Planning Bioinformatics Education and Information Services in an Academic Health Sciences Library

W. John MacMullen, K.T.L. Vaughan, and Margaret E. Moore

This article describes a planning process for the development of bioinformatics education and information services in an academic health sciences library. The project's five goals were to: (1) understand the changing environment for information related to bioinformatics; (2) understand the information needs of faculty whose work involves bioinformatics; (3) explore potential service offerings; (4) anticipate factors influencing the implementation of new services; and (5) envision strategies for recruiting and training information professionals to fill these roles. The authors describe the library's practice environment and review recent research on the information needs of biomedical researchers and clinicians. A variety of potential library-based services in relation to bioinformatics are enumerated, and the institutional, environmental, and personnel factors affecting the deployment of services are examined. Finally, the authors describe the educational and training context of the library, and explore potential roles for librarians and information professionals in the context of bioinformatics services.

This article describes the process of planning specialized service and resource offerings within the Health Sciences Library (HSL) at the University of North Carolina at Chapel Hill (UNC) for health sciences faculty working in the interdisciplinary field of bioinformatics. Such nontraditional services have been discussed recently in the library and medical literatures as ways to address the evolving information needs of biomedical researchers, educators, and clinicians and as examples of the evolving roles of information professionals in the sciences. This framework is offered as a stimulus

W. John MacMullen is a Doctoral Student in the School of Information and Library Science and the School of Medicine, Program in Bioinformatics and Computational Biology; e-mail: John_MacMullen@unc.edu; K. T. L. Vaughan is the User Services Librarian in the Health Sciences Library; e-mail: ktlv@email.unc.edu; Margaret E. Moore is Director of Planning in the Health Sciences Library; e-mail: Margaret_Moore@unc.edu; all at the University of North Carolina at Chapel Hill. *This work was supported in part by a National Library of Medicine–funded bioinformatics library fellowship from the UNC Department of Biomedical Engineering and the Health Sciences Library (NLM training grant #LM 07071) to the first author during the 2001–2002 academic year, and a predoctoral fellowship from the Program in Bioinformatics and Computational Biology, School of Medicine, UNC Chapel Hill, to the first author during the 2002–2003 academic year. The authors thank Carol G. Jenkins and Bradley M. Hemminger for their review of and feedback on early versions of this manuscript.*

to other libraries that are contemplating or planning the development of similar services and resources.

Goals

The goals of this work for the HSL were fivefold: (1) to understand the changing environment for information related to bioinformatics; (2) to understand the information needs of faculty whose work involves bioinformatics; (3) to explore potential service offerings; (4) to anticipate factors influencing the implementation of new services; and (5) to envision strategies for recruiting and training information professionals to fill these roles.

Focus Area

Bioinformatics involves the use of information science and technology to manage biological data and to support computer-based experimentation by researchers. Biology has been described as evolving into an information-oriented science.[1] Rapid growth in bioinformatics has led to a need for broad-based instruction and research support services for researchers, practitioners, and students. Many libraries have initiated nontraditional service programs to support these new needs of their existing clients.

Context

The HSL operates in a rich environment of biomedical education, research, and practice. UNC's 2002 enrollment was more than 25,000, and the university has approximately 2,600 faculty members. Universitywide-sponsored research funding in 2002 totaled more than $488 million, including $264 million from the National Institutes of Health (NIH). The university has committed more than $245 million over ten years to expand genomic research through the Carolina Center for Genome Sciences (CCGS). In 2003, the CCGS received a $5 million grant to support clinical genetics, particularly the development of a database of clinically relevant genetic information collected at the UNC Memorial Hospital. Research facilities for molecular biology include a centralized bioinformatics services unit, core facilities for proteomics, microarrays, and sequencing, and the Cystic Fibrosis National Bioinformatics Center.

