS staff to meet the training issues will be essential so that mutual benefits accrue to users and institutions.

8.12.3 Involvement of Information Professionals in the Management of Change

Historically, it has only been in the private sector that the information management skills of information practitioners have sometimes been recognised as potentially beneficial to the organisation and management of company "information" generally rather than just "library and information services" type information. Where this has occurred, information professionals have taken on wider document management responsibilities.

Developments in the academic sector, such as the Funding Councils' requirements for institutions to produce an Information Strategy to support teaching, learning, research and management, and the increasing convergence of library and computing services to help redress the information content versus the delivery mechanism balance, afford information professionals in the public sector the same as or greater opportunities than those in the private sector to apply their skills institution-wide. Information practitioners' skills of acquiring, organising, storing and retrieving information efficiently and effectively can be harnessed to the benefit of the whole institution. But it is up to information practitioners to be flexible and far-sighted enough to take up this challenge to become facilitators in this organisational management of change. It will often involve yet more work on top of existing heavy workloads, for example, in the time-consuming development of information strategies or in other information intensive areas such as management information systems.

Those information practitioners who take, or who have already taken on these challenges should document their experiences. A recent report (Pugh, 1997) summarised the 1997 position as far as convergence is concerned within academic support services in UK academic institutions, and Day et al. (1996) have indicated some of the difficulties encountered in such situations. In-depth case studies by information practitioners, who are facilitating the management of change within
institutions, will complement the work of initiatives such as the IMPEL2 Project and will benefit the whole academic community.

To conclude, the commonality of trends between the ICRF and the composite external comparison group shows how useful a barometer sample surveys of user populations are to the successful uptake or not of available LIS services and to the identification of unfulfilled user demands and potential aspirations. Case study research will continue to be a vital tool for information professionals in ensuring that the on-going technological developments of the late twentieth and early twenty-first centuries are harnessed to provide information systems that are in tune with developing and increasingly sophisticated user requirements.
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LIST OF ABBREVIATIONS
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>AAAS</td>
<td>American Association for the Advancement of Science</td>
</tr>
<tr>
<td>ACN</td>
<td>Advisory Committee on Networking</td>
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<tr>
<td>ACS</td>
<td>American Chemical Society</td>
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<tr>
<td>AEI</td>
<td>Article Express International</td>
</tr>
<tr>
<td>ARL</td>
<td>Association of Research Libraries</td>
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<tr>
<td>ARPAnet</td>
<td>Advanced Research Projects Agency Network</td>
</tr>
<tr>
<td>ATCC</td>
<td>American Type Culture Collection</td>
</tr>
<tr>
<td>BASIS</td>
<td>Batelle Automated Search Information System</td>
</tr>
<tr>
<td>BIC</td>
<td>Book Industry Communications</td>
</tr>
<tr>
<td>BIDS</td>
<td>Bath Information and Data Services</td>
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<tr>
<td>BIODOC</td>
<td>BIOtechnology and DOCuments</td>
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<tr>
<td>BLAST</td>
<td>Basic Local Alignment Search Tool</td>
</tr>
<tr>
<td>BLDSC</td>
<td>British Library Document Supply Centre</td>
</tr>
<tr>
<td>BLEND</td>
<td>Birmingham and Loughborough Electronic Network Development</td>
</tr>
<tr>
<td>BLR&amp;DD</td>
<td>British Library Research and Development Department</td>
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<tr>
<td>BLRIC</td>
<td>British Library Research and Innovation Centre</td>
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<tr>
<td>BMA</td>
<td>British Medical Association</td>
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<tr>
<td>BUBL</td>
<td>Bulletin Board for Libraries</td>
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<tr>
<td>CABIOS</td>
<td>Computer Applications in the Biosciences</td>
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<tr>
<td>CARL</td>
<td>Colorado Alliance of Research Libraries</td>
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<tr>
<td>CAS-IAS</td>
<td>Current Alerting Services -Individual Article Supply</td>
</tr>
<tr>
<td>CAS</td>
<td>ICRF's Current Awareness Service (when cited in Figures and Questionnaire)</td>
</tr>
<tr>
<td>CCML</td>
<td>Comprehensive Core Medical Library</td>
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<tr>
<td>CD-ROM</td>
<td>Compact Disc - Read Only Memory</td>
</tr>
<tr>
<td>CDI</td>
<td>Compact Disc Interactive</td>
</tr>
<tr>
<td>CHEST</td>
<td>Combined Higher Education Systems Team</td>
</tr>
<tr>
<td>C&amp;IT</td>
<td>Communications and Information Technology</td>
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<tr>
<td>CITED</td>
<td>Copyright in Transmitted Electronic Documents</td>
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<tr>
<td>CNI</td>
<td>Coalition for Networked Information</td>
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<tr>
<td>COPICAT</td>
<td>Copyright Ownership Protection in Computer-Assisted Training</td>
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<tr>
<td>COPYSMART</td>
<td>CITED Based Multimedia IPR Management on Cost-Effective Smart Device</td>
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<tr>
<td>CORE</td>
<td>Chemistry Online Retrieval Experiment</td>
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<tr>
<td>CSF</td>
<td>Critical Success Factors</td>
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<tr>
<td>CVCP</td>
<td>Committee of Vice-Chancellors and Principals</td>
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<tr>
<td>DEC</td>
<td>Digital Equipment Corporation</td>
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<tr>
<td>DNA</td>
<td>DeoxyriboNucleic Acid</td>
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<tr>
<td>EDIL</td>
<td>Electronic Document Interchange between Libraries</td>
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<td>EDDIS</td>
<td>Electronic Document Delivery - the Integrated Solution</td>
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<tr>
<td>EES</td>
<td>Elsevier Electronic Subscriptions</td>
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<tr>
<td>EI</td>
<td>Engineering Information</td>
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<tr>
<td>eLib</td>
<td>Electronic Libraries Programme</td>
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<tr>
<td>ELINOR</td>
<td>Electronic Library and Information Online Retrieval</td>
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<tr>
<td>EMBL</td>
<td>European Molecular Biology Laboratory</td>
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<tr>
<td>EORTC</td>
<td>European Organisation for Research and Treatment of Cancer</td>
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<tr>
<td>ERL</td>
<td>Electronic Reference Library</td>
</tr>
<tr>
<td>ESRC</td>
<td>Economic and Social Research Council</td>
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<tr>
<td>EuroCODE</td>
<td>European Computerised Oncology Data Exchange</td>
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<tr>
<td>FIDDO</td>
<td>Focused Investigation of Document Delivery Options</td>
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<tr>
<td>FIGIT</td>
<td>Follett Implementation Group for Information Technology</td>
</tr>
<tr>
<td>FTP</td>
<td>File Transfer Protocol</td>
</tr>
<tr>
<td>GCG</td>
<td>Genetics Computer Group</td>
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<tr>
<td>GDB</td>
<td>Genome DataBase</td>
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GEDI Group on Electronic Document Interchange
HCI Human-Computer Interaction
HEFC Higher Education Funding Councils
HEFCE Higher Education Funding Council for England
HGMP Human Gene Mapping Project
HENSNA Higher Education National Software Archive
HTML Hypertext Markup Language
ICNet Imperial Cancer Network
ICRF Imperial Cancer Research Fund
IDI Information Dimensions Incorporated
ILL Inter-Library Loan
IMM Institute of Molecular Medicine
IMO Information Market Observatory
IMPEL Impact on People of Electronic Libraries
INA Information Networking Alliance
INIST Institut de l'Information Scientifique et Technique
IOD Information on Demand
IP Internet Protocol
IS Information Systems
ISI Institute for Scientific Information
ISO International Organization for Standardization
IT Information Technology
IUCU Inter University Computing Committee
JANET Joint Academic Network
JIPS JANET IP Service
JISC Joint Information Systems Committee
JUGL JANET User Group for Libraries
LAN Local Area Network
LINC Library and Information Cooperation Council
LIS Library and Information Services
MA/HEM Methodology for Access/Holdings Economic Modelling
MCNC Microelectronics Center of North Carolina
MSDN Microbial Strain Data Network
NCBI National Center for Biotechnology Information
NCSU North Carolina State University
NHS National Health Service
NIH National Institutes of Health
NISS National Information Services and Systems
NRC National Research Council
NREN National Research and Education Network
NSF National Science Foundation
OCLC Online Computer Library Center
OJCT Online Journal of Current Clinical Trials
OMIM Online Mendelian Inheritance in Man
OPAC Online Public Access Catalogue
OPCS Office of Population Censuses & Surveys
OSI Open System Interconnection
PAD Packet Assembler/Disassembler
PDF Portable Document Format
PDQ Physician Data Query
PICA Dutch Centre of Library Automation
PIR Protein Information Resources
PLANET Plan For Library Action on Networking
PRISM Policy Research in Science and Medicine
RAE Research Assessment Exercise
RAPDOC Rapid Document Delivery Project
RIDDLE Rapid Information and Document Delivery in Library Environments
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tr>
<td>RSC</td>
<td>Royal Society of Chemistry</td>
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<tr>
<td>SCONUL</td>
<td>Standing Conference on National and University Libraries</td>
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<tr>
<td>SDI</td>
<td>Selective Dissemination of Information</td>
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<tr>
<td>SHarQ</td>
<td>Sequence Homology Alignment Remote Query</td>
</tr>
<tr>
<td>SOS</td>
<td>UnCover Single Order Source</td>
</tr>
<tr>
<td>SPIRS</td>
<td>SuperJANET Project on Information Resources</td>
</tr>
<tr>
<td>STM</td>
<td>Scientific, Technical and Medical</td>
</tr>
<tr>
<td>STN</td>
<td>Scientific and Technical Information Network</td>
</tr>
<tr>
<td>SUBIS</td>
<td>Sheffield University Biomedical Information Service</td>
</tr>
<tr>
<td>TAPin</td>
<td>Training and Awareness Programme in networks</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>Transmission Control Protocol / Internet Protocol</td>
</tr>
<tr>
<td>TILT</td>
<td>Teaching with Independent Learning Technologies</td>
</tr>
<tr>
<td>TULIP</td>
<td>The University Licensing Program</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
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<tr>
<td>UKAIIM</td>
<td>United Kingdom Association for Information and Image Management</td>
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<tr>
<td>UKERNA</td>
<td>United Kingdom Education and Research Networking Association</td>
</tr>
<tr>
<td>UKOLN</td>
<td>UK Office for Library Networking</td>
</tr>
<tr>
<td>ULCC</td>
<td>University of London Computing Centre</td>
</tr>
<tr>
<td>UMI</td>
<td>Universal Microfilms Incorporated</td>
</tr>
<tr>
<td>US</td>
<td>United States</td>
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<tr>
<td>WAIS</td>
<td>Wide Area Information Service</td>
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<tr>
<td>WISDOM</td>
<td>Wellcome Information Service Databases on Medicine</td>
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<tr>
<td>WWW</td>
<td>World-Wide Web</td>
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APPENDIX 1
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Questionnaire

ICRF LIBRARY & INFORMATION SERVICES

Impact of Information Technology Developments - Questionnaire

Current Awareness - content & mode of receipt
1.1 Do you have a current CAS (Current Awareness Service) profile?  
   (a) Yes  
   (b) No

1.2 If no, please state  
   (a) Reasons why?  
   (b) Other means of curr.aware.?

1.3 If yes, how long have you been utilising the Current Awareness Service?

1.4 What is your current CAS profile? - subject/author/contents pages? (journal names and numbers please).  
   (a) Subject  
   (b) journal nos.  
   (c) journal names

1.5 In what form do you receive your CAS results?  
   (a) Via e-mail  
   (b) Via printout  
   (c) Both

1.6 If you receive your results via e-mail, what were the main motivations behind your decision?  
   (a) Downloading to Ref.h.p.  
   (b) Elect. requt. from Lib.  
   (c) Lib. Comm. decision  
   (d) Other - please specify

1.7 Have any perceived benefits of receiving your results via e-mail been realised?  
   (a) Yes  
   (b) No  
   (c) Partly  
   (d) Not applicable

Current Awareness - Citation Scanning
1.8 What is the average number of citations you scan per week as a result of your CAS profile?  
   (a) 20 and fewer  
   (b) 21 to 50  
   (c) 51 to 100  
   (d) 101 to 150  
   (e) 151 to 200  
   (f) 201+ (please specify)

Current Awareness - full-text requests
1.9 On average, how many requests do you make for (or photocopies do you make of) the full-text of journal
articles per week as a result of your CAS profile? (a) 5 and fewer
(b) 6 to 10
(c) 11 to 15
(d) 16 to 20
(e) Over 20 (please specify)

Current Awareness - online abstracts facility
1.10 Has the provision of abstracts on the SciSearch Database helped the selection of relevant articles? (a) Yes
(b) No
(c) Not used it - why?
1.11 If so, has this abstracts facility reduced the number of requests made for the full-text of (what would have been) non-relevant articles? (a) Yes
(b) No
1.12 If there has been a reduction in number, what level of reduction in article numbers? (a) 5 and fewer
(b) 6 to 10
(c) 11 to 15
(d) 16 to 20
(e) Over 20 (please specify)

Current Awareness - circulation
1.13 How many people see a copy of your weekly CAS results? Please state number and mode of circulation.

