Biotechnology awareness study*, part 2: meeting the information needs of biotechnologists

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The second part of the biotechnology awareness study focused on health sciences libraries and how well they are meeting the needs of biotechnologists working in the study's nine medical centers. A survey was conducted over a three-month period to assess the demand for biotechnology-related reference services at nine libraries and the sources the librarians used to answer the questions. Data on monographic and current serial holdings were also collected. At the end of the survey period, librarians were asked for their perceptions about biotechnology research at their institutions and in their geographic areas. Their responses were compared to the responses the scientists at the nine schools gave to the same or similar questions.

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. More detailed notes in MeSH and a guide to online searching for biotechnology topics were suggested by the librarians as ways to improve reference service to this group of researchers. Journal collections were generally strong, with libraries owning from 50% to 87% of the titles on a core list of

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‡ MEDLINE is a registered trademark of the National Library of Medicine.

biotechnology journals compiled for this study. All libraries subscribed to the five titles most often cited by the scientists surveyed. Generally, librarians were unaware of the biotechnology-related research being done on their campuses or in their geographic areas.

The biotechnology awareness study was a model project funded by the National Library of Medicine (NLM) and conducted by the Southeastern/Atlantic Regional Medical Library (RML) and the University of Maryland at Baltimore (UMAB) Health Sciences Library during the 1987–1988 academic year. The study's overall goal was to assess the information needs of researchers in the developing field of biotechnology and to determine the resources in biotechnology currently available in major academic health sciences libraries.

Are librarians armed with the resources required to serve as the "information czars" the scientists said they wanted and needed librarians to be?

The project itself focused on obtaining answers to six questions which were specified in the original request for proposal (RFP). The study was divided into two parts: a survey of scientists working on biotechnology-related research and a survey of libraries. The rationale was to ask the same basic questions on both surveys to provide comparable responses for analysis.

The results of the scientists' portion of the study raised some basic questions about the future of health sciences libraries and the role of health sciences librarians [1]. The challenges are formidable; the answers are often difficult and complex. Is Molholt's assertion that "the library is becoming disembodied, disappearing, like the Cheshire Cat, slowly but relentlessly" [2] the latest version of "The sky is falling, the sky is falling"? Or, is it true as part one of this study suggests [3] that scientists do not generally need traditional library services and collections? If it is, are librarians armed with the resources required to serve as the "information czars" the scientists said they wanted and needed librarians to be?

The University of Maryland's technical proposal characterized the field of biotechnology as a developing one, where the "traditional patterns of scientific information dissemination are being challenged by rapid research advances" [4]. A preliminary literature review showed that potentially relevant literature in the new research area was widely dispersed across traditional disciplinary lines.

In their articles on information sources for biotechnology, Barnett [5] and Drummond [6] listed print and online resources in biotechnology and noted the difficulty of locating information for the field because it was scattered throughout existing journals and databases. In responding to the RFP, the study team found no collection development or service survey had been done to indicate whether libraries were keeping pace with the researchers' biotechnology information needs through printed or online sources. The preliminary literature review yielded no publication describing the scope of formal and informal resources used or needed by biotechnology researchers. Surveys had been reported that explored the role of libraries in the dissemination of biotechnology information [7], as well as the impact of the academic-industry relationship on information transfer [8]. The proposal's purpose was to begin to examine the role played by the academic health sciences library in the biotechnology information transfer process.

A survey was designed to collect data on the current biotechnology holdings of the nine participating libraries, the demand for biotechnology-related reference services in the libraries, and the sources librarians used to answer those questions. Nine academic health sciences libraries were selected for the study (Table 1). At the end of the survey period, librarians were asked to respond to general questions intended to determine their perceptions about biotechnology research at their institution and in their geographic area. The same or similar questions about current biotechnology research were also asked of the scientists [9]. The authors intended to compare these perceptions to provide additional insight into how well libraries and librarians had infiltrated the scientists' information loop and, consequently, how responsive librarians might be to new and evolving fields of research at their schools.

REVIEW OF THE LITERATURE

The literature review served two purposes: to identify what the literature said about biotechnologists and their information needs and to identify the resources used and cited by the biotechnologists themselves. Searches were conducted in the MEDLINE and BIOSIS§ databases. Scanning the results of the MEDLINE search, which yielded 125 citations, confirmed that biotechnologists used some of the noncommercial da-

§ BIOSIS is a registered trademark of Biological Abstracts, Inc.