In the academic medical center there are five health professional schools (Dentistry, Medicine, Nursing, Pharmacy, and Public Health), with a total of approximately 13,000 affiliates (faculty, staff, and students). The hospital complex includes North Carolina Memorial Hospital, the main state-run general hospital in the area; three specialty hospitals for women's, children's, and neurosciences treatment; a comprehensive cancer center; and many specialty clinics.

The HSL serves this diverse population with approximately sixty-five FTE librarians and staff. Its collections include approximately 310,978 volumes, 3,761 serial titles, 1,876 audiovisual, and 406 software titles. In addition, the library is responsible for the UNCLE digital library and the North Carolina Area Health Education Center (AHEC) Library and Information Services Network, and an associated digital library.[2,3] The library has developed and maintains the NC Health Information Online (NCHIO) database, a consumer health information project, in collaboration with the National Library of Medicine (NLM).[4] At the time of this writing, NCHIO is the only statewide product of its kind to be fully linked into MEDLINEplus, the popular NLM consumer health Web site.

In 2001–2002, the library's user interactions included 46,832 consultations, reference and directional questions, Ask-a-Librarian, and virtual reference transactions; 4,210 participants in education programs in more than 231 classes

taught; and 31,419 sessions on Web-based information management skills–building modules. Foot traffic as measured by exit counts totaled 320,876, and Web traffic included 515,663 UNCLE Web site sessions for access to electronic journals, indexes, and databases, and 543,436 sessions on the HSL Web site. The library is undergoing a complete renovation of its building, necessitating a cutback in access to collections, teaching laboratories, and other services from approximately fall 2002 to summer 2004.

Researchers' Bioinformatics Information Needs

Recent research and practice have indicated the need for specialized services and resources directed toward bioinformatics-oriented faculty and students. To date, little research has been conducted specifically on bioinformatics information needs or possible roles for libraries in meeting them. Robert Stevens and colleagues surveyed thirty-five biologists in academia and industry in the United Kingdom to derive a classification of tasks in bioinformatics.[5] Their goal was to develop requirements for a multipurpose query and database integration system. The tasks they identified were very granular and focused almost entirely on the manipulation of primary sequence or structure data. Only 10 of the 315 tasks were classified as "literature searching," which did not specify what types of questions researchers were trying to answer. Dihui Lu developed an online questionnaire based on the Stevens survey and assessed plant biologists' use of Web-based bioinformatics resources, surveying users' research areas, skill level in using bioinformatics tools, experience with online bioinformatics tools, and anticipated future needs for online bioinformatics tools.[6,7] The fifty-seven respondents reported that they learn about relevant bioinformatics resources primarily from Web surfing (30%), their colleagues (29%), and the literature (21%), with conferences and workshops comprising 14 and 6 percent, respectively. Most biologists said that finding the online resources they need and keeping up-to-date on new resources is not too difficult. However, nearly half reported being interested in attending workshops on bioinformatics resources.

This result also was found in a survey of attendees of the Field Guide to NCBI (National Center for Biotechnology Information) Resources' one-and-a-half-day lecture and hands-on workshop sponsored by the HSL in 2002 (75 respondents). The evaluation showed that participants found the lab sessions very valuable, particularly if they could use current, real-life problems as examples. Respondents also were interested in problem- or task-oriented approaches to understanding online resources, rather than enumerations of content or general overviews of scope and availability.

Stuart Yarfitz and Debra S. Ketchell surveyed and interviewed approximately fifty-seven scientists at the University of Washington to assess the need for a library-based, bioinformatics-focused consultation service.[8] Their findings indicated that researchers were interested in consultation services, improved access to electronic journals, and training and support for basic computer skills and specific bioinformatics software tools. Other biomedically related groups that have been studied prior to implementing specialized services include medical researchers[9]; clinical teams[10]; health sciences faculty[11]; biology faculty[12] and biology students[13,14]; biotechnologists[15,16]; family physicians[17]; hospice and palliative care providers[18]; and mental health service providers[19]. Using bibliometric approaches, Claudia Lascar and Loren D. Mendelsohn and

