Information Needs and
Information Seeking Behavior of Biomedical Scientists
An Evaluative Bibliography with Annotations

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INFO510: Information Resources & Services I
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Introduction and Scope

The topic of this bibliography is the information needs and information seeking behavior of biomedical scientists. Initially my objective was to examine the information needs and behavior specifically of molecular biologists, particularly those engaged in basic research to discover new medically relevant pharmaceutical agents. Citations in this bibliography are all in the English language, and span a range of seventeen years, from 1991 to 2008. Eight of fourteen articles were published more recently than 2000. Current articles were preferred in an effort to highlight the most recent research focused on this user group. My search strategies included keyword searching, citation searching, footnote chasing and browsing. Citation searching proved to be valuable in finding the literature most relevant to my subject user group. I focused my searches on using databases including Library Literature & Information Science Full-Text, Library & Information Science Abstracts (LISA), Library & Information Science & Technology Abstracts (LISTA), Web of Science and MEDLINE. I also used Ulrich’s International Periodicals Directory as a tool to determine which database(s) indexed specific journals. This was an important step in my process to locate full text copies of publications of interest, and in finding citations that could be imported into RefWorks citation manager.

Description of User Group

Initially I set out to explore the information needs and behavior of scientists who specialize in the investigation of genetic engineering of animals. At first I succeeded in finding only a very small number of references that reported research of information needs of molecular biologists. Thus I was induced to broaden my user group definition to include a broader range of biomedical scientists. My interest is the information needs and behavior of scientists who do intramural research at the National Institutes of Health (NIH), or NIH-funded research at extramural locations such as medical schools throughout the United States. The focus of NIH-funded research is essentially treatment and/or cure of human diseases. So, on the basis of search results I gradually broadened
my user group definition to include medical faculty, graduate students, advanced undergraduate students, and even students of veterinary medicine. Seven of these fourteen articles examine information needs and behavior of molecular biologists. One article (Lascar & Mendelsohn, 2001) focuses on a subgroup of molecular biologists, structural biologists. The other seven articles report on medical faculty, NIH scientists, NIH science administrators, graduate and undergraduate students and veterinary students. Biologists were included (Rolinson, Al-Shanbari & Meadows, 1996) using the rationale that, at this point in time, molecular biology has become an integrated component of biological education and research. That article was chosen, also, because it was published by information scientists in the United Kingdom and I wanted to obtain a perspective from the U.K. and Europe.

The user group I’ve defined is composed of individuals who rank extremely high in intellectual capacity. Many have completed graduate and post-graduate studies in their area of expertise, and some are educated as physicians or veterinarians. “Molecular biologists have a variety of disciplinary backgrounds and may be based in more than one academic department within the university environment.” (Hurd, Blecic & Vishwanatham, 1999, p. 8)

Hurd, et al. (1999, p. 6) describe molecular biology as being a very competitive, very active research front, and references cited tend to be less than five years old. The objectives of genetic engineering ranges from cloning of bacteria, plants or animals, to improving growth and reproductive characteristics of plants or agricultural animals, to development and production of transgenic plants or animals designed for greater production efficiency, more healthful food, or designed to produce pharmacologically relevant proteins in plants or in the milk of animals – so called “bio-pharming.”

**Summary of Findings About the User Group’s Information Needs and Behavior**

Molecular biologists and biomedical researchers have particularly unique information needs, notably including bioinformatics databases, and specialty journals, in addition to the well-known core science journals and laboratory references cited in this bibliography under Recommended Sources. Brown (2005, p. 90) suggests there are over 200 publicly available web-based bioinformatics databases (e.g., NCBI GeneBank). And
Lascar, et al., (2001) highlight a long list of subject specialty journals that are important to structural biologists. A key point, highlighted by Brown (2005, p. 89) is that molecular biology graduate students do not fully utilize bibliographic databases. Instead they rely heavily upon bioinformatics databases as a primary information source, and they learn about bioinformatics databases in their laboratories, from mentors and peers, rather than in libraries. Brown concludes that science and technology librarians must assimilate knowledge of and experience with bioinformatics databases, and discover effective methods for providing instruction in use of these resources in order to provide effective service to the molecular biology user community. MacMullen & Denn (2005) propose far more in-depth roles for information professionals by describing some information-oriented problems in molecular biology, and suggesting active roles and “insertion-points” for information scientists and practitioners, since molecular biology has become an “information-driven science”.