Current Awareness - currency
1.14 Is currency of CAS important? - how important? Please state preferred amount of time after publication and indicate its importance to you on a scale of 1 to 5 (1=not a consideration, 2=over 4 wks after publ., 3=3-4 wks after publ., 4=1-2 wks. after publ., 5=asap on publ.).

Current Awareness - preprints
1.15 Would the availability of electronic abstracts before the appearance of the print publication be of interest? Please indicate your level of interest on a scale 1 to 5 (5=of gt. interest, 1=of no interest).
1.16 If so, in what ways would this development aid your awareness and your current method of organising your information resources?

Current Awareness - effect of service absence
1.17 If CAS results were no longer produced and were not replaced by a similar service, how much time each week would it take you to seek out and find information equivalent to that provided by your CAS profile?
1.18 If CAS results were no longer produced and were not replaced by a similar service, what difference would this make to the progress of your work?
Personal Holdings / Local Library
2.1 Do you subscribe to journals yourself (Lab.) or receive any through membership of editorial boards? If so, how many and which titles? (a) Number (b) Titles - ed. bd. (c) Titles - subscribe

2.2 If not based at LIF, do you utilise a local Library? (a) Yes, ICRF funded (b) Yes, non ICRF funded (c) No

Core Journal Titles / Refereeing
3.1 Which journal titles do you regard as "core" titles in your area? (please specify). (a) Number (b) Core Titles

3.2 Have you/do you act as a referee for any of these "core" journals?

Browsing/Reading/Requesting (non CAS sources)
4.1 On average, how much time do you devote to browsing the literature each week? (a) 1 hr. and less (b) 1 to 2 hrs. (c) 2 to 3 hrs. (d) 3 to 4 hrs. (e) 4 to 5 hrs.

4.2 What is the average number of citations you scan per week as a result of other information sources? (i.e. browsing hard copy journals) (a) 50 and fewer (b) 51 to 100 (c) 101 to 150 (d) 151 to 200 (e) Over 200 (please specify)

4.3 On average, how many requests do you make for (or photocopies do you make of) the full-text of journal articles per week as a result of other information sources? (a) 5 and fewer (b) 6 to 10 (c) 11 to 15 (d) 16 to 20 (e) Over 20 (please specify)

4.4 How important is the browsing of print products to you? Please indicate level of importance on a scale of 1 to 5 (5=very impt.)

4.5 On average, how much time do you devote to reading the literature each week?

Source of Hard Copy Articles/Request Mode
5.1 From where do you obtain the full-text of relevant articles? (a) ICRF Library (yourself) (b) ICRF Library (Via staff)
5.2 If requests for photocopies are made to the Library, who makes them?
(a) You, personally
(b) Via your staff

5.3 Are these requests to the Library for photocopies sent electronically?
(a) Yes, personally
(b) Yes, via staff
(c) No, cards personally
(d) No, cards via staff
(e) E-mail

5.4 If so, what motivated you to utilise the Library's electronic requests facility?

5.5 Have any perceived benefits of utilising the Library's electronic requests facility been realised?
(a) Yes
(b) No
(c) Partly
(d) Not applicable

5.6 Is the number of photocopied articles requested by you increasing or decreasing (e.g. over the past year)? (Possible answers include increasing/decreasing/constant).

Reference Handling
6.1 Do you maintain your own database in a reference handling package?
(a) Yes - please name
(b) No
(c) In another form (please specify)

6.2 If so, do you download CAS results into database?
(a) Yes, personally
(b) Yes, via staff/colleague
(c) No

6.3 If you do download CAS results into database, do you store abstracts as well as citations?
(a) Yes
(b) No

6.4 Do you load other data from other sources into your reference handling package?
(a) Yes
(b) No

6.5 If so, please state
(a) Source(s)
(b) Manner of input
(c) Who maintains it

6.6 What is the approximate size of the database?

6.7 Do you use your reference handling package in conjunction with a word-processing
package to produce bibliographies at the end of your manuscripts for submission to journals? (a) Yes, personally (b) Yes, via staff (c) No

6.8 On average, how many papers do you publish per year? (a) 5 and less (b) 6 to 10 (c) 11 to 20 (d) 21 to 30 (e) Over 30 - please specify

6.9 What were the main motivations behind your decision to utilise a reference handling package?

6.10 Have the perceived benefits of utilising a reference handling package been realised? (a) Yes (b) No (c) Partly

6.11 Has your usage of this reference handling package increased or decreased (e.g. over the past year)?

CD-ROM Databases
7.1 Do you use MEDLINE on CD? (a) Yes, personally (b) Yes, via staff (c) No

7.2 If so, how frequently? (a) Weekly (b) Monthly (c) Occasionally (d) Rarely (e) Not at all

7.3 Do you have a personal CD-ROM drive? (a) Yes (b) No

7.4 If so, what CD-ROM databases/databanks do you possess? Please specify.

In-House Databases/Databanks
8.1 Which databases/databanks do you access on ICRF's main computing facility (i.e. Vax cluster)? (a) Library databases (b) Mol. biol. databanks (c) Clin. databases (d) Other(s)

8.2 For each category accessed, please specify which databases/databanks accessed and average frequency of use. (a) Name(s) (b) Weekly (c) Monthly (d) Occasionally (e) Rarely (f) Not at all

8.3 Do you find this centralised provision of
information sources aids you in your research work in one or more of the following ways? (a) Productivity (b) Awareness (c) Organ./control of own info. (d) Other - please specify

8.4 If not, please state why this centralised provision of information sources does not aid you in your work? (a) Database/bank content probs. (b) Network probs. (c) Retrieval software probs. (d) Speed of access probs. (e) Other - please specify

8.5 What mode of provision of the information sources would you prefer / find more helpful?

Remote databases/databanks
9.1 Do you utilise the Library's remote databases / databanks service? (a) Yes (b) No

9.2 If so, how often? (a) No. times/week (b) No. times/month (c) Occasionally (d) Rarely (e) Not at all

9.3 Do you search databases/databanks on non-ICRF computers? (a) Yes (b) No

9.4 If so, please specify which databases/databanks and mode of searching (a) Which? (b) Yourself? (c) Via your staff?

9.5 If so, how often? (a) No. times/week (b) No. times/month (c) Occasionally (d) Rarely (e) Not at all

Networks - E-mail
10.1 Do you utilise e-mail facilities? (Multiple answers possible) (a) Within ICRF (b) Via JANET (c) Via Internet (d) Via Other - please specify

10.2 On average, how much use of e-mail facilities do you make of each service listed above? (a) Hourly (b) No. times/day (c) No. times/week (d) No. times/mnth.

10.3 Is your usage of each service listed above increasing
or decreasing (e.g. over the last year)? (Possible answers include increasing/decreasing/constant/not applicable).

**Networks - list servers / bulletin boards**

11.1 Do you access list servers / bulletin boards? 
   (a) Yes, personally
   (b) Yes, via staff
   (c) No

11.2 If so, please specify names and degree of regularity of access? 
   (a) Name(s)
   (b) No. times/day
   (c) No. times/wk.
   (d) No. times/mnt.
   (e) Erratically

11.3 Is your usage of any service listed above increasing or decreasing (e.g. over the last year)? (Possible answers include increasing/decreasing/constant/not applicable).

**Networks - remote login / file transfer**

12.1 Do you login to remote computers? 
   (a) Yes
   (b) No

12.2 If so, please specify service(s) offered by these remote systems and regularity of access. 
   (a) Service(s)
   (b) No. times/day
   (c) No. times/wk.
   (d) No. times/mnt.
   (e) Erratically

12.3 Do you utilise the file transfer facility on these remote systems? 
   (a) Yes
   (b) No

12.4 If so, please specify what type of data is transferred from these remote systems and regularity of use of this facility. 
   (a) Data Type(s)
   (b) No. times/day
   (c) No. times/wk.
   (e) Erratically

12.5 On average, how long is downloaded data stored on your local machine? 
   (a) Hours
   (b) Days
   (c) Weeks
   (d) Months
   (e) Open-ended

12.6 Is your usage of remote login / file transfer increasing or decreasing (e.g. over the last year)? (Possible answers include increasing/decreasing/constant/not applicable).

**Other Information Gathering / Communication Activities**

13.1 Listed below are a number of means utilised by scientists/clinicians in an attempt to keep abreast
of the continuing information explosion in their subject areas. Please indicate the importance of each mode to you personally on a scale 1 to 5 (5=very important).

(a) Verbal comm. with colleagues (e.g. face to face/via telephone)
(b) Written comm. with colleagues (e.g. by letter/via e-mail/via fax)
(c) Attendance at confs./sems.
(d) Recpt. prepts from colls/compets.
(e) Unpublished res. papers/results
(f) ICRF Curr. Aware. Service
(g) Commercial Curr. Aware. Service
(i) Other (e.g.refs in paps/cit.search/rev.jns)

13.2 For each information gathering/communication activity mentioned in 16a, has your utilisation been increasing/decreasing over the past year?

13.3 Have technological developments such as fax and e-mail been factors in the increase in any information gathering/communication activity?

Full-Text Electronic Sources
14.1 Would you utilise the full-text of published journals in electronic form (including graphics) if they were available? (a) Yes (b) No

14.2 If yes to 14a, would you use the electronic form instead of the hard copy or as well as the hard copy? (a) Replacement (b) Supplement

14.3 If yes to 14a, would you wish the electronic form to apply to current issues only or back years as well? (a) Current only (b) Back years also

14.4 If no to 14a, please specify reasons.

14.5 If relevant to your research work, are you aware of/utilised/interested in the Online Journal of Current Clinical Trials?

Usage of Information Resources Provided Via LIS
15.1 Has your usage of the following information resources/facilities provided by the Library increased or decreased over the past year? (Possible answers include increased/decreased/constant/not applicable).
- Provision of books
- Provision of journals
- Current Awareness Service
- In-house Databases Service
- CD-ROM databases service
- Remote databases service
- Inter-Library Loans Service
- Internal photocopying service

15.2 For any information resource/facility for which increased usage is indicated in 15a, to what extent is increased usage due to information technology developments bringing perceived personal benefits?