Julie Hurd, Deborah D. Blecic, and Rama Vishwanatham studied journal use of, and citing behavior by, biologists in order to assess information needs, potential service offerings, and the possible impacts of those on collection development.[20,21]

Potential Service Offerings

Potential library-based resources and services for bioinformatics are numerous and range from the traditional to the innovative. Unfortunately, few libraries have chosen to publish details of their programs. Yarfitz and Ketchell described services implemented at the University of Washington following their needs assessment (summarized above).[22] These included development of a molecular biology consultation service that assisted with manipulation of primary source data and had a significant interpretive and analytic component, hands-on skills training with biologists on bioinformatics tools, teaching of a graduate-level course in the departments of pathobiology and medicine on bioinformatics and gene sequence analysis, and the development of Web-based resources, including pathfinders and toolkits. Michelle R. Tennant and Tara T. Cataldo described the liaison program developed for the six colleges in the health sciences center at the University of Florida.[23] Subject- and role-specific liaisons provide customized services for faculty, staff, and students. The Eskind Biomedical Library at Vanderbilt University Medical Center also has a long-standing clinical medical librarianship program where librarians work directly with clinical teams within their practice environment.[24]

A brief, informal e-mail survey conducted by the first author in December 2001 of Association of Academic Health Sciences Libraries (AAHSL) directors illustrated the range of services libraries have developed or are considering implementing. The authors have abstracted from that list and other examples from their research and the literature to create the general list shown in table 1.

General Education and Training

Health sciences libraries have a long history of bibliographic instruction on literature-searching techniques and strategies, and this will undoubtedly increase as more researchers search from their desktops. Some investigators have noted that the volume of literature is so large in their highly specialized areas that they have difficulty simply managing citations and personal collections of articles when doing literature reviews and background research for grant applications. A relevant area of instruction is in using bibliographic management software. Some libraries have developed Web-based interactive learning modules for some of these situations, but there is still a place for personalized education.

Specialized, In-depth Instruction

Some libraries offer instruction on specialized resources, including software tools for bioinformatics analysis.[25–27] When the

TABLE 1
Summary of Potential Service Offerings

Potential Library Service Offerings for Bioinformatics
• General education & training
• Specialized, in-depth instruction
• Course-integrated instruction
• Consultation services and liaison programs
• Dedicated specialists
• Bioinformatics computing resources and analysis
• Print and online collections
• Curated Web-based resources
• Repeatable/reusable literature searches and integration
• Anticipatory synthesis
• Library as "neutral space"

HSL sponsored the NLM's two-day Field Guide to NCBI Resources in 2002, more than two hundred researchers attended. This is just one example of the demand for instruction on specialized resources related to bioinformatics. UNC's Center for Bioinformatics provides some individual- and Web-based tutorials in this area.[28] In April 2003, the School of Information and Library Science at UNC offered a well-attended half-day course by an NLM trainer on PubMed searching. Given these beginnings on the UNC campus, here appear to be clear opportunities for the library to present seminars by experts, classroom tutorials, and Web-based tutorials in the use of both bibliographic and biological database use.

Course-integrated Instruction

Working with faculty to include information literacy topics in their classes has become a major focus of library instruction at most academic libraries. The HSL currently assists with instruction in a number of undergraduate- and graduate-level courses, ranging from freshman English composition classes to doctoral-level clinical seminars. Particularly with the move in medical schools toward problem-based learning (called case-based study in some contexts), bioinformatics is becoming a critical part of graduate education for health professionals.

Consultation Services and Liaison Programs

Many health sciences libraries have liaison programs to provide dedicated points of contact for certain departments, typically within schools of medicine. Some libraries also have developed liaison programs with biomedical and clinical informatics orientations (e.g., the University of Florida, Vanderbilt, the University of Washington).[29] There is a longer history of this in the biotechnology area.[30] The UNC Department of Pediatrics has funded a part-time clinical pediatrics librarian position since 2002. This librarian works with pediatrics faculty to provide relevant, evidence-based information at the point of need, whether it is for clinical, research, or instructional purposes.