“Because molecular biology is a rapidly-developing and interdisciplinary scientific field, information use and needs of scholars in this area has gained the interest of librarians.” (Kuruppu & Gruber, 2006, p. 610) Most of the studies in this bibliography were performed using surveys and content analysis methods, or citation and publication pattern analysis. Many studies are geared toward supporting core collection development decisions. Kuruppu, et al., (2006, p. 611) opine that, in current literature, “’information use’ and ’information need’ have not been clearly distinguished.” They quote Marquis and Allen (1966), explaining because information use is a behavior it can be quantified “by asking people about it, by observing its occurrence, or by examining its artifacts (e.g., documents).” For this reason the Kuruppu, et al. study is unique in that these investigators used qualitative research methods such as individual one-on-one interviews and focus group sessions in data collection. It is, therefore, one of the more interesting and comprehensive articles in this bibliography, and perhaps the most helpful and relevant as well. The article reaffirms the findings of other authors, specifically that journal articles are the main information source when doing research, and that journal articles supplemented with text books are used for teaching and learning. Personal communication (including email) also ranks very high as a preferred information source in this rapidly progressing field.
The studies cited suggest that biomedical scientists are of strongly independent nature and prefer to conduct their own searches and to utilize literature from their own office or laboratory. This tendency creates a distance between the library and the user community. Kuruppu, et al., (2006, p. 609) capture this issue more succinctly as follows: “understanding the information needs, information-seeking behavior, and information use of academic science scholars is challenging. This task becomes more complicated when we consider they are likely to perform several functions simultaneously (e.g., researcher, educator, planner, administrator and supervisor), that their interests and needs change with time, and that technological advances continuously affect how they find and use information.” And, regarding the user experience of the researchers Kuruppu, et al., (2006, p. 609) observe “in this complex environment, it is difficult for researchers to effectively track the discoveries even in their own specializations.” In this era of modern technology and information overload, one of the major problems, and greatest challenges mentioned (Roos, 2008, p. 16) is the researchers’ ability to filter essential information from non-essential information.

Cultural effects were noted as important factors that determine researchers’ interest in using library resources including bibliographic databases. For example, the oldest study cited (Cunningham, Grefsheim, Simon & Lansing, 1991, p. 49) suggests that established scientists may hold a traditional view of “libraries as collections and librarians as organizers. Scientists may not recognize librarians as specialists in information frontiers.” Biomedical research scientists are independent information seekers by preference. And this preference is learned by subordinates including graduate students and research fellows. Graduate students and undergraduate students learn the research trade under the tutelage of professors and senior scientists. Doing as instructed, they utilize the information sources recommended by their mentors. (Kraus, 2002, p. 175) Library bibliographic instruction appears to not be a required part of undergraduate or even graduate curricula at most institutions. The end result is that the core research skill set learned early on from mentors does not include library utilization skills, and is carried forward into the future, and passed along to the next generation of scientists.

By reviewing articles spanning this time period (e.g., 1991 – 2000) there is clear reflection of the tentative yet persistent adoption of computers and online data sources,
and the growth of these resources. Computer use grew steadily with increases in experience and confidence. For example, the Pelzer, Wiese & Leysen (1998) article effectively documents the impact of the profound growth of computer resources and availability of online information resources during the period from 1988 to 1998.

The amount of research related to information needs and information-seeking behavior of biomedical scientists has increased in the past decade. Results of these, and future studies will help science and technology librarians and information professionals adapt to the rapid changes occurring in biomedical research, and to develop information resources useful in fulfilling the unique demands of this user group.

**Bibliography**


**Search Strategy:** Search for articles specific to information needs of molecular biologists. Full text article obtained through ILL.

**Database Searched:** DIALOG CITEDREF One Search Group

**Search String:** E CR=Hurd JM, 1999

**Search Method:** Citation search.

**Excerpt from Abstract:** “Molecular biology graduate students read the traditional, highly regarded scientific journals, yet do not fully utilize bibliographic databases to find information. Instead, molecular biology graduate students rely on the extensive reservoir of information in bioinformatics databases as well as that within the National Library of Medicine’s PubMed. Graduate students learn about bioinformatics databases in their laboratories, not the campus library, thereby bypassing the library and adopting the laboratory as their information community. The data presented suggest that science and technology librarians must expand their knowledge base to include these resources as well as provide instruction that is both palatable and transparent to the next generation of leaders in the field of molecular biology.”