15.3 To what extent have perceived benefits been realised?
   (a) Yes
   (b) No
   (c) Partly
   (d) Not applicable

15.4 Please indicate (from your viewpoint) degree of success of information technology developments introduced by the Library on a scale of 1 to 5 (5=very successful)?

15.5 Potentially, would access to databases on JANET (e.g. ISI, EMBASE) be of interest? Please indicate degree of interest on a scale of 1 to 5 (5=very interested).

Training

16.1 In general, how satisfied are you with your ability to access information electronically? Please indicate your level of satisfaction on a scale 1 to 5 (5=completely satisfied)

16.2 Has the level of training provided been adequate for your needs? Please indicate on a scale 1 to 5 (5=very adequate) for each of the services you utilise.
   (a) Use of Vax
   (b) Use of e-mail
   (c) Use of Mol.Biol.Soft.
   (d) Use of Clin. D/s.
   (e) Use of Lib.Databases
   (f) Use of Lib.CD-ROM D/s.
   (g) Not Applicable

16.3 What factors would increase your use of electronic information?

Background

17.1 Please specify your discipline? (Indicate more than one category, if necessary)
   (a) Epidemiology
   (b) Molecular Biology
   (c) Cell Biology
   (d) Genetics
   (e) Biochemistry
   (f) Immunology
   (g) Medicine
   (h) Statistics
17.2 What pre-ICRF experience did you have of electronic information sources? (Please specify which and for what duration)

(a) In-house databases
(b) CD-ROM databases
(c) Remote online databs./databks.
(d) E-mail
(e) Comp. conferencing/bull. bds.

(i) Computer Science
(j) Psychology

17.3 Please indicate the nature of the activities involved in your position (including time spent on your job outside normal working hours). (N.B. Must add up to 100%).

R&D
(a) R&D - basic research
(b) R&D - applied research
(c) Eval. of res. of others
(d) Dev. new techniques based on res. activs.

Providing Advice & Support
(a) Within ICRF
(b) To other res. agencies

Other Activities
(a) Confs., seminars, workshops

Management & Administration

Professional Development

Other - please specify

17.4 Please specify which age band applies to you?

(a) 25 yrs. or under
(b) 26 to 30 yrs.
(c) 31 to 35 yrs.
(d) 36 to 40 yrs.
(e) 41 to 45 yrs.
(f) 46 to 50 yrs.
(g) 51 to 55 yrs.
(h) 56 to 60 yrs.

17.5 Please specify into which category of staff you fall?

(a) Sen. scientist
(b) Clinician
(c) Clin. Res. Fellow
(d) Res. Fellow
(e) Grad. student
(f) Scientific Officer

17.6 How long have you been employed at ICRF?

(a) 1 yr. or less
(b) 1 - 2 yrs.
(c) 2 - 3 yrs.
(d) 3 - 4 yrs.
(e) 4 - 5yrs.
(f) Over 5 yrs.
# APPENDIX 2

## List of Laboratories and Units Represented by ICRF Sample Group

<table>
<thead>
<tr>
<th>Site</th>
<th>Lab/Dept</th>
<th>Category of Staff</th>
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<td>London -</td>
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DNA Replication Control (CH)  
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Enzymology of Genetic Recombination CH  
Enzymology of Genetic Recombination CH  
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Enzymology of Genetic Recombination CH  
Enzymology of Genetic Recombination CH  
Gene Activation CH  
Gene Activation CH  
Human Genetic Resources CH  
Human Genetic Resources CH  
Mammalian DNA Repair CH  
Mutagenesis  
Mutagenesis CH  
London -  
London - Applied Development (Dominion House)  
London - Haemopoiesis (Dominion House)  
London - Structural Molecular Biology Unit  
London - Structural Molecular Biology Unit  
London - Clinical Oncology Unit  
London - Clinical Oncology Unit  
Guy's Hospital  
Guy's Clinical Oncology Unit  
Guy's Clinical Oncology Unit  
Guy's ICRF Immunohistology (Guys)  
Guy's Clinical Oncology Unit  
Guy's Clinical Oncology Unit  
Guy's Clinical Oncology Unit  
London -  
London - Molecular Oncology (HH)  
London - Gene Transcription (HH)  
London - Molecular Pathology (HH)  
London - Molecular Pathology (HH)  
London - ICRF Health Behaviour Unit  
London - ICRF Health Behaviour Unit  
London -  
Lon.Hosp. ICRF Skin Tumour Laboratory  
London - Histopathology Unit RCS (Research)  
Royal Histopathology Unit RCS  
College of Surgeons Histopathology Unit RCS (Research)  
Lon.UC Tumour Immunology Unit (Univ.Coll.Med.School)  
Med. Sch. Tumour Immunology Unit  
Leeds Genetic Epidemiology Lab (LEEDS)  
Dundee Molecular Pharmacology Unit  
Dundee Molecular Pharmacology Unit  
Dundee Molecular Pharmacology Unit  
Dundee Molecular Pharmacology Unit  
Dundee Molecular Pharmacology Unit
| Oxford - CEU | Molecular Pharmacology Unit | Graduate Student |
| Oxford - CCG | Medical Oncology Unit (Edinburgh) | Deputy Head of Unit |
| Oxford - Cell Cycle Group | | Chief Scientific Officer |
| Oxford - Cancer Epidemiology Unit (Ox) | Laboratory Scientist |
| Oxford - Cancer Studies Unit (Ox) | Clinical Research Scientist |
| Oxford - Cell Cycle Group | Laboratory Scientist |
| Oxford - Experimental Morphology (Ox) | Clinical Consultant |
| Oxford - Developmental Genetics (Ox) | Scientific Officer (Res) |
| Oxford - Developmental Biology Unit (Ox) | Head of Unit (Prof) |
| Oxford - Developmental Biology Unit (Ox) | Research Fellow |
| Oxford - Developmental Biology Unit (Ox) | Graduate Student |
| Oxford - Developmental Biology Unit (Ox) | Snr. Scientific Officer |
| Oxford - Developmental Biology Unit (Ox) | Clinical Consultant |
| Oxford - Developmental Biology Unit (Ox) | Snr. Scientific Officer |
| Oxford - Developmental Biology Unit (Ox) | Clinical Scientist |
| Oxford - Developmental Biology Unit (Ox) | Head of Lab. |
| Oxford - Developmental Biology Unit (Ox) | Research Fellow |
| Oxford - Developmental Biology Unit (Ox) | Chief Scientific Officer |
| Oxford - Developmental Biology Unit (Ox) | Snr. Scientific Officer |
| Oxford - Developmental Biology Unit (Ox) | Scientific Officer |
| Oxford - Developmental Biology Unit (Ox) | Clinical Research Fellow |
| Oxford - Cell Adhesion (Ox) | Head of Lab. |
| Oxford - Cell Adhesion | Graduate Student |
| Oxford - Human Genetics Laboratory (Ox) | Head of Lab. |
| Oxford - Microbial Genetics (Ox) | Research Fellow |
| Oxford - Microbial Genetics (Ox) | Graduate Student |
| Oxford - Microbial Genetics (Ox) | Graduate Student |
| Oxford - Microbial Genetics (Ox) | Head of Lab. |
| Oxford - Microbial Genetics (Ox) | Research Fellow |
| Oxford - Microbial Genetics (Ox) | Laboratory Scientist |
| Oxford - Microbial Genetics (Ox) | Graduate Student |
Molecular Oncology
Molecular Oncology
Molecular Oncology
Molecular Oncology
Molecular Oncology
Molecular Oncology
Molecular Oncology
Graduate Student
Research Fellow
Snr. Scientific Officer
Laboratory Scientist
Snr. Scientific Officer
## APPENDIX 3

List of Laboratories and Units Represented by Composite External Comparison Group

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<th>Lab/Dept</th>
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APPENDIX 4
APPENDIX 4

EXTRACT FROM A MAILBASE MESSAGE

CURRENCY OF CAS-IAS SERVICES

This section attempts to give an indication of the currency of some of the CAS-IAS services available (SciSearch via BIDS, EMBASE via BIDS, Inside Information via BIDS and CARL's UnCover) by comparing the latest journal issue of 14 selected titles held by ICRF Library.

Obviously, besides currency, other factors such as title coverage (varies with subject areas of interest), data format (all authors or first four authors only, start and end pages or start page only etc.), article coverage (journal article coverage only or book reviews, editorials, letters to the editor etc. also), presence or not of abstracts, and cost of each service will affect an individual Library's preferred service (or combination of services).

However, ICRF Library intends to update the table shown below every two months for the foreseeable future, incorporating other CAS-IAS services to which it has access as they become available. On the question of currency only, when comparing SciSearch (SCI) via BIDS (established service) and Inside Information (II) via BIDS (relatively new service), it is interesting to note that out of the 14 titles surveyed, both SCI and II displayed the same latest issue in respect of 7 titles (Nature, British Journal of Cancer, Cell, Embo, Lancet, Molecular & Cellular Biology and Cytogenetics & Cell Genetics), and each displayed a later issue than the other in respect of three titles (PNAS, Science and Journal of Biological Chemistry in the case of SCI; British Medical Journal, Nucleic Acids Research and Oncogene in the case of II). II did not contain details of one title (Nature Genetics). Perhaps, most interesting of all is the fact that when comparing the three services SCI, II and UnCover, the UnCover service ("free" to end-user by telnetting to pac.carl.org) displayed the latest issue in respect of five titles (Nature, PNAS, Cell, Journal of Biological Chemistry and Lancet). These are just a few comments on the data displayed below. Is this sort of information of general interest? Has any other library conducted similar surveys of these CAS-IAS services?

Any comments, additions or amendments to this section will be welcome. Please e-mail to ICRF PLANET contact S_Osborne@uk.icnet.icrf
### Currency of Journal Issues Friday 24th September 1993

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<th>BIDS Inside Information</th>
<th>UnCover</th>
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<td>J Biol Chem (3x a month)</td>
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<td>BMJ (w)</td>
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<td>307(6904)</td>
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<td>Mol Cell Biol (m)</td>
<td>13(10)</td>
<td>13(9)</td>
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<td>13(8)</td>
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<td>Nucl Acids Res (2w)</td>
<td>21(18)</td>
<td>21(16)</td>
<td>21(17)</td>
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<td>Oncogene (m)</td>
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<td>8(9)</td>
<td>8(10)</td>
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<td>Nature Genet (m)</td>
<td>5(1)</td>
<td>4(4)</td>
<td>-</td>
<td>5(1)</td>
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<td>Cytogenet (m)</td>
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<td>64(2)</td>
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## ICRF DOCUMENT SUPPLY TESTS: 1994-1995