Dedicated Specialists

Librarians trained in the biological sciences have been recruited to supply subject-specialized reference and consultation services in libraries and/or to work directly with research teams on a per-project basis. The clinical medical librarianship program at Vanderbilt University Medical Center described above has been a model for this type of service.[31] Other universities that have moved in this direction are the University of Washington and Cornell University. In addition, the National Library of Medicine sponsors several bioinformatics fellows each year who support a variety of subject-specific services in medical and health libraries.

Bioinformatics Computing Resources and Analysis

A small number of libraries have implemented services focused on the data analysis component of bioinformatics, including hardware, software, and consulting (e.g., the University of Washington and the Medical University of South Carolina).[32] These services require much more subject expertise and experience than the other programs. However, even if the library is not responsible for purchasing software packages, it can provide its expertise with regard to the process of trialing, licensing, and networking databases as an advisor to the unit making the final purchase.

Print and Online Collections

The historical role of the academic library, at least in the eyes of most faculty, has been to purchase, make available, and

archive scholarly information. Although this role is now only one of many available to libraries, it remains one of the most popular. Libraries will face fiscal constraints when purchasing many of the core journals, monographic series, and online databases for bioinformatics. In addition, universities with separate health and science library branches or systems must coordinate collection development to prevent gaps and overlaps. Anecdotal evidence indicates that online versions of books and journals are preferred by faculty to their print counterparts.

Curated Web-based Resources

Several libraries have developed online portals with links to internal and external bioinformatics resources (e.g., University of Washington and Vanderbilt).[33] Some have argued this is a critical role, in line with the historical mandate of libraries. This mirrors the development of similar resources for the clinical and evidence-based medicine areas, among others.[34,35] Essentially these "Webliographies" are transformations into digital space of traditional print pathfinders.

Repeatable/Reusable Literature Searches and Integration

A next step in the evolution of the pathfinder is the creation of online tools that enable knowledge-sharing across time and disciplinary boundaries. This may start with capturing and analyzing reference and consultation interactions to look for trends and repeats, then repackaging them in online archives or preconfigured search queries. The emergence of the blog as a reference tool is one example. Another is the ability of expert searchers to created canned searches in PubMed MEDLINE using a static URL or the Cubby feature.

Anticipatory Synthesis

One speculative, but interesting, service could be a more proactive approach to organizing and synthesizing information than libraries have traditionally done. As a result of the highly specialized nature of science, implicitly related or complementary knowledge becomes fragmented due to a lack of explicit connections, such as citations. Swanson described the potential for finding this "undiscovered public knowledge" within databases such as MEDLINE through the use of semi-automated methods for literature-based discovery.[36,37] Others have built systems that Michael D. Gordon and Robert K. Lindsay[38] characterized as "discovery support systems" or what Swanson and Neil R. Smalheiser[39] called "hypothesis generation systems."[40–43] One approach to implementing this type of service could be in consultation with researchers on specific questions. Given the highly interdisciplinary nature of emerging fields such as bioinformatics, providing access to articles not connected by citation patterns could create or facilitate exciting new lines of research on and between academic campuses.

Library as "Neutral Space"

Lastly, nondepartmental libraries may be able to offer meeting, collaboration, and instruction space to interdisciplinary faculty and students. At UNC, the HSL is literally situated in the center of the physical homes of the five health affairs schools, making it a natural meeting and instruction space. With a major renovation due to be completed in mid-2004, the library is already offering meeting rooms, computer laboratories, and a conceptual Advanced Technologies Center to bioinformatics faculty needing places to work together without the politics of turf.

The HSL is fortunate to be part of a research and practice environment that includes such units as the Center for Bioinformatics, which provides many of the

biology and bioinformatics software training and support services that investigators need. This allows the HSL to focus on addressing other unmet needs that leverage the core strengths of information professionals: discovering, selecting, organizing, and presenting relevant information, and instruction on effective methods for accessing information. (See table 1.)