**Annotation:** Examines the importance of bioinformatics databases as an information source for user group, and posits this trend may have short- and long-term impacts on information seeking behavior of user group. Molecular biologists tend to share DNA and amino acid sequence and protein structure data, without peer review, within a variety of publicly available Web-based bioinformatics databases. Study based on email survey of molecular biology graduate students followed by content analysis of materials reportedly used. Study found that journals read by the students are different from those in which they have published. This author has published previously on this and related topics. The
topic is useful for user group and for librarians in understanding the major functional changes that are occurring in information resources used by this user group, and how bioinformatics databases seamlessly interrelate with bibliographic databases.


**Search Strategy:** Search library literature for “biotechnology” and “information need?”.
Full text article available electronically through SFX.

**Database searched:** DIALOG File 438: Library Lit. & Info. Science

**Search String:** ss biotechnology and information()need?

**Search Method:**Keyword search

**Excerpt from Abstract:** “Results showed few biotechnology-related reference questions were asked of the librarians. The recorded questions dealt with a range of biotechnology subjects. MEDLINE was used to answer 77% of the questions received during the survey period.”

**Annotation:** Second part of NIH-funded regional survey study of biotechnologists at nine medical schools. Purpose to assess whether health science libraries are meeting information needs of user group. This part of the study analyzes reference statistics to define and quantify user group information needs. Observations at the time of this study suggest researchers not utilizing libraries as their primary source of information, and that science librarians were underutilized, unrecognized resource. Study illuminates generational “gap” among biotechnologists concerning computer and keyboard literacy, and comprehension of availability and value of library resources. Excellent study and useful reference.


**Search Strategy:** Search for articles specific to information needs of molecular biologists. Consider expanding user group to health sciences faculty. Full text article available electronically through SFX.

**Source:** Found as a cited reference in the Hurd, 1999 publication.

**Search Method:** Footnote chasing

**Excerpt from Abstract:** “The study found that use of the print Index Medicus among faculty was in transition: While 30.5% continued to use the print resources, 68.0% of
faculty accessed MEDLINE through electronic means. Faculty preferred accessing electronic databases from their offices to doing so from the library. Health sciences faculty used a wide variety of databases, in addition to MEDLINE, to fill their information needs. Most faculty did not take advantage of either in-house or electronic training sessions offered by librarians.”

**Annotation:** Survey-based study, follow-up to similar study done in 1991. Objective to document user migration from print indexing resources to newer electronic resources. This study takes a closer look at user group utilization of library training programs. Source is credible and the report is polished and very well done. This group of authors has published repeatedly on similar surveys of a range of user groups so this report is authoritative. Reference is valuable and relevant to this bibliography.


**Search Strategy:** Search library literature for “biotechnology” and “information()need?”.
Full text article available electronically through SFX.
**Database searched:** DIALOG File 438: Library Lit. & Info. Science
**Search String:** ss biotechnology and information()need?
**Search Method:** Keyword search

**Excerpt from Abstract:** “In general, scientists obtained information from three major sources: their own experiments, personal communication with other scientists, and textual material (print or electronic). For textual information, most study participants relied on personal journal subscriptions.”

**Annotation:** Regional survey study, funded by the National Library of Medicine (NLM), conducted at nine medical schools, of researchers in biotechnology to assess information needs and resources available to meet those needs. Study objective to develop information to support initiative to establish the National Center for Biotechnology Information. Very useful article albeit dated at 18 years old. Interesting and predictable observations regarding emerging use of desktop computers in research. Highly credible reference given the funding source and objectives. Institutions selected for study on the basis of federal support for basic sciences research.

**Search Strategy:** Search for articles specific to information needs of molecular biologists. Full text article available electronically through SFX.

**Database searched:** Dialog OneSearch Group CITEDREF

**Search String:** E CR=Hurd JM, 1999

**Search Method:** Citation search

**Excerpt from Abstract:** “NIH scientists overwhelmingly used the NIH Library (424/500), began their searches at the library’s Website rather than Google (P = < 0.001), were likely to seek information themselves (474/500), and valued desktop resources and services…The findings underscored the need to continue assessing specialized needs and seek innovative solutions.”

**Annotation:** A large, survey-based study to document information needs of NIH scientists versus science administrators. Primary objective to inform library services. Appears to be well-designed study; notes use of Outsell’s User Needs Assessment Toolkit. Source highly credible. Primary author published similar landmark study in 1991 (Grefsheim, Franklin & Cunningham, 1991) while at Univ. of Michigan, and “now” in 2007 is a Director at NIH’s Library. Grefsheim appears the leading authority on information needs of NIH scientists. Reference is useful and highly relevant to this bibliography.