<table>
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<tr>
<th>SUPPLIER</th>
<th>ORDER</th>
<th>MODE</th>
<th>COST</th>
<th>TURN-AROUND TIME</th>
<th>QUALITY</th>
<th>PROBLEMS</th>
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<td>BL (Standard)</td>
<td>Account via ARTTel</td>
<td>Mailed</td>
<td>£4.29 (inc. VAT)</td>
<td>Range: 1 - 65.5 days</td>
<td>Good photocopy</td>
<td>Delays due to waiting lists</td>
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<td></td>
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<td>30 &lt;= 4.5 days</td>
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<td></td>
<td></td>
<td></td>
<td>Average: 3 days</td>
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<tr>
<td>BL (BIDS)</td>
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<td>Mailed</td>
<td>£7.70 (inc. VAT)</td>
<td>Range: 1.5 - 5.5 days</td>
<td>Good photocopy</td>
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<tr>
<td></td>
<td>Mark records</td>
<td></td>
<td></td>
<td>Average: 3 days</td>
<td></td>
<td>Slow searching</td>
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<tr>
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<td></td>
<td></td>
<td></td>
<td>7 unavailable</td>
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<tr>
<td>UnCover</td>
<td>Account or Credit Card Search database</td>
<td>Fax</td>
<td>$8.50 + $3 + copyright fee</td>
<td>Range: 15 mins - 2 days</td>
<td>Faxes poor quality</td>
<td>Slow searching</td>
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<tr>
<td></td>
<td>Mark records</td>
<td></td>
<td>(varies)</td>
<td>Average: 1 day</td>
<td>especially graphics</td>
<td>Free database</td>
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<td></td>
<td>Missing / cancelled</td>
</tr>
<tr>
<td>ISI</td>
<td>Account or invoice E-mail requests</td>
<td>Mailed</td>
<td>Document and copyright prices</td>
<td>Range: 7.5 - 35.5 days</td>
<td>Good tear sheets or</td>
<td>11 photocopies had writing on.</td>
</tr>
<tr>
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<td>vary.</td>
<td>Average: 18 days</td>
<td>reprints</td>
<td>4 unavailable</td>
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<td>Average: $15.84</td>
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<td>INIST</td>
<td>Account</td>
<td>Mailed</td>
<td>44 French Francs + 22 FF</td>
<td>Range: 2.5 - 19 days</td>
<td>Excellent (scanned</td>
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<td>Fax requests</td>
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<td>(10+ pages)</td>
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<td>articles)</td>
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<td>Average: 44 FF</td>
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<td>Mailed</td>
<td>Prepaid or electronic: £1.80</td>
<td>Range: 2.5 - 4.5 days</td>
<td>Good photocopy</td>
<td>Coverage problems</td>
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<td></td>
<td>Prepaid stamps or invoice</td>
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<td>Standard: £3.00 (inc. VAT)</td>
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*Table 3: Analysis of ICRF Document Supply Tests 1994-95*
APPENDIX 5
## APPENDIX 5 - OVERVIEW OF CAS-IAS SUPPLIERS
### JULY 1997

<table>
<thead>
<tr>
<th>SUPPLIER</th>
<th>NAME/SUBJECT COVERAGE</th>
<th>SOURCE OF DATA</th>
<th>SCOPE OF DATA</th>
<th>MODE OF ACCESS</th>
<th>COST OF ACCESS</th>
<th>DOCUMENT ORDERING</th>
<th>DOCUMENT SUPPLIERS</th>
<th>MODE OF DELIVERY</th>
<th>DOCUMENT COST</th>
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<tbody>
<tr>
<td>Academic Press IAS</td>
<td>IDEAL. Multi Discipline - 175 Academic Press journals. 1996</td>
<td>Academic Press journals - other publishers approached re using IDEAL system</td>
<td>TOCs, citation, abstracts - HTML, fulltext - PDF</td>
<td>Via WWW - UK site at BIDS</td>
<td>Free to sites in pilot license scheme - 3 year period</td>
<td>Online via WWW</td>
<td>Direct from own titles</td>
<td>Online PDF</td>
<td>Free at licensed sites. Certain titles are temporarily free for all</td>
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<tr>
<td>ADONIS IAS</td>
<td>ADONIS Biomedical field</td>
<td>Covers ~700 journals from 70 publishers. Select specific titles</td>
<td>Abstracts, citations, fulltext</td>
<td>Subscription based plus quarterly billing of royalties.</td>
<td>Stand alone: 1997 subscription yr - NLG325.80K; 1996 subscription yr - NLG 28K</td>
<td>From supplied CD discs</td>
<td>Printout locally on site titles subscribed to</td>
<td>Hardcopy printout locally</td>
<td>Developing launch of PDF support for 2nd quart. 1997 for 500 titles</td>
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<tr>
<td>BIDS CAS</td>
<td>BIDS Multi discipline, subscribe to a range of databases</td>
<td>Range of database suppliers e.g. ISI, Embase, RSC JournalsOnline Participant publishers - 120 journal titles</td>
<td>Articles, conf. proc. Abstracts 1991 - Data entered - available after pub. Stored search facility for updating. Includes citations &amp; abstracts - free for all - Full text free if subscribe to h/copy.</td>
<td>Teled/WWW</td>
<td>HE institutions pay annual fee depending on databases subscribed to. No charges at point of use for users</td>
<td>ISI databases now linked to JournalsOnline</td>
<td>n/a</td>
<td>Results emailed to individual</td>
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Mail: c/right cleared £12.65 Fax: £13.95
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<th>DOCUMENT SUPPLIERS</th>
<th>MODE OF DELIVERY</th>
<th>DOCUMENT COST</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIOSIS CAS</td>
<td>BI-F-S: BIOSIS Information Transfer System. 6K scientific journals, books, conf.procs. Life Sciences</td>
<td>Document Express</td>
<td>BIOSIS Previews database. BIOSIS d'bases: Biol. Abstracts, BIOSIS previews, BioBusiness etc.</td>
<td>Diskette/ - variety of formats e.g. Pre-Cis. EndNote, Ref Manager etc. Email/ftp</td>
<td>Annual subscription - $50 dependent on volume of refs. instead. 3 mths. $150 followed by annual fee.</td>
<td>Variable dependent on mode of access.</td>
<td>BIOSIS/ Email</td>
<td>BIOSIS &gt;1993 $11.00 + orig.冉 Rels: &lt;10.00 Fax: $3.00 per page. Vol. discounts available. Credit Card account min. $500.</td>
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</tr>
<tr>
<td>BMA IAS</td>
<td>Clinical medicine</td>
<td>- 3k journals held in BMA library</td>
<td>Full text copies. Individual BMA library members. Institutional -invited, prepaid stamps</td>
<td>Mail, email, fax</td>
<td>Own collection or will send requests to BLDSC further</td>
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<td>EC: £3.80 Prepaid £1.90</td>
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<td>CISTI supply</td>
<td>Own collection, BLDSC &amp; other suppliers.</td>
<td>Online via CISTI's catalogue: OCLC Pros, WWW, NLM, DoLine, GratefulMed. Enquiry, CD-ROM CISTI holdings, SwetScan, NLC, ISSN, fac, mail/phone</td>
<td>Online via CISTI catalogue: OCLC Pros, WWW, NLM, DoLine, GratefulMed. Enquiry, CD-ROM CISTI holdings, SwetScan, NLC, ISSN, fac, mail/phone</td>
<td>Tel/Fax/Internet</td>
<td>Direct: $8 up to 50p if under $1. Price per page: $1.50 Non-e - $45 loan Link: $33</td>
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<td>CoDAS covers &gt;60 journals in condensed matter &amp; mat. sciences.</td>
<td>CoDAS</td>
<td>3-4 week pre-publication. Citations &amp; abstracts Specific profiles may be built</td>
<td>Via WWW</td>
<td>£50 + VAT - indiv. £200 + VAT - inst.</td>
<td>Via WWW</td>
<td>CoDAS/EBSCO</td>
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<td>EBSCO CAS</td>
<td>EBSCO Doc: Multi discipline</td>
<td>EBSCO Doc</td>
<td>EBSCO Doc: Manifeste of 30k in house journals + Inside Information, Inside Conferences, ADONIS d'base available on WWW</td>
<td>EBSCOCONET &amp; WWW</td>
<td>Cart. Citations: Online $900 per simalt. access. CD-ROM $1.5k incl. monthly updates. TOCs &amp; SDI's priced per item - $3.50-$150</td>
<td>Mail/Phone/ Fax/WWW</td>
<td>EBSCO/EBSCO</td>
<td>EBSCO/EBSCO document services</td>
<td>Fax/Counter/Mail/Actel</td>
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<td>Elsevier</td>
<td>ESI TOC &gt; 1k Elsevier</td>
<td>Elsevier titles</td>
<td>TOCs, abstracts searchable, not viewable. From Jan. 95 - 6 weeks after despatch of h/copy</td>
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<td>ESI</td>
<td>ESI Electronic</td>
<td>Full text CD ROM/Magnetic Tape</td>
<td>Full text CD-ROM/Magnetic Tape, weekly/biweekly delivery dependent on title</td>
<td>Via WWW</td>
<td>Free</td>
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<tr>
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<td>Subscriptions EES - entire range of Elsevier journals</td>
<td>45 jnl: neuroscience cardioiology</td>
<td>Full text</td>
<td>Pilot stage - no prices given. Licensing facilities - price model in level of implementation &amp; funct. or individual fee per access. Based on h/copy sub. + % annual host fee</td>
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<td>EiDDS - AEI DocDel El/Text - under development Articles on Call</td>
<td>Pre scanned articles</td>
<td>Via Email - small fee</td>
<td>Site licence based on user pop. or no. of concurrent users ranging from $4250 - $275.5K. Additional charges to allow access to other services e.g. CompendexWeb</td>
<td>Online ordering via AEI databases Fee/Email/FTP Payment in advance</td>
<td>From AEI Collection</td>
<td>Mail/Fax/Courier credit card. Services monthly</td>
<td>From AEI coll. $10.5 +right +fee, AEI coll. $15.00 +right Add. charges: fax: $2.0 +$1.25 each page Courier: at cost</td>
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<td>Via Email - small fee</td>
<td>Site licence based on user pop. or no. of concurrent users ranging from $4250 - $275.5K. Additional charges to allow access to other services e.g. CompendexWeb</td>
<td>Online ordering via AEI databases Fee/Email/FTP Payment in advance</td>
<td>From AEI Collection</td>
<td>Mail/Fax/Courier credit card. Services monthly</td>
<td>From AEI coll. $10.5 +right +fee, AEI coll. $15.00 +right Add. charges: fax: $2.0 +$1.25 each page Courier: at cost</td>
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<td>Online via AEI</td>
<td>Site licence based on concurrent users: 1 user: $1.97/k pa &lt;3 $1.77/k pa &lt;6 $1.25/k pa</td>
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<td>Updated quarterly, EU, ISO world-wide, Germany, France, Norway, Sweden, US, Japan, Austral. others to be added</td>
<td>Online via AEI</td>
<td>Site licence based on concurrent users: 1 user: $1.97/k pa &lt;3 $1.77/k pa &lt;6 $1.25/k pa</td>
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<td>DOCUMENT ORDERING</td>
<td>DOCUMENT SUPPLIERS</td>
<td>MODE OF DELIVERY</td>
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<td>Faxon CAS</td>
<td><em>Faxon Finder</em> Multi discipline</td>
<td>Keyboarded TOC’s 12k journals from 1990. Articles, news, editorials, book reviews, conference proceedings</td>
<td>Includes 10 authors TOC’s updated daily online - monthly CD-ROM Entry to change 7-12 days after receipt</td>
<td>Search software provided - menu driven CD-ROM in Windows interface Removal options 3 access options: (i) online - unlimited access via WWW, search profiles. (ii)CD-ROM - single user/ library access - monthly updates, local holdings linked, direct docdel, search profiles. (iii) Online - network wide access, instits. front end &amp; search engine, link to other info. sources, weekly updates</td>
<td>(i)Online: $950 pa sub. + $50 set-up + $50 per connect hour +connect charges. (ii)Online - print request based on specification. (iii)CD-ROM - single user $950 - 95/96 $904 - 100 pa multi user $2.5k 95/96 96/97 $100 pa. Discount packages - CD + Online together</td>
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<td>Multi/Courier</td>
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<td>TOCs</td>
<td>Via Finder services or WWW Emails results</td>
<td>Email: 1-10 titles $10 - 1 user. $12 distrib. 11-50 $8 51-100 $6, $8 101-300 $5, $7 &gt;300 $3, $5 Fax only in US /Can.</td>
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<td>n/a</td>
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<td>IEEE IAS</td>
<td><em>ASK</em>IEEE Specialises in electrical eng. comp.sci. &amp; phys. sciences journal. &amp; conf. proc.</td>
<td>INSPEC, IEE &amp; IEEE collections</td>
<td>INSPEC 1994 - Also provides ordering system for purchase of books &amp; standards</td>
<td>Varies according to mode of access</td>
<td>Tel/Fax/ Email/ online ordering</td>
<td>Full collections of IEE &amp; IEEE</td>
<td>Multi/Fax/Email/ online ordering</td>
<td>$12.00/right</td>
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<td>Infotrieve IAS</td>
<td><em>Science/biomedical/business Collections in US &amp; Europe</em></td>
<td><em>Medline on the Web</em> service. $30 per month access to medical jour. Adaline &amp; Toxline also available</td>
<td>2 methods: i:sub: single user $600 pa - 10 concurrent users $9.75. Customised options e.g. library holdings linked, direct docdel, deposit account - searching Medline free Tel/Fax/Email/www</td>
<td>Various - InfoTrieve act as a brokerage service</td>
<td>Internet/fax/email/courier</td>
<td>$0.25 per article +right +$1 for fax per pg. $10 for rush service. Monthly billing, credit card, deposit account. Discounts available</td>
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IEE IAS http://www.ieee.org.uk/publishing/inspec/askieee.html
Infotrieve IAS http://www.infotrieve.com