Table 1
Biotechnology-related library requests (n = 135)

Site	Total queries (%)	Researchers	Clinicians	Faculty	Students	Other
1. Duke University	45 (33%)	17	8	9	0	11
2. Emory University	0 (0%)	0	0	0	0	0
3. Johns Hopkins–Welch Medical Library	17 (13%)	2	1	7	2	5
4. University of Miami	20 (15%)	3	3	9	3	2
5. University of Alabama–Birmingham	6 (4%)	4	0	1	1	0
6. University of Florida–Gainesville	0 (0%)	0	0	0	0	0
7. University of North Carolina	13 (10%)	4	0	4	5	0
8. University of Virginia	7 (5%)	1	0	3	2	1
9. Vanderbilt University	27 (20%)	1	0	15	5	6
Total	135 (100%)	32 (24%)	12 (9%)	48 (36%)	18 (13%)	25 (18%)

For the number of requests received: mean = 15, median = 13.

tabases (e.g., GenBank). In addition a list of journals containing biotechnology information was generated from the MEDLINE search and from the Drummond [10] and Barnett [11] articles. Results of the BIOSIS search (111 citations) identified additional journal titles. Scanning these citations revealed that newsletters and meetings were also potentially important sources of biotechnology information. A combined list of biotechnology journals from the Drummond and Barnett articles plus the two database searches became the core list of journals and the third part of the library survey instrument (Appendix 1).

METHODOLOGY

The survey was designed to elicit answers to the following questions:

- Which departments in each institution are conducting biotechnology research? From what sources do they obtain information in this area?
- Does the library acquire books and subscribe to journals in the biotechnology field? If so, how many?
- Does the reference staff receive requests for information in the biotechnology field? What is the nature of these requests?
- Who requests this information and from what departments and specialty areas?
- What resources does the librarian use to answer these questions?
- Are there other sources for this information within the institution?

A consultant was hired to ensure that the questions in the survey were phrased to elicit consistent responses. By the end of November 1987, the revised draft was submitted to NLM for preliminary examination. Both Virginia Commonwealth University (VCU) and the UMAB Health Sciences Library pretested the survey instrument from December 7, 1987, to January 8, 1988.

No biotechnology-related reference requests were received at VCU's library during the test period. However, the VCU library staff did make recommendations for refining the survey instrument. UMAB reported only four related reference requests. Both test sites reported the major impact of the survey was in raising the staff's awareness level, but that direct involvement of the library in research on campus in this area was not apparent. Suggested changes were incorporated into the final survey, and by February 1, the surveys were mailed out. During the next two weeks, project staff called all nine sites to be sure that the survey had been received and instructions were clear.

The actual survey period began on February 15 and ended May 13, 1988. All sites were asked to return the completed surveys by May 20. By mid-July, all nine surveys were returned.

RESULTS

The first part of the survey had asked the libraries to record actual questions received, the sources used to answer the requests, and the departmental affiliation of the people submitting the requests. During the three-month survey period, the nine libraries reported a total of 135 biotechnology-related reference questions. One library reported forty-five questions; two libraries reported none. The average was fifteen; the median was thirteen. It was clear that libraries were not receiving heavy reference activity in the biotechnology subject area. Because of the relatively small number of reference questions received, all 135 questions were analyzed without regard to the individual institutions.

The nature of these requests confirmed the array and diffusion that characterizes the biotechnology field. For the purposes of analysis, questions were grouped loosely into four categories: verification/location, factual/directory, general biotechnology subject requests, and specialized biotechnology research

Table 2
Biotechnology reference queries by category (n = 135)

Verification/location	18 (13%)
Factual/directory	8 (6%)
General biotechnology subject	16 (12%)
Specialized biotechnology research	93 (69%)
Total	135 (100%)

Table 3
Academic departments most frequently represented by the requesters (n = 135)

Pathology	17 (13%)
Biochemistry	16 (12%)
Medicine	12 (9%)
Microbiology/immunology	8 (6%)
Pharmacology	5 (4%)
Total	135 (100%)

requests (Table 2). In this rough grouping, 18 questions were classified as verification types, 12 of which originated from one library. The fewest number of questions received (eight) fell in the factual/directory area. General biotechnology questions totaled sixteen. By far, the largest number (93 or 69%) were specialized subject requests.

