University of Washington Libraries

Biosciences Resources and Services Planning Task Force

Final Report

Draft Sep. 2006
Revised Jun. 2007

Executive Summary

The Libraries Biosciences Resources and Services Planning Task Force sought to understand both the information needs of the bioscience user community and how the Libraries currently responds to those needs. On the basis of what we learned we posited "preferred futures" of resources and services. These futures suggest several recommendations that are organized into the areas of Discovery and Delivery, Integrated Service Framework, and Organizational Structure and Footprint.

What We Learned

Bioscience has been redefined through molecular, genomic and computational studies and techniques. There is convergence afoot as biological systems are being understood at new levels from the molecule to the ecosystem. Disciplinary boundaries are blurring and falling. The excitement in the field is propelling unprecedented collaboration among computer scientists, physical scientists, biologists, and medical researchers. Bioscience is becoming a networked and data-driven science. Computation and simulation are becoming standard research methodologies that will organize and enable large data sets to be used collaboratively for discovery and knowledge building.

Bioscience is a major foundation for UW excellence. Bioscientists receive more federal research funding and produce more highly ranked programs than any other part of the University. Bioscience-related teaching, learning, research and clinical work are found throughout the UW: from core life science programs in the College of Arts and Sciences, to biomedical and health science programs in the 6 health sciences schools, and resource management programs in the College of Ocean and Fishery Sciences and the College of Forest Resources. The biosciences at the UW account for 56% of faculty, 41% of graduate/professional students, and 25% of undergraduates with declared majors. 39% of all doctorates are awarded in the biosciences. Bioscience research accounts for more than 80% of externally funded research. The growth of the biotechnology industry in Washington State is directly related to the strength of UW bioscience research. Given the growing research convergence with other sciences and

engineering, broadening the definition to include these associated areas increases the reach to 75% of faculty and 60% of graduate and professional students.

Use of the UW Libraries has changed dramatically. Triennial survey results show a striking shift to remote use only of the libraries among faculty, especially in the sciences and health sciences. Remote use is the preferred method for information access and retrieval. All measures of traditional library use (print use, gate counts, reference questions) have declined substantially. While use of "remote services" have increased dramatically to more than 4 million downloads of scientific and medical journal articles in 2005. Many faculty and graduate students see the provision of e-journals as the Libraries most valuable contribution to their research. It is interesting to note that faculty in Sciences, Engineering, and Health Sciences who receive federal research funding rate the Libraries higher in importance to their work and use e-journals more frequently than do their non-funded colleagues.

The network of branch libraries based on separate collections in related science areas is cited by faculty and students as a hindrance to multidisciplinary research at a time when online access transcends discipline-based collections. Different service policies – between "upper campus" and Health Sciences libraries – complicate the use of libraries. The dissolution of traditional disciplinary boundaries coupled with the increase in multidisciplinary research has created situations where UW bioscientists working on the same research project may have different access routes and costs for the same services and materials. The Libraries budget allocation process for acquisition of library materials is structured around individual subject funds and groups for support of subject-based academic programs. This may hinder support of emerging and interdisciplinary fields. Related to this, the separate "Main" and Health Sciences resources budgets should be reviewed regarding how they affect the licensing of shared resources.

Users are experiencing information overload and want easier to use and better-integrated search systems. They need a better way to manage data sets. Use of specialty online resources in the biosciences is declining while there is growing use of general search engines. There is an expressed need for personal information management tools and more specialized services such as the Health Sciences Library's BioCommons initiative, which offers gene sequence and expression analysis tools, training, and support.

Libraries' connection to the bioscience enterprise needs strengthening. Many bioscientists are not aware of services and resources offered by the Libraries. Library liaisons provide a personal connection between the Libraries and bioscience programs, but only 40% of bioscience faculty could rate their satisfaction with the program. A review of how Libraries staff are organized to support the biosciences is indicated. The importance of the sponsored research enterprise in the sciences, engineering, and health sciences are not explicitly addressed by or reflected in the current Libraries organization.

What It Means For the University Libraries

Library as place: The rapid transition from print to online and the associated decline in use of print leads to high overhead cost of maintaining multiple print-based library facilities. Off-site storage space for little used but still valuable print collections provides an opportunity to repurpose space and consolidate collections and services. Consolidating life and health sciences collections and services in the south and southwest parts of the Seattle campus, near where the majority of bioscience programs are located, offers advantages. Making increased use of off-site storage at the Sand Point shelving facility and compact shelving would allow greater flexibility in reconfiguring spaces based on user needs.

Libraries organizational structure: An organization structured around the needs of user communities with similar interests and usage patterns, rather than facilities and individual disciplines, would offer the most value to the University. The Libraries organizational structure should support a consistent set of high quality services without regard to program affiliation.

Information discovery: Bioscientists are turning away from Libraries created or sanctioned pathways. We need to better understand how to facilitate discovery of bioscience information and services in a way that utilizes tool sets that researchers, instructors, and students use in their work.

Information delivery: Most don't want to physically come to the library. Our task is to make it as simple as possible for them to get what they want delivered to them digitally (if possible) at their location of choice (e.g., their office or lab).