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<th>COST OF ACCESS</th>
<th>DOCUMENT ORDERING</th>
<th>DOCUMENT SUPPLIERS</th>
<th>MODE OF DELIVERY</th>
<th>DOCUMENT COST</th>
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<td>INISTIAS</td>
<td><a href="http://www.inist.fr">http://www.inist.fr</a></td>
<td>Concentrate on grey lit. in all fields of science &amp; tech. 33k journal titles, 60k confs., 100k dia. not limited to PASCAL database contents.</td>
<td>Scans images of 2k most requested titles.</td>
<td>Full text</td>
<td>Online WWW</td>
<td>n/a</td>
<td>Mail/Fax/Online host/FTP 4 levels of service</td>
<td>INIST collections but if cannot satisfy will send to other collections.</td>
<td>Mail/Courier/Fax</td>
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<td><a href="http://www.iop.org/ij">http://www.iop.org/ij</a></td>
<td>IOP journal titles</td>
<td>IOP titles</td>
<td>TOCs &amp; abstracts - html, Fulltext - PDF &amp; PostScript</td>
<td>Via WWW</td>
<td>Free to sites in PLSI if institution subscribes to hard copy</td>
<td>Online</td>
<td>IOP titles</td>
<td>PDF/PostScript format</td>
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<tr>
<td>ISI IAS</td>
<td><a href="http://www.isinet.com">http://www.isinet.com</a></td>
<td>The Genuine Article</td>
<td>ISI databases</td>
<td>7k journals 5 yr coverage extends coverage outside ISI collection</td>
<td>Full text</td>
<td>Mail/Phone/Fax/Online: Dialog, OCLC, First Search, STN, DIMDI &amp; WWW site</td>
<td>Online</td>
<td>Fax/Mail/Courier</td>
<td>Acquisitions/holdings - to be extended</td>
</tr>
<tr>
<td>ISI CAS</td>
<td><a href="http://www.bids.ac.uk">http://www.bids.ac.uk</a></td>
<td>The Genuine Article</td>
<td>ISI databases</td>
<td>Current Contents: Citation indexes - multi-disciplinary, Research Alert Direct: RAD Multi-discipline - 6 titles</td>
<td>Full text</td>
<td>Mail/Phone/Fax/Online: Dialog, OCLC, First Search, STN, DIMDI &amp; WWW site</td>
<td>Online</td>
<td>Fax/Mail/Courier</td>
<td>Acquisitions/holdings - to be extended</td>
</tr>
</tbody>
</table>

Note: The table contains information on various document suppliers, their subject coverage, sources of data, scope of data, mode of access, cost of access, document ordering, document suppliers, mode of delivery, and document cost. The data is intended to provide a comprehensive overview of the services offered by each supplier.
<table>
<thead>
<tr>
<th>Supplier</th>
<th>Name/Subject Coverage</th>
<th>Source of Data</th>
<th>Scope of Data</th>
<th>Mode of Access</th>
<th>Cost of Access</th>
<th>Document Ordering</th>
<th>Document Suppliers</th>
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<th>Document Cost</th>
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<td>Knight Ridder CAS</td>
<td>Article Express</td>
<td>KR databases</td>
<td>Updates vary usually each time database updated. Result: daily fax/weekly email</td>
<td>Online to KR databases</td>
<td>Varies according to frequency - charged per update</td>
<td>Phone/Fax/Email/WWW</td>
<td>From stock &amp; collection of libraries</td>
<td>Fax/Email/FTP/Mail/Ariel</td>
<td>Standard $12.95/article, Rush $26.95/article. SuperRush $29.95/article - only from internal collection. Delivery charges mail - none, fax $11/Email - no charge. Discounts for vol. &amp; deposit accounts. Credit Cards/added to KR database invoice.</td>
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<td>Knight Rider IAS</td>
<td>KR SourceOne</td>
<td>Internal holdings, external collection of libraries including BLDSIC</td>
<td>Citation</td>
<td>Online via WWW, Dialog databases</td>
<td>Fee at WWW site - varies via online host</td>
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<td>OCLC CASIA</td>
<td>ArticleFirst/ContentsFirst/ContentsAlert/NetFirst</td>
<td>TOC of &gt;15k journals held by OCLC libraries</td>
<td>Excludes letters, editorials &amp; reviews. Cites first 4 authors only</td>
<td>Subscription or fee based service. Per buy in blocks of 500.</td>
<td>Via Chest -5 options -extra negotiable databases. (60k-150k) blocks from $575 from 500 searches to $35k for &gt;40k searches. $5 per title for alert, $7.5 for distrub</td>
<td>Online ordering</td>
<td>BLDSIC/ISIS/UMI</td>
<td>Mail/Fax/Courier/download ASCII text. Credit card/account</td>
<td>Doc. suppliers prices vary. EPIC: $0.75 per article</td>
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<tr>
<td>OVID CASIA</td>
<td>OVID Biomedical</td>
<td>Covers &gt;500 journal titles</td>
<td>Citations, abstracts &amp; full text links to databases - Medline, PsychLit, Cinahl. Jan 1993 - Updated monthly</td>
<td>Via WWW SGML format or load database on a local server</td>
<td>Discounted if hardcopy kept. Fined fee 'pick &amp; mix'</td>
<td>Online ordering</td>
<td>Online - locally held on server or access to server in Amsterdam</td>
<td>Varies for collections: Core: single user $4.85/acad. 2 concurrent user: $4.95K. 20 concurrent user $13.05K (all for single site).</td>
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<td>NAME/SUBJECT COVERAGE</td>
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<td>SCOPE OF DATA</td>
<td>MODE OF ACCESS</td>
<td>COST OF ACCESS</td>
<td>DOCUMENT ORDERING</td>
<td>DOCUMENT SUPPLIERS</td>
<td>MODE OF DELIVERY</td>
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<tr>
<td>RLG IASt</td>
<td>Citadel using ARIBL - document transmission software Eureka - CAS</td>
<td>ARIBL, INSIDE INFORMATION, ENV. SCI. &amp; POLL. MAN.</td>
<td>Citations &amp; abstracts Citations, abstracts, full text</td>
<td>Online using Ariel, Mux/Fax</td>
<td>Free for CURL group</td>
<td>Via Citadel file Selection of files</td>
<td>Credit card, deposit account - itemized reports</td>
<td>Vary from $8-25 dependent on file searched</td>
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</tr>
<tr>
<td>Royal Society of Chemistry CAS</td>
<td>Tailored search services Science &amp; technology Library &amp; Information Centre, Chemistry</td>
<td>RSC databases + external databases eg. Chem.Abstr, BIOSIS, Inspec</td>
<td>Updated monthly with a keyword search, citation + abstract Full text</td>
<td>Mediated search carried out by RSC</td>
<td>Variable annual fee per profile</td>
<td>TriFax/email/email</td>
<td>RSC Mail/Fax</td>
<td>Varies according to status &amp; service. Members may use prepaid vouchers</td>
<td></td>
</tr>
<tr>
<td>Springer-Verlag CAS</td>
<td>Springer Journals Preview Service SJPS</td>
<td>Springer Journals Preview Service SJPS</td>
<td>TOCs &amp; abstracts pre publication</td>
<td>Email/FTP/WWW</td>
<td>Fee for TOC service Abstract service for all titles $30 pa. Credit card charged in DM Fee for 1997 for h/copy subscriber.</td>
<td>n/a</td>
<td>n/a</td>
<td>Email/WWW n/a</td>
<td></td>
</tr>
<tr>
<td>SWETS CAS</td>
<td>SwetScan. All disciplines biomedical bias SwetDoc</td>
<td>13k journals scanned + selected journal profiles</td>
<td>Includes all authors TOCs</td>
<td>Online via DataSwets/Disckets/ magnetic tape/ printout/file transfer/ STN/Email</td>
<td>Single annual subscription complete subscription Per title costs for subset of databases</td>
<td>Online</td>
<td>BLDSC</td>
<td>Mail/Fax</td>
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237
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<th>SUPPLIER</th>
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<th>SOURCE OF DATA</th>
<th>SCOPE OF DATA</th>
<th>MODE OF ACCESS</th>
<th>COST OF ACCESS</th>
<th>DOCUMENT ORDERING</th>
<th>DOCUMENT SUPPLIERS</th>
<th>MODE OF DELIVERY</th>
<th>DOCUMENT COST</th>
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<tr>
<td>UMI IAS</td>
<td>InfoStore</td>
<td>Large internal collection &amp; external collection</td>
<td>Full text</td>
<td>Fax/Email/Phone/Dial ORDER/OCLC/Ans /Wilson Disc/PQDD/WWW</td>
<td>NA</td>
<td>Fax/Phone/email/mail /WWW</td>
<td>In-house collection - external suppliers network</td>
<td>Fax/Mail/Courier/ Ariel</td>
<td>From Umi collection base rate: $9.0 $right, (usually $2.0) Fax:+$5.00, overnight $11.00, Mail/Ariel free.</td>
</tr>
<tr>
<td>ProQuest Direct - Applied Science &amp; Technology</td>
<td>Scanned images &gt;4k images</td>
<td>Citation, abstracts, full text, full page images</td>
<td>WWW interface or customised Windows interface</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ProQuest: Electronically - pdf format or traditional - fax/courier/email</td>
<td>ProQuest: Citation: $0.5 abstract: $1.5 fulltext: $4.10 invoice: $9.75 (+delivery charge)</td>
</tr>
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<td>UnCover</td>
<td>Science &amp; Technology - 55% Social Sciences - 33% Humanities 12%</td>
<td>&gt;15K journals - 55 million articles since 1988</td>
<td>Citations</td>
<td>WWW access, Telnet via BIDS 5 modes: open - no charge for search, pword, direct connect, standard gateway, customised gateway.</td>
<td></td>
<td>Online require profile no. &amp; pword</td>
<td>Request not able to be satisfied sent to contributing libraries</td>
<td>Fax Cost viewable online pre ordering. $8.50 $right Credit card/account. Deposit account - min. $100, max. a no of accounts. Billing - invoices monthly - $10 invoicing fee, no ceiling limit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Express</td>
<td>&gt;15K journals - 55 million articles since 1988</td>
<td>Current awareness direct to email. Select from 17K journals &amp; TOCs sent. Store search strategies, run weekly</td>
<td>20k articles documents available in 1 hr.</td>
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APPENDIX 6
APPENDIX 6