Planning and Deployment Factors

Based on the analysis above and prior experience, the authors identified the following factors as key enablers or inhibitors of new service offerings. These enablers generally fall into one of three broad categories: environmental, institutional, and personnel.

Environmental Factors

The broad academic and scientific environments in which the library operates influence management decision-making. Factors specific to bioinformatics are discussed below.

Growth of bioinformatics relative to other areas of research, practice, and teaching. Bioinformatics is just one area in academic biomedicine that is growing rapidly. The library needs to stay alert to changing trends in the environment that affect bioinformatics and other subjects that might emerge. This relates to the question of scalability in the institutional factors section (below).

The information needs of scientists. Research on people who are working in areas similar to those of local faculty, staff, and students has been helpful in understanding the broad needs of biologists with regard to bioinformatics tools and resources. It is important to understand the unique culture of biomedical science: how questions are selected and investigated, what types and sources of information are important, and how experiments are carried out.

Other institutions' offerings. Related to the previous factor is the examination of those services other libraries have already developed for bioinformatics and related areas. More examples and case studies need to be published as additional libraries deploy and evaluate services.

Role of librarians and information professionals in specialized areas. The authors also have explored the general idea of new roles for librarians and information professionals in meeting the information needs of faculty. Introduction of the "Informationist" concept has been instructive as the authors try to conceptualize what a similar role might look like in an academic rather than a purely clinical setting.[44]

Institutional Factors

Each college or university's local environment differs in many aspects that will affect the ability of the library to offer new services. First are a number of factors that determine the library's place socially and fiscally at the university, as well as the importance of the subject at the university and at the library. Second are library-specific factors that will be critical in the library's ability to consider new programs.

The information needs of the library's core constituents. Building on the general information needs of scientists described in the environmental factors above, a clear understanding of what faculty, staff, and students' needs are is critical prior to the implementation of services. However, users may be unaware of potential and actual solutions that might address their needs.

Institutional structure. Like all major research universities, UNC has varying levels of decentralization and bureaucracy that enable and inhibit collaboration and partnership and joint funding. Building relationships with collaborators

and developing the knowledge of how to navigate the institutional structure are important to success.

Demonstrated institutional commitment. Perhaps more than a funded mandate, an explicit commitment to specialized service offerings and an understanding of the general value the library provides is needed. This includes clear buy-in to the specific concept of library-based services for bioinformatics.

Budgetary constraints. In times of declining state revenues and university budget cutbacks, it is difficult for libraries to implement new services. This can be complicated by new mandated, but unfunded, services or existing funding allocated to mandated programs that cannot be reallocated to new services.

Ability to collaborate with other units. Although the library has identified bioinformatics as an area where new services are needed, constraints on resources, scalability, and addressable areas require collaboration with other units on campus in order to satisfy all requirements and to forestall conflicts over turf. The library expects to collaborate with the Carolina Center for Genome Science, the Center for Bioinformatics, the health affairs schools and the hospital, the Academic Affairs Libraries (particularly the two biology section libraries), and the School of Information and Library Science in order to meet the overall objectives.

Library service capacity and priorities. Determining and balancing the variety and depth of services offered is important in planning for new services. Included is an understanding of the library's current priorities and how new services fit in the ranking, given the library's budgetary and staff resources. It may help to model the scalability of pilot projects and their sustainability once launched. Scalability is also a consideration if other areas arise that may require specialized services, such as public health and consumer health informatics. There is a tension between continuing to provide excellent service to the broad user community and developing a new customized service dedicated to an emerging area such as bioinformatics.

Nontraditional funding opportunities. Many libraries are seeking external funding in order to support new bioinformatics services, which could potentially be offered in part to local biotechnology and pharmaceutical companies. Funding sources may come from private companies, nonprofit organizations such as the Institute for Museum and Library Services, and federal agencies such as the National Institutes of Health or the National Science Foundation, or via federal grant programs such as the Library Services and Technology Act (LSTA). The library should make it a point to ask faculty to include library resources (materials, personnel, etc.) in grant proposals.