Analysis of the status of the requester (Table 1) revealed that 48 (36%) of the questions originated from faculty and 32 (24%) originated from researchers. Students accounted for 18 (13%) of the requests, and clinicians accounted for 12 (9%). The remaining 25 (18%) came from other sources, including alumni and private corporations.

The list of academic departments represented by requesters totalled forty-one. The departments most frequently represented (Table 3) included pathology (17 or 13%), biochemistry (16 or 12%), and medicine (12 or 9%). It is important to note that seventeen requests came from "unknown" sources. It is also probable that several requests came from the same individual. The vast majority, 111 requests (82%), did come from departments on campus.

In terms of resources used by the librarians to answer the 135 requests, the MEDLINE database was listed 77% of the time (104 requests). Other indexing and abstracting sources were used to answer an additional 9% of the queries (12 requests). The remaining sources fell into two groups: online catalog/union lists (13 responses) and printed directories (6 responses). In some cases, more than one resource was used to respond to a request. It should be noted that in the vast majority of cases a secondary source, MEDLINE, was used to assist patrons. Whether the scientists were able to locate the primary sources, the actual journal article or item needed, cannot be determined by the survey data. User satisfaction or success rate at the library site was outside the scope of this study. The results indicated that the librarians dealt with the questions by using the familiar sources available to them in the library. Librarians reported using a source outside the library only once (Appendix 2).

The librarians made some general comments on the reference questions they found difficult to answer. They felt most biotechnology questions they were asked could be answered by bibliographic databases. However, librarians shared the frustration noted by the scientists doing subject searching in MEDLINE. The librarians proposed more detailed notes in MeSH and a guide to online searching of biotechnology topics. Five respondents noted queries on product development were difficult to handle. Respondents also suggested additional resources could be developed in the following areas: online directories (3 responses), factual databases (2 responses), and courses in searching biotechnology topics online (2 responses).

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Part three of the library survey dealt with collection strength of both journal and monographic holdings in the area of biotechnology. To assess journal holdings, the survey provided a basic list of 100 biotechnology journals (Appendix 1). Respondents were asked to indicate which journals they owned and to identify others they thought should be added to the core list. The nine libraries reported owning from 50 to 87 of the 100 journals on the core list. Six libraries added a combined total of 88 titles to the list. The average number of titles owned of the 188 journals was 78; the median number owned was also 78.

In part one of the survey, the scientists had been asked to list the 5 to 10 most useful journals in their biotechnology research [12]; 37 titles were cited by the scientists. Of these, the following five were noted by seven or more respondents: *Cell, Journal of Biological Chemistry, Proceedings of the National Academy of Sciences, Nature,* and *Science.* Twenty-four of the journal titles were mentioned only once, and in many cases the journal title gave no immediate indication as to its relative merit for biotechnology research. Of the 37 journals mentioned by the scientists, 18 were on the survey core list, and 3 more were on the expanded

list. The scientists' sample size was too small to consider this to be more than preliminary data.

Libraries were also asked to assess their monographic collections in biotechnology and to estimate the number of titles owned by counting the number of titles in given ranges of Library of Congress or NLM classification schemes (Table 4). The responses ranged from a low of 1,190 monographs to a high of 5,018. The average was 2,853; the median was 2,650. The great majority of the reported titles fell within the biochemistry class. The survey provided some baseline data where none appeared to previously exist. There was, however, no way of assessing the comparative quality of the nine collections.

Table 4
Book collection

NLM Classification	
	QH 426–470
	QT 34
	QU
	QW 51
	QZ 50
	SF 105
Library of Congress Classification	
	HD 999.B44–444
	Q 317–321
	QD 433–436
	QH 426–470
	QP 501–772
	R 856–857
	RB 155
	SF 105
	TP 248.6

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The final part of the library survey included general questions about perceptions of research activities in the area of biotechnology currently underway on campus. Sites also were asked to comment on how such activities had affected library services. The same general questions concerning the level of biotechnology research had also been asked of the scientists. There was a surprising difference between the librarians and the scientists in the perception of the level of current research activity in biotechnology. One half of the scientists felt it had increased, but the majority of librarians felt the level of current activity in biotechnology had not changed, or they did not know.