**Search Strategy:** Early search of library literature for “molecular biologists”. Full text article available electronically through SFX.

**Database searched:** DIALOG(R)File 438: Library Lit. & Info. Science

**Search String:** ss molecular(w)biologists (3 hits)

**Search Method:** Keyword search

**Excerpt from abstract:** “Article reports findings from a citation analysis of publications of a group of university molecular biology faculty…Citations in molecular biologists’ publications are overwhelmingly to journal articles, with the largest number of citations to journals that class in biology. The specialization displays a very high level of immediacy with a citation half-life of referenced articles just over four years. Ranked lists of journals cited provide insights to support library decision-making.”
Annotation: Illustrates well the value of citation analysis of the subject user group as it concludes that journal articles are by far the largest number of citations. Discusses basis of methodology relative to bibliometric research by Katherine W. McCain. Conclusions lend support to library decision-making, and propose methodology that might be used in other library settings. Authors appear to be authoritative in their observations and conclusions. Reference very useful in comprehending and planning for information needs of scientific specialists in any vital and rapidly developing scientific subspecialty. Key reference in this bibliography due to focus on molecular biologists.

A reference cited in this article led me to Curtis (1997). There were multiple articles by the same authors (Curtis, Weller and Hurd) from the University of Illinois at Chicago. It appeared to me that these authors are authorities on this topic. For further information see Julie Hurd’s ASIS website http://ils.unc.edu/~wildem/ASIS1998/Hurd-bio98.html.


Search Strategy: Search for articles specific to information needs of molecular biologists. Full text article obtained through ILL.
Database Searched: DIALOG CITEDREF One Search Group
Search String: E CR=Hurd JM, 1999
Search Method: Citation search

Excerpt from Abstract: “Thirty-three undergraduate student papers in biology that were presented at an annual symposium of undergraduate research at the University of Denver from 2000 through 2002 were evaluated…It was determined that 76.2% of the citations came from journal articles, 16.4% came from books or book chapters, 6.4% were to other miscellaneous sources, and only 1.0% were to Web sites. Other findings include the top cited journals, the oldest cited journal articles, the average age and range of books and journals, the types of miscellaneous sources cited, and the stability of the cited Web sites.”

Annotation: While I’m most interested in information needs of active biomedical researchers I found this peek at needs of advanced undergraduate biology students interesting as it may shed light on behavioral differences attributable to age. Study is continuation of previous study done 1997-1999. Author argues exercise of caution and consideration of confounding factors when using citation numbers and Institute for Scientific Information (ISI) impact factors as basis for collection development. This contradicts method and conclusion of Lascar, et al., (2001) article. Article provides overview of relevant literature. However conclusions are not useful as they reveal strong influence of faculty advisors on undergraduate students’ work. Information behavior of students is merely a reflection of information behavior of faculty, a completely predictable conclusion.

**Search Strategy:** Search for articles specific to information needs of molecular biologists. Full text article available electronically through SFX.
**Database Searched:** DIALOG CITEDREF One Search Group
**Search String:** E CR=Hurd JM, 1999
**Search Method:** Citation search

**Excerpt from Abstract:** “Qualitative research methods, interviews and focus groups, were used to examine what types of information these scholars need for their research, teaching and learning, how they seek that information, and perceptions.”

**Annotation:** Comprehensive paper that is relatively recent and contains great revelations. Objective to characterize information needs and behavior of agricultural and biological scientists at the authors’ institution. Provides thorough review of relevant literature including studies on molecular biologists. Compares and contrasts methodology and findings of various studies. Articulates well challenges facing scientists in tracking current discoveries in a competitive and complex scientific environment. Describes valid shortcomings of survey methodology in terms of differentiating information use and information needs, then proceeds by using qualitative methods of interview and focus groups to collect data. This is a unique approach when compared with other studies presented in this bibliography. Journal articles are main source when doing research; journal articles supplemented with text books used for teaching and learning. Personal communication is next important source. PubMed is the database most commonly used. Most participants not aware of library services offered.


**Search Strategy:** Search for articles specific to information needs of molecular biologists. Full text article available electronically through SFX.
**Database Searched:** DIALOG CITEDREF One Search Group
**Search String:** E CR=Hurd JM, 1999
**Search Method:** Citation search.

**Excerpt from Abstract:** “Using bibliometric methodologies, it analyzes the publication and citation patterns of a sample group of structural biologists from multiple institutions.”
The citations analyzed covered a very large subject range, demonstrating the multidisciplinary nature of this subfield. The results were consistent with several models for journal selection. These models were used to compile a short list of specialized titles supporting structural biology.”