Existing liaison programs. The library may already be supporting clinical informatics or other liaison programs, in which case adding a new program for bioinformatics may be relatively simple. At universities where the science and medical libraries are separated, it is important to determine who will take responsibility for which aspects of the program, including in areas of collection management, instruction, and reference. In this situation, it is particularly critical to avoid confusing faculty and angering colleagues by preemptively claiming faculty in departments outside the traditional core constituencies.

Department-level commitment(s). Offering a new service requires commitments (often including financial and staff support) from all units in the library that will be tasked with new responsibilities. This may require reevaluating how resources are allocated to existing services.

Personnel Factors

Service offerings are only possible when qualified personnel are available. The nature of bioinformatics as an interdisciplinary area is such that it may be more difficult than normal to find appropriate people to staff positions. This is equally as important a factor as having funding and institutional support available.

Availability of students, trainees, and professionals. Given the general shortage of science librarians, building a pipeline of students from the School of Information and Library Science through coursework, internships, and fellowships is crucial. The relatively small number of MLS students with undergraduate science degrees is a limiting factor on recruitment. Many schools are taking steps to attract and train bioinformatics specialists through the development of joint degree and certificate programs.

Employee knowledge and skill development. Although some institutions have hired Ph.D.-level subject experts for bioinformatics positions, this is not always feasible or desired. Another approach is developing current staff with backgrounds or interests in the area through education and training. As described in the following section, many education and development opportunities are available.

Roles and scope of specialized personnel. As needs and resources vary, so will the roles of librarians and the scope of work in which they are involved. These differences will affect the availability, selection, and development of internal and external candidates. Most "bioinformatics librarian" employment advertisements seem to require a wide variety of roles: education and instruction, consultation, liaison, resource selection and evaluation, Web development, grant writing, collaboration with biomedical units, and so on.

It is clear that there is a complex set of interdependent variables that must be modeled as new services are planned, regardless of subject area. Although some of the preceding factors are specific to UNC's situation, the authors believe that other academic libraries can abstract from them and create a general model that they may find useful for their planning processes. This model could potentially be useful for planning services other than those focused on bioinformatics. Table 2 presents a distilled list of the factors.

Educational Environment and Roles

The subject-specific education and training of librarians were identified as critical factors in the preceding section. Several educational opportunities are available at UNC and elsewhere to support the development of a pipeline of professionals who have the knowledge and skills required to provide a bioinformatics service offering. This article concludes with examples of potential roles for information professionals in the context of library-based bioinformatics services.

Interdisciplinary Bioinformatics Education on Campus

In conjunction with the university's ten-year, $245 million plan to expand development of its Carolina Center for Genome Sciences, a multidisciplinary Ph.D.-level program in bioinformatics and computational biology was developed in 2001.[45] The modularized seminars are available to students and faculty outside the program as space is available. The UNC School of Information and Library Science (SILS) has developed a master's-level certificate program in biomedical informatics that includes opportunities to work with researchers on a project of mutual interest. The SILS has had a biomedical informatics journal club since 2001, which has helped raise the level of knowledge of students and faculty of the key information-oriented issues and driving problems

TABLE 2
Factors Influencing the Creation and Deployment of New Library Services

Environmental Factors	Institutional Factors	Personnel Factors
• Growth of bioinformatics relative to other areas of research, practice, and teaching • The information needs of scientists • Other institutions' offerings • Role of librarians and information professionals in specialized areas	• The information needs of the library's core constituents • Institutional structure • Demonstrated institutional commitment • Budgetary constraints • Ability to collaborate with other units • Library service capacity and priorities • Nontraditional funding opportunities • Existing liaison programs • Department-level commitment(s)	• Availability of students, trainees, and professionals • Employee knowledge and skill development • Roles and scope of specialized personnel

facing biology and bioinformatics.[46] Other resources include informatics-oriented course work in several of the health affairs schools and a strong biomedical engineering department in the School of Medicine. In 2003, UNC and NC State University launched a joint biomedical engineering degree program that places a strong emphasis on bioinformatics. Nearby North Carolina State, Duke University, and North Carolina Central University also have resources related to biomedical informatics.