Personal and Laboratory Journals (Reported As Regularly Scanned)
Over Project Period Listed Alphabetically By Title

Listing A6.1.1 Personal Journals - Phase 1

American Psychologist
American Statistician
Annals of Probability
Antisense Research and Development
Appetite
Behavioral Psychotherapy
Behaviour Research and Therapy
Biometrics
Biometrika
British Journal of Rheumatology
Cell (reported by 2 staff members)
Chance
Current Opinion in Cell Biology
Current Opinion in Immunology
Developmental Biology
Gut
Health Psychology
Human Gene Therapy
Immunology Today
International Statistical Review
Journal of Abnormal Psychology
Journal of Behavioral Medicine
Journal of the American Statistical Association
Journal of the Royal Statistical Society Series A (reported by 2 staff members)
Journal of the Royal Statistical Society Series B
Journal of the Royal Statistical Society Series C
Lancet (reported by 3 staff members)
Mammalian Genome
Nature (reported by 2 staff members)
New Scientist
Psychooncology
Public Health Reports
Science (reported by 2 staff members)
Scientific American
Trends in Biotechnology
Trends in Genetics (reported by 2 staff members)

Listing A6.1.2 Personal Journals - Phase 2

American Journal of Human Genetics
American Psychologist
American Statistician
Annals of Probability
Annual Review of Cell Biology
Annual Review of Neuroscience
Antisense Research and Development
Appetite
Behavioral Psychotherapy
Behaviour Research and Therapy
Bioessays
Biometrics
Biometrika
British Journal of Cancer
British Journal of Rheumatology
Cell (reported by 3 staff members)
Cell Growth and Differentiation
Chance
Current Opinion in Cell Biology
Current Opinion in Immunology
Current Opinion in Oncology
Developmental Biology
European Journal of Cancer
Gut
Health Psychology
Histopathology
Human Gene Therapy
Human Molecular Genetics
Immunology Today
International Statistical Review
Journal of Abnormal Psychology
Journal of Behavioral Medicine
Journal of Pathology (reported by 2 staff members)
Journal of the American Statistical Association
Journal of the Royal Statistical Society Series A (reported by 2 staff members)
Journal of the Royal Statistical Society Series B
Journal of the Royal Statistical Society Series C
Journal of the Royal Statistical Society Series D
Lancet (reported by 2 staff members)
Mammalian Genome
Nature (23 copies)
Nature Genetics (reported by 2 staff members)
New Scientist
Psychooncology
Public Health Reports
Science (reported by 2 staff members)
Scientific American
Trends in Biotechnology
Trends in Genetics (reported by 3 staff members)

Listing A6.1.3 Personal Journals - Phase 3
American Journal of Human Genetics
American Psychologist
American Statistician
Annals of Probability
Annals of Statistics
Annual Review of Cell Biology
Annual Review of Neuroscience
Appetite
Applied Immunohistochemistry
Behavioral Psychotherapy
Behaviour Research and Therapy
Biometrics
Biometrika
Biotechniques
British Journal of Cancer
British Journal of Cardiology
British Journal of Rheumatology
British Medical Journal
Cell (reported by 4 staff members)
Cell Growth and Differentiation
Chance
Current Biology
Current Opinion in Cell Biology (reported by 2 staff members)
Current Opinion in Genetics and Development
Current Opinion in Immunology
Development
Developmental Biology
European Journal of Cancer
Genes and Development
Genetics
Gut
Health Psychology
Histopathology
Human Molecular Genetics (reported by 2 staff members)
Immunology Today (reported by 2 staff members)
International Statistical Review
Journal of Abnormal Psychology
Journal of Behavioral Medicine
Journal of Pathology (reported by 2 staff members)
Journal of the American Statistical Association
Journal of the Royal Statistical Society Series A (reported by 2 staff members)
Journal of the Royal Statistical Society Series B
Journal of the Royal Statistical Society Series C
Journal of the Royal Statistical Society Series D
Lancet (reported by 2 staff members)
Mammalian Genome
Nature (reported by 23 staff members)
Nature Genetics (reported by 2 staff members)
New Scientist (reported by 3 staff members)
Public Health Reports
Science (reported by 4 staff members)
Scientific American
Trends in Genetics (reported by 2 staff members)

Listing A6.2.1 Laboratory Journals - Phase 1

Addictive Behaviors
American Journal of Surgical Pathology
Annual Review of Biochemistry
Annual Review of Cell Biology
Bioessays (reported by 2 staff members)
Blood
Bone and Mineral
Calcified Tissue International
Cell (reported by 7 staff members)
Controlled Clinical Trials
Current Biology
Current Genetics
Current Opinion in Cell Biology (reported by 3 staff members)
Current Opinion in Structural Biology
Cytokine
Development
EMBO Journal (reported by 4 staff members)
Genes and Development (reported by 3 staff members)
Genomics (reported by 3 staff members)
Glycobiology
Gynecologic Oncology
Hematology
Histopathology (reported by 2 staff members)
Human Molecular Genetics (reported by 2 staff members)
Human Pathology
Immunogenetics
Immunology Today
International Journal of Developmental Biology
Journal of Bacteriology
Journal of Bone and Mineral Research
Journal of Cell Biology (reported by 2 staff members)
Journal of Clinical Pathology (reported by 2 staff members)
Journal of General Virology
Journal of Investigative Dermatology
Journal of Molecular Biology
Journal of Pathology (reported by 3 staff members)
Journal of the Royal College of Physicians
Lancet
Nature (reported by 27 staff members)
Nature Genetics (reported by 3 staff members)
New England Journal of Medicine
New Scientist
Oncogene
Proceedings of the National Academy of Sciences (reported by 2 staff members)
Protein Engineering
Protein Expression and Purification
Protein Science
Science (reported by 10 staff members)
Trends in Biochemical Sciences (reported by 5 staff members)
Trends in Genetics (reported by 4 staff members)

**Listing A6.2.2 Laboratory Journals - Phase 2**

Addictive Behaviors
American Journal of Surgical Pathology (reported by 2 staff members)
Annual Review of Biochemistry
Annual Review of Cell Biology
Bioessays (reported by 2 staff members)
Blood
Bone and Mineral
British Journal of Cancer
Calcified Tissue International
Cancer Metastasis Reviews
Cancer Research (reported by 2 staff members)
Cell (reported by 11 staff members)
Cell Adhesion and Communication (reported by 2 staff members)
Chromosome Research
Controlled Clinical Trials
Current Opinion in Cell Biology (reported by 2 staff members)
Current Opinion in Hematology
Current Opinion in Structural Biology
Development (reported by 2 staff members)
EMBO Journal (reported by 6 staff members)
Genes Chromosomes and Cancer
Genes and Development (reported by 4 staff members)
Genomics (reported by 3 staff members)
Glycobiology
Gynecologic Oncology
Hematology
Histopathology (reported by 2 staff members)
Human Molecular Genetics
Human Pathology
Immunogenetics
Immunology
Immunology Today (reported by 4 staff members)
International Journal of Developmental Biology
Journal of Biological Chemistry (reported by 4 staff members)
Journal of Bone and Mineral Research
Journal of Cell Biology (reported by 3 staff members)
Journal of Cell Science
Journal of Clinical Pathology (reported by 2 staff members)
Journal of Experimental Medicine
Journal of General Virology
Journal of Investigative Dermatology
Journal of Molecular Biology
Journal of Pathology (reported by 3 staff members)
Journal of the Royal College of Physicians
Lancet
Modern Pathology
Molecular Biology of the Cell
Molecular Endocrinology
Molecular and Cellular Biology (reported by 2 staff members)
Molecular and Cellular Endocrinology
Nature (reported by 34 staff members)
Nature Genetics (reported by 3 staff members)
Nature Structural Biology
New England Journal of Medicine
New Scientist
Oncogene (reported by 2 staff members)
Proceedings of the National Academy of Sciences
Protein Engineering
Protein Expression and Purification
Protein Science
Science (reported by 10 staff members)
Structure
Trends in Biochemical Sciences (reported by 4 staff members)
Trends in Cell Biology
Trends in Genetics (reported by 3 staff members)
Listing A6.2.3 Laboratory Journals - Phase 3

Addictive Behaviors
American Journal of Surgical Pathology (reported by 2 staff members)
Annual Review of Biochemistry
Annual Review of Cell Biology
BioTechnology
Bioessays (reported by 3 staff members)
Bone and Mineral
British Journal of Cancer
Calcified Tissue International
Cancer Metastasis Reviews
Cancer Research (reported by 5 staff members)
Cell (reported by 10 staff members)
Cell Adhesion and Communication (reported by 2 staff members)
Chromosome Research
Controlled Clinical Trials
Current Biology
Current Opinion in Cell Biology (reported by 6 staff members)
Current Opinion in Genetics and Development (reported by 4 staff members)
Current Opinion in Structural Biology (reported by 3 staff members)
Development
Differentiation
EMBO Journal (reported by 5 staff members)
European Journal of Cancer
Flow Cytometry
Gene Therapy (reported by 2 staff members)
Genes Chromosomes and Cancer
Genes and Development (reported by 3 staff members)
Genomics (reported by 3 staff members)
Histopathology (reported by 2 staff members)
Human Gene Therapy (reported by 2 staff members)
Human Molecular Genetics
Human Pathology
Immunity
Immunogenetics
Immunology
Immunology Today (reported by 4 staff members)
International Journal of Developmental Biology
International Journal of Gynecological Pathology
Journal of Bacteriology (reported by 2 staff members)
Journal of Biological Chemistry (reported by 6 staff members)
Journal of Bone and Mineral Research
Journal of Cell Biology (reported by 6 staff members)
Journal of Cell Science
Journal of Cellular Physiology
Journal of Clinical Pathology (reported by 2 staff members)
Journal of Computational Biology
Journal of Experimental Medicine
Journal of General Virology
Journal of Investigative Dermatology
Journal of Molecular Biology
Journal of Pathology (reported by 3 staff members)
Journal of the National Cancer Institute
Journal of the Royal College of Physicians
Lancet
Modern Pathology (reported by 2 staff members)
Molecular Biology of the Cell
Molecular and Cellular Biology
Molecular and Cellular Endocrinology
Molecular and General Genetics
Nature (reported by 37 staff members)
Nature Genetics (reported by 4 staff members)
Nature Structural Biology
New England Journal of Medicine
Oncogene
Proceedings of the National Academy of Sciences
Progress in Growth Factor Research
Protein Engineering
Protein Expression and Purification
Protein Science
Science (reported by 11 staff members)
Structure (reported by 3 staff members)
Trends in Biochemical Sciences (reported by 7 staff members)
Trends in Cell Biology
Trends in Genetics (reported by 6 staff members)
**APPENDIX 7**