**Annotation:** Provides in-depth overview of schools of molecular biology as means to clarify definition of structural biology. Authors’ objective to identify key information resources useful and familiar to subject user group, a subgroup of molecular biologists. Rather than surveys, citation and publication patterns used to quantify the importance of structural biology journals, cited as a model used by numerous authors to study variety of other user groups. Citation and publication patterns observed to be similar. Quantitatively identifies core collection of journal titles relevant to user population. Certain journals given extra weight on basis of opinions of use patterns obtained from librarians at home institutions. Study agrees with hypothesis that collection content more important than collection size. Data used to support collection development. Study chosen since may be useful for special library planning but it’s far more specific than other articles in this bibliography.


**Search Strategy:** Search for articles specific to information needs of molecular biologists. Full text article available electronically through SFX.

**Database Searched:** DIALOG CITEDREF One Search Group

**Search String:** E CR=Hurd JM, 1999

**Search Method:** Citation search.

**Excerpt from Abstract:** “In this article we provide an overview of opportunities for research and practice in the domain of molecular biology by information and library scientists. We introduce the changing role of data and information in molecular biology, and how molecular biology is evolving from a technique- and technology-driven science to an information-driven science.”

**Annotation:** Author proposes that information and library science principles can lead to resolution of complex and unprecedented information management challenges posed by rapid growth of bioinformatics. Because information needs unique to molecular biologists includes familiarity with literature and resources for gene banking, and genomics, proteomics and metabolomics data storage and processing systems, this paper is a valuable addition to this bibliography. Many biological topics and model organisms are the subjects of curated and heavily annotated databases. These too should be viewed as valuable information resources for biotechnological research scientists. Article presents information useful to user group regarding capability and utility of information and library science professionals.

**Search Strategy:** Search “information seeking behavior” in MEDLINE and browse results. Full text article available electronically through SFX.

**Database searched:** DIALOG(R)File 155: MEDLINE

**Search String:** ss information(w)seeking(w)behavior (117 hits)

**Search Method:** Keyword search followed by browsing the hits. (I could not resist this topic!)

**Excerpt from Abstract:** “…when these students went beyond textbooks and handouts to seek current information, a major shift was seen from the use of print indexes and abstracts in 1987 towards the use of computerized indexes and other electronic resources in 1997. Almost 60% of the students reported using the Internet for locating current information.”

**Annotation:** Survey-based study compares results with similar study done ten years previously by two of the same authors. Information behavior of vet student user group differs from research scientists, but is comparable when task requires search for most current information. Need for information is driven by curriculum. Conclusions of this study are logical and predictable. Reference is useful benchmark if user group interest is students; however not relevant comparison to information behavior of active biomedical research scientists. Report effectively documents impact of profound growth of computer resources and availability of online information resources. Promotes computer literacy as tool vital in future clinical veterinary practice, and ability of librarians to provide relevant instruction.


**Search Strategy:** Early search of library literature for “biological research” and “information”. Full text article obtained through ILL.

**Database searched:** DIALOG(R)File 438: Library Lit. & Info. Science

**Search String:** ss biological(w)research and information (3 hits)

**Search Method:** Keyword search

**Excerpt from Abstract:** “It is found that biologists have a spread of information needs which parallels in its diversity that of all the sciences taken together. Changes in
information-handling in biology are occurring, but to differing extents, depending on the institution and the biological specialism.”

**Annotation:** Another in a series of similar survey studies by students of A.J. Meadows (senior author). This study compares information usage by single discipline of biology with usage across science as a whole. While the focus is on information needs of biologists the study is confounded by sample selection across range of four markedly different type laboratories. Four of five references cited are their own publications. The fifth is a British Library R&D report. This publication is confusing and contains several typographical and grammatical errors that lead me to question the reference’s authority and credibility. The report lacks depth and insight and has no new information useful to library collection managers. This article is not recommended as useful to the subject user group.


**Search Strategy:** Search for articles specific to information needs in biotechnology. Full text article available online by searching the title in Google.

**Database searched:** DIALOG OneSearch Group CITEDREF

**Search String:** CR=Grefsheim S, 1991

**Search Method:** Citation search.

**Excerpt from Abstract:** “The information environment consists of broad categories of data, tools, published material and interpersonal communication. The usage of portals and other integrated resources was substantial. The role of PubMed was central in searching scientific facts.”