Recruitment and Training

The lack of information and library science students with biological science education and experience is major problem for recruitment. The library typically has three graduate assistants on staff throughout the year, but none have been dedicated to bioinformatics.

The Medical Library Association (MLA) offers a variety of continuing education classes focused on molecular biology, genetics, genomics, bioinformatics, and the development of proficiency with related resources, particularly those from NCBI. NCBI itself, along with NLM, provides focused training and mentoring in these areas for both librarians and researchers, including its seminar entitled "A Field Guide to NCBI Resources,"[47] the five-day NCBI Advanced Workshop for Bioinformatics Information Specialists,[48] and ongoing mentoring for the same cohort.[49] The MLA also has a molecular biology and genomics special interest group (SIG) that facilitates communication and education among librarians, and has sponsored a bioinformatics journal club.[50] Several other professional societies, including the American Society for Information Science and Technology (ASIS&T) and the American Medical Informatics Association (AMIA) have special interest groups with declared interests in bioinformatics. The MLA has taken a leadership role in addressing the recruitment and training needs in this area by creating an Information Specialist in Context task force charged with taking the recommendations from the Informationist conference in April 2002.[51] In addition, the NLM is developing education and training programs around the Informationist concept.[52]

The Eskind Medical Library at Vanderbilt has been experimenting with methods for training current clinical librarians in bioinformatics tools.[53,54] This training has focused on providing a basic background in bioinformatics to all staff, with selected staff electing to participate in a more in-depth program. It was found that although the age and length of term as a librarian has some effect on the ability of professionals to learn concepts and tools, prior education in biology does not.

Kristine Alpi recently published a brief review of instruction and continuing education opportunities and outlets.[55] In it, she discussed institution-, society-, and government agency–based programs such as the ones mentioned above, as well as a number of e-mail lists.

Roles

In their research, the authors identified a continuum of roles for librarians and information professionals interested in bioinformatics. At one end, health sciences librarians continue to provide standard, and generalized, services to a user population that includes researchers focused on bioinformatics. Some libraries will experience demand for specialized services based on local needs.[56] Known solutions include variants of the clinical medical librarian role[57,58] or the medical informaticist role.[59] Library staff at a government research institute who provide researchers with assistance in the form of extensive literature searching and synthesis of gene annotation information indicated in unpublished interviews that they are both challenged and intellectually stimulated by the activity. New credentials and pre- and post-master's learning opportunities may be developed.[60]

At the far end of the spectrum is the Informationist model of the information professional as a peer on a clinical or research team.[61] Whether this role evolves from that of the clinical medical librarian or another, this model is qualitatively different and requires specialized training.[62,63] Each library will develop roles based on the needs of its clients and the abilities of its staff. Again, this is a continuum, not a hierarchy, meaning that one role is not "better" than another. Some roles may be more appropriate for certain user groups and in certain contexts.

Conclusion

This article has presented part of the research the library has undertaken in planning library-based bioinformatics services. At this point, the authors have begun to condense their needs, goals, and abilities into actionable services. At the HSL, the authors decided to take a team approach to bioinformatics support on campus. The team includes a member of the public services, administration, and information technology services departments, with contacts throughout the library to provide support and advice, when needed. The program will include many of the possibilities described above, including general and course-integrated instruction, curated and collected resources, and the library space as a nexus of research and education.

At UNC, support services are already supplied to researchers by the Center for Bioinformatics and other units, and graduate-level computational biology instruction is provided through the Ph.D.-certificate program. This existing infrastructure allows the library to focus on its strengths and the information-oriented needs of its user population.

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