In general, librarians were unaware of research activity on campus in the biotechnology field. Translated into terms of activity at the reference desks, all nine libraries noted the level of requests on biotechnology topics was average or below average. The relatively low number of reference questions received per site per month (five) would tend to bear this out. Scientists, on the other hand, indicated that interest in the topic had increased on campus (16 of the 20 respondents), along with the perceived increase in the level of research activity noted earlier. Apparently libraries are not being sought by researchers to assist with the biotechnology information needs.

DISCUSSION

From the point of view of the libraries and librarians surveyed, probably the most positive outcome of this study was the heightened awareness of the field of biotechnology and the level of research being conducted on their campuses. Although the survey revealed different perceptions of current research in the area of biotechnology between the librarians and the scientists, the survey may have made both librarians and scientists aware of mutual concerns in accessing biotechnology information. The study team has continued informal communication with biotechnology researchers on campus. No follow-up has been made of the survey sites, but the scientists and librarians may be talking together in those locations, as well. Even informal conversation can lead to improvements in collections and service.

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The established scientists included in the survey may hold a traditional view of libraries as collections and librarians as organizers. Although photocopy and online search services were frequently used by the scientists in this study (eleven), the low number of reference queries on the subject raises the question whether the health sciences libraries are, in fact, involved in the information loop of the biotechnologists. Scientists may not recognize librarians as specialists in information frontiers. They may have found that informal communication networks provide more rapid and relevant information than published or online sources can deliver.

If librarians are to be part of the scientists' continuing information network, librarians must be more

than tangential to the scientific process. They must help the biotechnologists channel the flood of information. This two-part biotechnology awareness study provided a first step. A follow-up study of junior or representative scientists may show different information-seeking patterns.

Also worthy of note was the finding that both the scientists and the librarians requested help in doing online searching for biotechnology subjects. The scientists wanted to obtain a better understanding of MeSH or more dependable organization of genetic databases. The librarians wanted assistance in developing search techniques, as well as recommendations of other online databases to use. NLM's Unified Medical Language project, the Directory of Biotechnology Information Resources, the proposed BIOTECHSEEK database, inclusion of protein sequence identifiers in MEDLINE and other databases [13], and certainly the National Center for Biotechnology Information's GENINFO project should enable scientists and librarians to search more effectively for information in this field.

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Because the field is so wide-ranging, no academic health sciences library can afford, in terms of human or material resources, to handle all the research needs of biotechnologists. It is doubtful whether special libraries devoted exclusively to biotechnology could cover all aspects of the field. The EPIC search service announced by OCLC Online Computer Library Center, Inc. will provide a new way to locate information from all types of libraries across the country. The expanded core journal list from the survey gives a preliminary list of periodicals to consider if libraries want to expand holdings in the biotechnology area.

CONCLUSIONS

This limited study showed that libraries are not being sought by researchers to assist with biotechnology information needs. In reflecting upon the reference questions received during the survey period, many suggestions were made by librarians for additional training to assist them in handling biotechnology requests. The suggestions included a continuing education course and a "hotline" for librarians to obtain expert assistance on these emerging topics. The survey also underscored the need to identify, and if necessary, develop, nontraditional sources for biotechnology information such as an online directory of biotechnology companies.

The study also pointed out that libraries need to share collections and staff expertise. Librarians need to know about nontraditional resources to meet the demands of the biotechnologists working on their campuses. Even in the short time since this study was completed, significant improvements have been made in several national databases, which will increase the usefulness of online searches to biotechnologists.

The challenge for librarians, which is evident from the results of both parts of the study, is to develop additional skills in information gathering and information management and then aggressively to promote this expertise to the scientists librarians serve.