**Annotation:** First installment of a series to investigate information practices of researchers in molecular medicine. This study based on surveys and interviews of investigators. Focus is information environment rather than information behavior in an effort to clarify the currently poorly understood context within which information behavior occurs. Information environment consists of a variety of databases, information retrieval systems and analysis tools, all seamlessly interconnected. Personal communication mentioned as most important source for timely information. Also emphasizes growth in usage of genomic and proteomic databases. Reference is lengthy and verbose, but not deep or probing. No surprises here. Aside from unique “environmental” approach, does not seem an important contribution to this literature.

**Search Strategy:** Search for articles specific to information needs in biotechnology. Full text article available electronically through SFX.

**Source:** Found as a cited reference in the Roos, 2008 publication.

**Search Method:** Footnote chasing.

**Excerpt from Abstract:** “Medical faculty read a great deal, especially compared to scientists. The most frequently reported principal purpose of reading is to support their primary research (30% of reading). The majority of reading comes from recently published articles, mostly from personal subscriptions. Medical faculty continues to rely on print journals (approximately 70% of readings) versus electronic journals.”

**Annotation:** Interesting comparison of information use of medical faculty versus scientists. However “scientist” is not well defined; reference expands the term mentioning biologists, chemists, geological scientists, mathematicians, statisticians, computer scientists, physicists, engineers and astronomers. Survey-based study to discern how medical faculty use journals and alternatives to journals, and to compare results with results for scientists. Data for scientists was obtained by this author using same survey questions for previous publication. (Tenopir, King, Boyce, Grayson, Zyhang & Ebuen, 2003) This author has done similar survey studies of several other user groups (e.g., “...more than fifty readership surveys dating back to 1977.” (Tenopir, King & Bush, 2004, p. 235)) Credible reference, limited value to this bibliography.
Recommended Sources

The following is a list of recommended resources for biomedical research scientists in general, with a focus on research in molecular biology or genetic engineering.


Web of Knowledge (WoK) is a commercial database that provides coverage of over 10,000 high-impact journals in the sciences, social sciences and humanities, and over 120,000 conference proceedings. Web of Science (WoS) is one component of WoK that is particularly relevant for the subject user group because it indexes the most relevant and frequently cited journals. A basic search allows searching by the usual author, topic and title as well as funding agency and grant number. Basic search uses Boolean logic, and allows addition of extra fields as needed. Advanced search allows use of field tags, Boolean operators and parentheses, and creation of sets, making a search similar to using Dialog. The cited reference search is a distinctive and important feature that allows one to find articles that cite an author’s work. This feature is important to the subject user group as it facilitates documentation of their own cited works, which can be important factor in tenure decisions. The date range currently available at Drexel is 1980 to 2009. Under the additional resources tab is found Journal Citation Reports. This feature provides journal performance metrics that are, according to the description provided by WoS, an indicator of a publication’s impact and influence in the global research community. Other additional resources include a web search tool, Scientific Web Plus, and several recommended web sites. Finally, a range of other features enable customization of your search experience. It allows you to save and run searches, creates alerts and RSS feeds, and you can save and manage your references with EndNote Web. There are live Web seminars and recorded tutorials for both novice and experienced users.

Methods in Enzymology is a series, first published in 1955, and still published on an irregular schedule by Academic Press which is now a part of Elsevier. The latest edition I encountered through searching online is Volume 396, published in 2005. Each edition is bound as a hardcover book, focuses on a specific topic related to molecular biology, biophysics and chemistry, and is edited by guest editor(s). This reference, cited in the Hurd, et al., (1999) article, is especially relevant to my subject user group because its contents are articles usually written by experts in their fields that offer detailed description of experimental techniques. “The series is widely used and cited in the biomedical research field.” (Wikipedia, accessed on June 1, 2009. http://en.wikipedia.org/wiki/Methods_in_enzymology) So, not only is this series important as a reference, it is a laudable academic ambition to produce a paper suitable for publication in this reference.