Core Journals Identified Over Project Period Ranked in Order By Title

**Listing A7.1.1 Core Journals Phase 1**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>TITLE</th>
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<td>Nature</td>
</tr>
<tr>
<td>125</td>
<td>Cell</td>
</tr>
<tr>
<td>92</td>
<td>Science</td>
</tr>
<tr>
<td>80</td>
<td>EMBO Journal</td>
</tr>
<tr>
<td>79</td>
<td>Proceedings of the National Academy of Sciences</td>
</tr>
<tr>
<td>61</td>
<td>Journal of Biological Chemistry</td>
</tr>
<tr>
<td>49</td>
<td>Molecular and Cellular Biology</td>
</tr>
<tr>
<td>41</td>
<td>Genes and Development</td>
</tr>
<tr>
<td>37</td>
<td>Cancer Research</td>
</tr>
<tr>
<td>35</td>
<td>Nucleic Acids Research</td>
</tr>
<tr>
<td>28</td>
<td>Journal of Cell Biology</td>
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<td>24</td>
<td>British Journal of Cancer</td>
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<td>23</td>
<td>Lancet</td>
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<td>Trends in Genetics</td>
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<td>18</td>
<td>Development</td>
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<td>18</td>
<td>Journal of Cell Science</td>
</tr>
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<td>17</td>
<td>New England Journal of Medicine</td>
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<td>Oncogene</td>
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<td>British Medical Journal</td>
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<td>15</td>
<td>Biochemistry</td>
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<tr>
<td>15</td>
<td>European Journal of Cancer</td>
</tr>
<tr>
<td>15</td>
<td>Journal of Experimental Medicine</td>
</tr>
<tr>
<td>15</td>
<td>Journal of Immunology</td>
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<tr>
<td>14</td>
<td>Nature Genetics</td>
</tr>
<tr>
<td>13</td>
<td>Journal of the National Cancer Institute</td>
</tr>
<tr>
<td>13</td>
<td>Trends in Biochemical Sciences</td>
</tr>
<tr>
<td>11</td>
<td>Genomics</td>
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<tr>
<td>10</td>
<td>Developmental Biology</td>
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<tr>
<td>10</td>
<td>European Journal of Immunology</td>
</tr>
<tr>
<td>9</td>
<td>Cancer</td>
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<td>International Journal of Cancer</td>
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<tr>
<td>8</td>
<td>Journal of Clinical Oncology</td>
</tr>
<tr>
<td>8</td>
<td>Journal of Molecular Biology</td>
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<tr>
<td>7</td>
<td>American Journal of Human Genetics</td>
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<tr>
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<td>Biochemical Journal</td>
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<tr>
<td>7</td>
<td>Current Opinion in Cell Biology</td>
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<td>Human Molecular Genetics</td>
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<td>6</td>
<td>Bioessays</td>
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<td>Genetics</td>
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<td>Histopathology</td>
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<td>6</td>
<td>Journal of Investigative Dermatology</td>
</tr>
<tr>
<td>6</td>
<td>Journal of Pathology</td>
</tr>
<tr>
<td>6</td>
<td>Molecular Biology of the Cell</td>
</tr>
<tr>
<td>6</td>
<td>Scientific American</td>
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</table>
American Journal of Clinical Oncology: Cancer Clinical Trials
American Journal of Pathology
American Journal of Surgical Pathology
Biochemical Pharmacology
Computer Applications in the Biosciences
FEBS Letters
Immunology
Journal of Bacteriology
Journal of Cellular Physiology
Molecular Endocrinology
Molecular and General Genetics
Mutation Research
Protein Engineering
Protein Science
Biochemical and Biophysical Research Communications
Blood
Breast Cancer Research and Treatment
Cancer Chemotherapy and Pharmacology
Gene
Immunology Today
Journal of Clinical Investigation
Journal of Virology
New Scientist
American Journal of Epidemiology
American Journal of Public Health
Annals of Internal Medicine
Annals of Oncology
Anticancer Research
Artificial Intelligence
Cancer Treatment Reviews
Carcinogenesis
Current Biology
Cytogenetics and Cell Genetics
Differentiation
Gut
Human Immunology
Human Pathology
Immunogenetics
Journal of Clinical Pathology
Journal of Epidemiology and Community Health
Journal of the American Medical Association
Preventive Medicine
Proteins
Seminars in Oncology
Trends in Cell Biology
Advances in Cancer Research
American Journal of Clinical Pathology
Analytical Biochemistry
Antisense Research and Development
Biotechniques
Cancer Epidemiology Biomarkers and Prevention
Cancer Metastasis Reviews
Clinical Endocrinology
Clinical and Experimental Immunology
Current Opinion in Genetics and Development
Current Opinion in Structural Biology
Development, Growth and Differentiation
Disease Markers
2 Endocrinology
2 European Journal of Biochemistry
2 European Journal of Immunogenetics
2 Gastroenterology
2 Genes Chromosomes and Cancer
2 Health Psychology
2 Human Gene Therapy
2 Immunological Reviews
2 International Immunology
2 International Journal of Radiation Biology
2 Invasion and Metastasis
2 Japanese Journal of Cancer Research (Gann)
2 Journal of Bone and Mineral Research
2 Journal of Cancer Research and Clinical Oncology
2 Journal of Cellular Biochemistry
2 Journal of Immunological Methods
2 Knowledge Engineering Review
2 Mammalian Genome
2 Methods of Information in Medicine
2 Molecular and Cellular Endocrinology
2 Muse Archives
2 Neuron
2 Psychology and Health
2 Radiation Research
2 Statistics in Medicine
2 Teratology
2 Tissue Antigens
2 Tobacco Control
1 Addiction
1 Advances in Radiation Biology
1 American Journal of Cardiology
1 American Journal of Clinical Nutrition
1 American Journal of Hematology
1 American Journal of Respiratory and Critical Care Medicine
1 American Statistician
1 Analytical Chemistry
1 Annals of Statistics
1 Annual Review of Biochemistry
1 Annual Review of Cell Biology
1 Appetite
1 Applied Artificial Intelligence
1 Archives of Dermatological Research
1 Archives of Dermatology
1 Artificial Intelligence Review
1 Artificial Intelligence in Medicine
1 Behavioral Medicine
1 BioTechnology
1 Biochemical Actions of Hormones??
1 Biochimica et Biophysica Acta
1 Biometrics
1 Biometrika
1 Biopolymers
1 Bone
1 Bone and Mineral
1 British Heart Journal
1 British Journal of Clinical Psychology
1 British Journal of Dermatology
1 British Journal of Obstetrics and Gynaecology

250
1 British Journal of Rheumatology
1 CA - A Cancer Journal for Clinicians
1 Calcified Tissue International
1 Cancer Causes and Control
1 Cancer Genetics and Cytogenetics
1 Cancer Investigation
1 Cancer Letters
1 Cancer Surveys
1 Cancer Topics
1 Cancer and Metastasis Reviews
1 Cell Growth and Differentiation
1 Cell Proliferation
1 Cellular Immunology
1 Chance
1 Circulation
1 Computers and Biomedical Research
1 Controlled Clinical Trials
1 Current Genetics
1 Current Opinion in Immunology
1 Current Opinion in Neurobiology
1 DNA Sequence
1 Decision Support Systems
1 Developmental Genetics
1 Electrophoresis
1 Epidemiology
1 European Heart Journal
1 European Journal of Human Genetics
1 Exp Hematol
1 Experimental Cell Research
1 Expert Systems
1 FASEB Journal
1 General Hospital Psychiatry
1 Genetic Analysis Techniques and Applications
1 Genetic Epidemiology
1 Glycobiology
1 Gynecologic Oncology
1 Health Physics
1 Hearing Research
1 Human Genetics
1 IEEE Expert
1 International Journal of Radiation, Oncology, Biology, Physics
1 Japanese Journal of Clinical Oncology
1 Journal of Applied Social Psychology
1 Journal of Biochemistry
1 Journal of Chromatography
1 Journal of Clinical Endocrinology and Metabolism
1 Journal of Clinical Psychology
1 Journal of Consulting and Clinical Psychology
1 Journal of General Virology
1 Journal of Interferon Research
1 Journal of Molecular Endocrinology
1 Journal of Molecular Evolution
1 Journal of Molecular Graphics
1 Journal of Obstetrics and Gynaecology
1 Journal of Personality and Social Psychology
1 Journal of Physical Chemistry
1 Journal of Psychosomatic Research
1 Journal of Steroid Biochemistry

251
Listing A7.1.2 Core Journals Phase 2

Frequency TITLE
148 Nature
134 Cell
101 Science
91 EMBO Journal
88 Proceedings of the National Academy of Sciences
73 Journal of Biological Chemistry
61 Molecular and Cellular Biology
48 Genes and Development
41 Cancer Research
38 Nucleic Acids Research
35 Journal of Cell Biology
26 British Journal of Cancer
26 Journal of Cell Science
26 Lancet
25 Nature Genetics
25 Trends in Genetics
23 Development
22 Oncogene
2 Methods of Information in Medicine
2 Molecular and Cellular Endocrinology
2 Muse Archives
2 Psychology and Health
2 Radiation Research
2 Tissue Antigens
2 Tobacco Control
2 Virology
1 Addiction
1 Advances in Radiation Biology
1 American Journal of Cardiology
1 American Journal of Hematology
1 American Journal of Respiratory and Critical Care Medicine
1 American Statistician
1 Analytical Chemistry
1 Annals of Human Genetics
1 Annals of Statistics
1 Annual Review of Biochemistry
1 Annual Review of Cell Biology
1 Appetite
1 Applied Artificial Intelligence
1 Archives of Dermatological Research
1 Archives of Dermatology
1 Artificial Intelligence Review
1 Artificial Intelligence in Medicine
1 Behavioral Medicine
1 Biotechnology
1 Biochemical Actions of Hormones??
1 Biometrics
1 Biometrika
1 Biopolymers
1 Bone
1 Bone and Mineral
1 British Heart Journal
1 British Journal of Clinical Psychology
1 British Journal of Dermatology
1 British Journal of Nutrition
1 British Journal of Obstetrics and Gynaecology
1 British Journal of Rheumatology
1 CA - A Cancer Journal for Clinicians
1 Calcified Tissue International
1 Cancer Investigation
1 Cancer Letters
1 Cancer Surveys
1 Cancer Topics
1 Cancer and Metastasis Reviews
1 Cell Adhesion and Communication
1 Cell Growth and Differentiation
1 Cell Proliferation
1 Cellular Immunology
1 Chance
1 Circulation
1 Clinical Orthopaedics and Related Research
1 Clinical Pharmacology
1 Computers and Biomedical Research
1 Controlled Clinical Trials
1 Current Opinion in Neurobiology
1 Cytokine

255
Listing A7.1.3 Core Journals Phase 3

Frequency TITLE
153 Nature
134 Cell
111 Science
97 Proceedings of the National Academy of Sciences
96 EMBO Journal
75 Journal of Biological Chemistry
66 Molecular and Cellular Biology
52 Genes and Development
47 Cancer Research
38 Journal of Cell Biology
36 Nucleic Acids Research
31 Journal of Cell Science
30 Oncogene
28 British Journal of Cancer
28 Nature Genetics
26 Lancet
25 Trends in Genetics
23 Biochemistry
23 New England Journal of Medicine
22 Current Opinion in Cell Biology
22 Development
21 Trends in Biochemical Sciences
20 Journal of Immunology
18 British Medical Journal
18 Journal of Experimental Medicine
17 European Journal of Cancer
16 Journal of the National Cancer Institute
15 Human Molecular Genetics
14 Current Biology
13 Genomics
12 European Journal of Immunology
12 Journal of Molecular Biology
11 Bioessays
11 Cancer
11 Developmental Biology
11 International Journal of Cancer
9 Journal of Clinical Oncology
8 American Journal of Human Genetics
8 Biochemical Journal
8 Molecular Biology of the Cell
8 Scientific American
7 Biochemical Pharmacology
7 Blood
7 Genetics
7 Immunology Today
7 Journal of Investigative Dermatology
6 American Journal of Pathology
6 FEBS Letters
6 Histopathology
6 Immunity
6 Immunology
6 Journal of Pathology
6 Mutation Research
6 Neuron
6 New Scientist
5 American Journal of Clinical Oncology: Cancer Clinical Trials
5 American Journal of Epidemiology
5 American Journal of Surgical Pathology
5 Biochemical and Biophysical Research Communications
5 Breast Cancer Research and Treatment
5 Computer Applications in the Biosciences
5 Current Opinion in Genetics and Development
5 Current Opinion in Immunology
5 FASEB Journal
5 Journal of Bacteriology
5 Journal of Clinical Investigation
5 Molecular and General Genetics
5 Nature Structural Biology
5 Protein Engineering
5 Protein Science
5 Structure
5 Trends in Cell Biology
4 Annals of Oncology
4 Biochimica et Biophysica Acta
4 Biotechniques
4 Cancer Chemotherapy and Pharmacology