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APPENDIX 1

Biotechnology journals

Acta Biotechnologica
Advances in Applied Microbiology
Advances in Biochemical Engineering/Biotechnology
Advances in Biotechnological Processes
Advances in Chemical Engineering
Advances in Genetics
Agricultural Wastes

AICHE Journal (American Institute of Chemical Engineers)
American Journal of Human Genetics
Annals of the New York Academy of Sciences
Annual Reports on Fermentation Processes
Annual Review of Biophysics and Biophysical Chemistry
Annual Review of Cell Biology
Annual Review of Genetics
Annual Review of Microbiology
Antibiotiki I Meditsinslkaia Biotekhnologiia
Antimicrobial Agents and Chemotherapy
Applied Biochemistry and Biotechnology
Applied Microbiology and Biotechnology
Archives of Biochemistry and Biophysics
Arzneimittel-Forschung
Basic Life Sciences
Biochemical and Biophysical Research Communications
Biochemical Engineering Journal
Biochemistry and Cell Biology
Biochemistry
Biochimica et Biophysica Acta
Biomass
Biophysical Chemistry
Biosystems
Biotechnology Advances
Biotechnology and Applied Biochemistry
Biotechnology and Genetic Engineering Reviews
Canadian Journal of Microbiology
Cell
Clinical Chemistry
Cold Spring Harbor Symposia on Quantitative Biology
CRC Critical Reviews in Biotechnology
Cytobios
Developments in Biological Standardization
Developments in Industrial Microbiology
DNA
EMBO Journal
Enzyme and Microbial Technology
European Journal of Biochemistry
European Journal of Cell Biology
Experientia
FEBS Letters
Federation Proceedings
Folia Microbiologica
Gene
Genetika
Horizons in Biochemistry and Biophysics
Human Biology
Human Genetics
Immunogenetics
Infection and Immunity
Izvestiia Akademii Nauk SSSR Seriia Biologicheskaia
JAMA, The Journal of the American Medical Association
Journal of Antibiotics
Journal of Bacteriology
Journal of Biochemical and Biophysical Methods
Journal of Biological Chemistry
Journal of Biotechnology
Journal of Cellular Biochemistry
Journal of Chemical Technology and Biotechnology
Journal of Experimental Biology
Journal of Experimental Medicine
Journal of Fermentation Technology
Journal of General Microbiology
Journal of General Virology
Journal of Immunological Methods
Journal of Immunology
Journal of Interferon Research
Journal of Molecular Biology
Journal of Theoretical Biology
Journal of Virology
Life Sciences
Microbiological Sciences
Molekuliarnaia Biologiia
Molecular and Cellular Biochemistry
Molecular and Cellular Biology
Molecular and General Genetics
Mutation Research
Nature
Nucleic Acids Research
Photosynthesis Research
Plasmid
Preparative Biochemistry
Proceedings of the National Academy of Sciences of the United States: Section B (Biological Sciences)
Proceedings of the Society for Experimental Biology and Medicine
Process Biochemistry
Progress in Clinical and Biological Research
Recombinant DNA Technical Bulletin
Science
Somatic Cell and Molecular Genetics
Symposia of the Society for Experimental Biology
Virology
Zeitschrift fur Allgemeine Mikrobiologie
Zhurnal Evolyutsionnoi Biokhimii I Fiziologii

APPENDIX 2

Databases in biotechnology

Commercial

BioBusiness
BIOETHICSLINE
Biotechnology
BIOSIS Previews
CA Search
CAB Abstracts
Cancerlit
Chemical Industry Notes
Compendex
EMBASE
Life Sciences Collection
MEDLINE
NTIS
Pharmaceutical News Index
PTS PROMT
SCISEARCH
Supertech (formerly Telegen)
TOXLINE

Noncommercial

ATCC Cell/Tumor Bank
BIONET
Brookhaven X-Ray Databank

Crystallographic Data Center
Cytogenetics Database
EMBL Bank (Europe)
GenBank (NIH)—Genetic Sequences Databank
Genetic Maps (NIH)
Human Gene Library (Yale)
Human Gene Map (SHG)
Hybridoma Data Bank
Los Alamos/Livermore Banks
Mouse Map (Jackson Labs)
Protein Data Bank
Protein Databases, Inc.
Protein Identification Resource
Protein Resource (NBRF)
Proteus Technologies, Inc.

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Articles in Forthcoming Issues

A library for the fifteenth through the twenty-first centuries
Richard S. Cooper

Selected list of books and journals for the small medical library
Alfred N. Brandon and Dorothy R. Hill

Videodisc technology trends in academic health sciences libraries
Thomas Singarella, Shelley Bader, and Howard J. Ramagli

Academic health sciences librarians' publication patterns
Carol A. Mularski and Pamela S. Bradigan

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Beth M. Paskoff

Developing a quality assurance program for online services
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