Described on its website as a “weekly, international, interdisciplinary journal of science.” (retrieved on June 5, 2009, from http://www.nature.com/nature/about/) The website continues with the following description: “Nature is the world's most highly cited interdisciplinary science journal, according to the 2007 Journal Citation Report Science Edition (Thomson, 2008). Its Impact Factor is 28.751. (Institute for Scientific Information. (2009) Journal Citation Reports (online). Accessed June 5, 2009. http://admin-apps.isiknowledge.com.ezproxy2.library.drexel.edu/JCR/JCR?SID=4BN@1K8kHbhIL6EILpfr. This journal is a very important resource for my subject user group because, along with Proceedings of the National Academy of Science of the United States of America (PNAS) and Science, it is among the three journal titles
most highly cited by users queried in the studies in this bibliography. All published studies are peer-reviewed, and, like *PNAS* and *Science*, publications cover a wide range of scientific fields. The most significant articles are summarized with brief notes or through accompanying articles to make the material more accessible for students, media and the general public. Nature Publishing Group also publishes an impressive range of other specialized journals including *Nature Biotechnology*, *Nature Genetics*, *Nature Methods*, *Nature Structural and Molecular Biology*, the *Nature Reviews* and *Nature Clinical Practice* series of journals and many others. *Nature* offers a comprehensive variety of modern features from its website (http://www.nature.com/nature/index.html) including advanced online publication, podcasts that accompany each edition of the journal, news, news feeds and alerts. Along with being a vital source for reporting current research advances, publication in this prestigious journal is a major accomplishment that can bolster one’s research career, improve success in obtaining research funding, lead to promotions and even media attention.


This most prestigious scientific journal publishes highly cited research articles and other related materials including actions of the Academy. The Thomson ISI impact factor for *The Proceedings of the National Academy of Sciences of the United States of America (PNAS)* for 2007 is 9.598. (Institute for Scientific Information. (2009) *Journal Citation Reports* (online). Retrieved on June 5, 2009 from http://admin-apps.isiknowledge.com.ezproxy2.library.drexel.edu/JCR/JCR?SID=4BN@1K8kHbhjL6FIlpf.) Calculation frequency is weekly, and topics include biological, physical and social sciences with most papers published covering biomedical science. All papers are peer-reviewed. *PNAS* is available in print and in electronic form online. *PNAS* uses delayed open access, allowing free online access to all articles six months after publication via *PNAS Online*. However, authors may consent to open access, allowing immediate access. In addition *PNAS* provides immediate free access to
more than 140 developing countries making cutting edge scientific literature available worldwide. *PNAS Online* allows cross-journal searching and the ability to download references to your citation manager. In addition, alerting services and RSS feeds are available. This is the most important journal resource mentioned by scientists queried in many of the papers cited in this bibliography. According to *Wikipedia* ([http://en.wikipedia.org/wiki/Proceedings_of_the_National_Academy_of_Sciences](http://en.wikipedia.org/wiki/Proceedings_of_the_National_Academy_of_Sciences), accessed on May 21, 2009) *PNAS* has received criticism for providing advance release of materials to science journalists who often confuse scientific results in their published media reports.


This text is the most valuable laboratory reference for biomedical scientists working with DNA. This third edition is a three-volume, updated version of the first two editions, and contains 2,344 pages. The first edition was published in 1982 (Maniatis, T., Fritsch, E.F., Sambrook, J., 1982). The reference, exhaustive in its coverage, provides detailed descriptions of laboratory methods, from the most basic to advanced, used by scientists working with DNA, including studies in genetics, molecular biology, developmental biology, microbiology, neuroscience, and immunology. Its descriptions of laboratory protocols explain not only how to achieve success in genetic cloning, but also explain why techniques work, and the history behind how the technique was developed. A condensed version titled *The condensed protocols from Molecular cloning: a laboratory manual* (Sambrook J., Russell D.W., 2006) is also available. In addition an online version is available at [http://www.molecularcloning.com:8765/custom](http://www.molecularcloning.com:8765/custom) that contains summarized versions of experimental protocols published in the third edition. References cited with each protocol are linked to *MEDLINE* through the National Library of Medicine’s *PubMed* interface. The website also provides a moderated bulletin board.
On its website (accessed on May 29, 2009, http://www.sciencemag.org/about/) Science claims to be “the world’s leading journal of original scientific research, global news, and commentary.” The journal is published by the American Association for the Advancement of Science (AAAS) in partnership with HighWire Press, a division of Stanford University Libraries. AAAS is an international, non-profit organization, and the world’s largest general scientific society according to the publisher’s own data as reported on Wikipedia (accessed on May 29, 2009, www.wikipedia.org). This journal is relevant to my subject user group because it was one of the three titles most commonly recommended by the articles in this bibliography as publishing highly cited articles. The Thomson ISI impact factor for Science for 2007 is 26.372. (Institute for Scientific Information. (2009) Journal Citation Reports (online). Accessed June 5, 2009.