258
1 Cell Growth and Differentiation
1 Cell Proliferation
1 Cellular Immunology
1 Chance
1 Circulation
1 Clinical Orthopaedics and Related Research
1 Clinical Pharmacology
1 Controlled Clinical Trials
1 Current Opinion in Neurobiology
1 Cytokine
1 DNA Sequence
1 Decision Support Systems
1 Developmental Genetics
1 Diagnostic Molecular Pathology
1 Electrophoresis
1 Epidemiology
1 Essays in Biochemistry
1 European Heart Journal
1 European Journal of Human Genetics
1 Exp Hematol
1 Experimental Cell Research
1 Expert Systems
1 General Hospital Psychiatry
1 Genetic Analysis Techniques and Applications
1 Genetic Epidemiology
1 Growth Factors
1 Gynecologic Oncology
1 Health Economics
1 Health Physics
1 Hospital Pharmacy
1 Hybridoma
1 IEEE Expert
1 IEEE Transactions on Pattern Analysis and Machine Intelligence
1 Image and Vision Computing
1 In Vitro Cellular and Developmental Biology
1 Infection and Immunity
1 International Journal of Behavioral Medicine
1 International Journal of Radiation, Oncology, Biology, Physics
1 Investigative Radiology
1 Japanese Journal of Clinical Oncology
1 Journal of Applied Social Psychology
1 Journal of Behavioral Medicine
1 Journal of Biochemistry
1 Journal of Chromatography
1 Journal of Clinical Endocrinology and Metabolism
1 Journal of Clinical Epidemiology
1 Journal of Computational Biology
1 Journal of Consulting and Clinical Psychology
1 Journal of Experimental and Theoretical Artificial Intelligence
1 Journal of General Virology
1 Journal of Interferon Research
1 Journal of Medical Genetics
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<td>18</td>
<td>Genes and Development</td>
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<td>18</td>
<td>Journal of Cell Biology</td>
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<td>12</td>
<td>Lancet</td>
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<td>Nucleic Acids Research</td>
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Listing A7.2.3 Top 12 Titles of Laboratory Scientists - Phase 3

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Listing A7.3.1 Top 12 Titles of Clinical Scientists - Phase 1

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<td>11</td>
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<tr>
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<td>Lancet</td>
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<td>10</td>
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<td>10</td>
<td>European Journal of Cancer</td>
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<td>British Medical Journal</td>
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</table>
5 Journal of Experimental Medicine
5 Oncogene

**Listing A7.3.2 Top 12 Titles of Clinical Scientists - Phase 2**

**Frequency** | **TITLE**
---|---
14 | Nature
13 | British Journal of Cancer
12 | Cancer Research
11 | Cell
11 | Lancet
10 | European Journal of Cancer
10 | New England Journal of Medicine
9 | Proceedings of the National Academy of Sciences
8 | Science
6 | British Medical Journal
5 | EMBO Journal
5 | Journal of Biological Chemistry
5 | Journal of Experimental Medicine
5 | Journal of the National Cancer Institute
5 | Oncogene

**Listing A7.3.3 Top 12 Titles of Clinical Scientists - Phase 3**

**Frequency** | **TITLE**
---|---
14 | Nature
13 | British Journal of Cancer
13 | New England Journal of Medicine
12 | Cancer Research
11 | Cell
11 | Lancet
10 | European Journal of Cancer
10 | Science
9 | Proceedings of the National Academy of Sciences
7 | British Medical Journal
7 | Oncogene
5 | Cancer
5 | EMBO Journal
5 | Journal of Biological Chemistry
5 | Journal of Clinical Oncology
5 | Journal of Experimental Medicine
5 | Journal of the National Cancer Institute

**Listing A7.4.1 Top 12 Titles of Research Fellows - Phase 1**

**Frequency** | **TITLE**
---|---
27 | Nature
23 | Cell
17 | Proceedings of the National Academy of Sciences
17 | Science
15 | EMBO Journal
13 | Journal of Biological Chemistry
11 | Molecular and Cellular Biology
8 | Nucleic Acids Research
7 | Genes and Development
6 | Journal of Cell Biology
4 Development
3 Biochemistry
3 Developmental Biology
3 Genetics

Listing A7.4.2 Top 12 Titles of Research Fellows - Phase 2

Frequency TITLE
28 Nature
24 Cell
19 EMBO Journal
18 Science
16 Proceedings of the National Academy of Sciences
15 Journal of Biological Chemistry
13 Molecular and Cellular Biology
9 Nucleic Acids Research
8 Genes and Development
7 Journal of Cell Biology
5 Biochemistry
4 Development
4 Journal of Bacteriology

Listing A7.4.3 Top 12 Titles of Research Fellows - Phase 3

Frequency TITLE
28 Nature
24 Cell
20 EMBO Journal
20 Science
19 Proceedings of the National Academy of Sciences
16 Journal of Biological Chemistry
15 Molecular and Cellular Biology
9 Nucleic Acids Research
8 Journal of Cell Biology
5 Biochemistry
4 Cancer Research
4 Development
4 Journal of Bacteriology
4 Oncogene

Listing A7.5.1 Top 12 Titles of Graduate Students - Phase 1

Frequency TITLE
25 Cell
25 Nature
16 EMBO Journal
16 Science
14 Proceedings of the National Academy of Sciences
9 Journal of Biological Chemistry
7 Molecular and Cellular Biology
6 Journal of Cell Science
5 Journal of Cell Biology
5 Nucleic Acids Research
4 Trends in Genetics
3 Biochemistry
3 Genes and Development
3 Nature Genetics
3 Scientific American

Listing A7.5.2 Top 12 Titles of Graduate Students - Phase 2

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<td>Molecular and Cellular Biology</td>
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<td>Nature Genetics</td>
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<td>Nucleic Acids Research</td>
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<td>Trends in Biochemical Sciences</td>
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Listing A7.5.3 Top 12 Titles of Graduate Students - Phase 3

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Listing A7.6.1 Top 12 Titles of Scientific Officers- Phase 1

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### Listing A7.6.2 Top 12 Titles of Scientific Officers- Phase 2

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### Listing A7.6.3 Top 12 Titles of Scientific Officers- Phase 3

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APPENDIX 8
APPENDIX 8

Introduction to the List of Figures

The numbering of the figures is significant. The figures prefaced by zero illustrate references to background issues. The figures with no prefix before them (e.g. Figure 1.1.1) relate directly to the notation utilised in the questionnaire for the responses from the ICRF sample group. The figures with an “E” prefix (e.g. E1.1.1) relate again to the notation utilised in the questionnaire but for the responses from the Composite External Comparison Group. Where a rating scale of one to five is employed in the questionnaire, responses of “3.5” are rounded up to “4” and included in the figures accordingly. The following abbreviations are utilised to indicate categories of staff in the figures: LS (laboratory scientists), CS (clinical scientists), RF (research fellows), GS (graduate students) and SO (scientific officers). The abbreviations “incr”, “decr” and “con” used in the graph legends stand for increased, decreased and constant, respectively.
Figure 0.1.1: Growth in Usage of LIS' Databases 1991-1995

Figure 0.1.2: Growth in Usage of LIS' Internal Databases 1991-1995

Figure 0.1.3: Growth in Usage of LIS' External Databases 1991-1995
Figure 0.2.1: Total Number of Documents Supplied 1991-1995

Figure 0.2.2: Document Requesting: Electronic v. Manual 1991-1992

Figure 0.2.3: Document Requesting: Electronic v. Manual 1992-1993
Document Supply 1993-1994

- Manual: 35%
- Electronic: 65%

Figure 0.2.4: Document Requesting: Electronic v. Manual 1993-1994

Document Supply 1994-1995

- Manual: 47%
- Electronic: 53%

Figure 0.2.5: Document Requesting: Electronic v. Manual 1994-1995


- CAS: 49%
- KEYED: 28%
- LIT: 6%
- CD: 2%
- SCI: 15%

Figure 0.3.1: Document Supply: Modes of Electronic Requesting 1991-1992
Figure 0.3.2: Document Supply: Modes of Electronic Requesting 1992-1993

Figure 0.3.3: Document Supply: Modes of Electronic Requesting 1993-1994

Figure 0.3.4: Document Supply: Modes of Electronic Requesting 1994-1995
**Figure 0.4.1: Increase in Volume of Electronic Mail**

**Figure 0.4.2: Decline in Use of PAD For Remote Login**

**Figure 0.4.3: Growth in User Accesses to USENET News**
Figure 0.5.1: CAS-IAS Currency Surveys Sep.93-Mar.'97

Figure 0.5.2: CAS-IAS Currency Survey Sep.'93

Figure 0.5.3: CAS-IAS Currency Survey Oct.'95
Figure 0.5.4: CAS-IAS Currency Survey Mar.'97

Figure 0.6.1: Breakdown of ICRF Staff Sample

Figure 0.6.2: ICRF Staff Sample as % of Total ICRF Scientific Staff
Figure 0.7.1: Volume of ICRF Staff Publications 1991-1995
Figure 0.7.2: Journal Articles Published by ICRF Staff 1991-1995: Top 12 Journal Titles Ranked by Number of Articles
Figure 1.1.1: Current Awareness Service: % Recipients

Figure 1.1.2: Current Awareness Service: Recipients of CAS Direct by Category of Staff

Figure 1.1.3: Current Awareness Service: Recipients of CAS Indirect by Category of Staff
Figure 1.4.1: Current Awareness Service: Search Profile Type

Figure 1.5.1: Current Awareness Service: Mode of Delivery

Figure 1.6.1: Current Awareness Service: Motivations for Electronic Output
Figure 1.7.1: Current Awareness Service: Perceived Benefits of Electronic Receipt Realised?

Figure 1.8.1: Current Awareness Service: Average Number of References Received Per Week

Figure 1.9.1: Current Awareness Service: Average Number of Photocopied Articles Per Week from CAS References
Figure 1.10.1: Current Awareness Service: Online Abstracts Helped Selection of CAS Articles / Reduction in Requested Articles from CAS References

Figure 1.10.2: Current Awareness Service: Abstracts Searched &/or Sent with Weekly Results

Figure 1.14.1: Current Awareness: Currency Rated 4 and Over
Figure 1.14.2: Current Awareness: Currency Rated 4 and Over by Category of Staff

Figure 1.15.1: Electronic Abstracts Pre-Publication: Interest Rated 4 and Over

Figure 1.15.2: Electronic Abstracts Pre-Publication: Interest Rated 4 and Over by Category of Staff
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