This peer-reviewed journal is published weekly, is available to subscribers and through institutional subscription in print and electronically, and, like Nature and PNAS, covers a full range of scientific disciplines. Previous issues are available in two archives, Science, January 1997 to present, and Science Classic, July 1880 to December 1996. Separate institutional subscription determines the dates available at a given institution. The online version offers cross-journal searching, an advanced search mode, and a search mode that covers all journals published by HighWire Press. Alerting services and RSS feeds are available. The website also provides service as a forum for communication of issues that promote the advancement of science. A comparative review of the journal Science on InfoTrac, HighWire, Journals@OVID, EBSCOhost, and JSTOR is available on The Charleston Advisor, an online source that publishes “critical reviews of web products for information professionals.” (The Charleston Advisor. Accessed on May 30, 2009. http://www.charlestonco.com/index.php.)

Produced by the U.S. National Library of Medicine (NLM), this is NLM’s bibliographic database that contains more than 18 million references to journal articles, ranging back to 1948, and covering the life sciences with a concentration on biomedicine. Covering virtually all areas of biomedicine, subjects range from basic clinical medical research to nursing, pharmacy, dentistry, veterinary medicine, public health and health care. However MEDLINE does not reference all journals published covering molecular biology and closely related topics, so familiarity with other specialty bibliographic databases is necessary for comprehensive coverage of this literature. Can be accessed from most academic libraries through MEDLINE In Process (information and abstracts before records are indexed with MeSH heading(s)), through Ovid, which is a commercial vendor, through Dialog, another commercial vendor, or through PubMed which is the NLM interface. MeSH is NLM’s controlled vocabulary used for indexing the database. An online thesaurus is available for identifying MeSH descriptor terms.

This is the bibliographic database most commonly utilized by individuals in the subject user group that were queried in most of the articles in this bibliography. PubMed offers a user-friendly search interface with simple keyword searching, the option of more advanced searching using Boolean operators, and the ability to limit searches by author, journal title, date, human or animal subjects, subject gender and age, article language, and type of article. PubMed offers many options for saving search strings, saving search results, and links to a large number of other related databases, notably covering topics relevant to molecular biologists including Genome, Nucleotide, Protein, Probe, and many others. Bioinformatics databases were mentioned repeatedly in the articles presented in this bibliography as being a very important information source for molecular biologists and biomedical scientists. NLM’s databases are the most common bibliographic sources referenced by biomedical scientists in the U.S.
Conclusion and Personal Statement

• **What did you learn about information structure?**

Bibliometrics, an array of analytical methods, can be used to document and quantify the information needs of a user group. Such comprehension of user group information needs helps collection managers decide how best to allocate limited resources, the appropriate time for eliminating obsolete reference materials, and can even lend documentary support to development of facilities in addition to information resources.

• **What did you learn about this topic?**

Information need is driven by curriculum (aka. objective). This obvious yet profound fact became evident as my user group broadened and information needs varied between user subclassifications. Busy researchers, having limited time, make use of familiar information sources in an effort toward efficiency. Many scholars, students and researchers choose convenience over quality of information sources and will tend to be satisfied with references found easily using Google searches. Personal communication was cited among the top sources of information. “Almost all scientists interviewed said their most important and timely information came from personal communication because it contained information far in advance of printed sources.” (Grefsheim, et al., 1991, p. 41)

• **What did you learn about searching?**

Published scholarly articles are inter-related through citations. Reference databases with citation search capability make use of this relationship. Once a key reference is identified (e.g., through bibliographic database search) citation searching, both forward and backward in time, can often produce a number of relevant and useful references.

Also, library instruction should be a requirement of any graduate school curriculum.

• **What did you learn about this assignment?**

Primarily, I read a large number of interesting scholarly journal articles that I would otherwise not have been exposed to. This was a lot of work, but I learned a great deal. I gained unique and valuable insight that enables assessment and appreciation of an article’s contribution to the body of literature, and the dynamic state of the body of literature as a whole (e.g., where are the gaps?). In addition I learned to use RefWorks as a bibliographic database and manager and the intricacies of exporting citations from the various indexes into RefWorks. I also learned to use Ulrich’s International Periodicals Directory as a reference to discover which bibliographic databases index which journal titles.
INTRODUCTION Information is inevitable to almost all jobs and professions. The need to become informed and knowledgeable individuals leads to the process of identifying information needs. The importance of information to biomedical scientists is irrefutable. Obviously, health science is a continuously advancing discipline, involved in the development of various medicines, breakthrough in the control of various diseases and general improvement in human health. These advances are due to research activities undertaken by biomedical scientists, which in turn lead to the proliferation of medical information.