Collections and information resources: Increasing interdisciplinarity points to the need for a broader view of bioscience information resources. The current method of allocation based on a nearly constant share of the overall budget (based on historical practice) should be reviewed as well as the separate allocation processes for Health Sciences and the rest of the UW Seattle libraries, and the individual fund groups for the non-Health Sciences Libraries.

Reference, instruction and liaison services: If bioscientists are not coming to our spaces, we must meet them in theirs. Library staff can work closely with others to integrate information seeking and finding skills into the research and learning process. There is a need to work collaboratively with instructors and others in fashioning a more integrated approach to developing and sustaining information and learning competencies.

Collaborative efforts to further the research enterprise: The flood of scientific data illuminates the need for data selection, organization, curation, and preservation. This will require collaboration between scientists and librarians to develop digital repositories

of both publications and data. The Libraries can provide leadership and direction on a wide range of scholarly communication issues.

External bioscience community: The greater Seattle bioscience community ranges from small start-ups to large companies or their subsidiaries. This creates a range of needs and options. Further study is needed to better understand the needs and what role the Libraries could and should play in supplying the information needed by this community.

Library communication and marketing: Because of information overload and because library websites are not part of our users' normal workflow, they may not be effective means of disseminating information to our users. Library liaisons can play an important role to personalize the connection with library services.

Preferred Futures

- Integrated service framework emphasizing easier, simpler, discovery and delivery
- Further the research enterprise through collaboration in scholarly communication and e-science
- A more coherent, cohesive organizational structure for health sciences and biosciences, and possibly all sciences, in the UW Libraries
- Fewer physical locations located closer to users

Overview

Bioscience is central to the mission and future of the University of Washington. It is the foundation of excellence that is responsible for the international recognition of the UW as one of the great research universities in the world. Externally funded bioscience research awards brings more than half a billion dollars per year to the University. During the past decade, new bioscience research, supported by advances in computational methods and data availability, has expanded into nearly all areas of science, engineering and health sciences.

The Libraries has not systematically reviewed its role, structure, and function in relation to this large and critical user community during a period of far-reaching changes in the scientific community as well as the library and information environments. The emergence of networked digital content has dramatically altered how the research community discovers and uses information. These changes are reflected in library use patterns and support needs. It is timely to evaluate and assess the Libraries connection to the bioscience community and envision a preferred future of collaboration and support for UW biosciences.

Task Force Background and Charge

The Biosciences Resources and Services Planning Task Force was formed in October 2005 and reports to the Dean of University Libraries. The Task Force was charged with reviewing the current situation and making recommendations on how the Libraries can best support teaching, learning and research in the biosciences. The timing or phasing of recommended changes and an estimate of any associated expenses or cost savings were also to be included. The Task Force was instructed to consider the following in its work:

1. Define "bioscience" programs and identify all such programs at the University of Washington
2. Bioscience programs relationships with other UW academic programs
3. Relevant data points to measure use of information resources, services, and facilities
4. Information resources needs (bibliographic and non-bibliographic) and how well they are met
5. The Libraries connection to and impact on research, especially sponsored research
6. Library liaison responsibilities and best practices
7. Communication and marketing issues
8. Support of undergraduate teaching, learning and research
9. Coordination of services and resource delivery
10. Development and implementation of new services and/or elimination of current ones
11. The library service needs for researchers at South Lake Union and other off-campus locations, including the Friday Harbor Laboratories
12. The library service needs for bioscience researchers unaffiliated with the University (e.g., Allen Institute for Brain Science
13. Library facility needs of faculty, students, researchers and staff
14. The use of remote shelving facilities at Sand Point

The appointment letter further noted that “The Task Force is expected to take a customer-centered approach, involving the broader UW community in its review with a special emphasis on faculty, researchers, administrators and students in the biosciences. The group should consult widely with relevant faculty, students, and other users as well as Libraries staff. The Task Force may want to examine how other research libraries provide information resources and services to the biosciences.”

Task Force Membership

Nancy Blase, Head, Natural Sciences Library (through Jun. 2006); Liaison to Biology/Zoology (Jul. 2006-)
Paul Constantine, Co-chair, Associate Dean, Research and Instructional Services
Rob Estes, Reference and Instruction/Science Librarian, UW Bothell
Steve Hiller, Director, Assessment and Planning, UW Libraries
Terry Jankowski, Head, Information and Education Services, Health Sciences Library
Pam Mofjeld, Head, UWorld Express
Maureen Nolan, Natural Sciences and Resources Librarian/Friday Harbor Librarian
Neil Rambo, Co-chair, Associate Director, Health Sciences Library (through Feb. 2007); Director, Cyberinfrastructure Initiatives (Mar. 2007-)
Sandy Tao, National Library of Medicine Fellow, Health Sciences Library (through Aug. 2006)
Mary Van Court, Library Supervisor, Health Sciences Library

Methods Used

The Task Force used multiple methods to collect and analyze information for this review. New information came primarily from qualitative efforts such as focus groups, interviews and an open-ended questionnaire for peer libraries. Other information was mined from existing data sources includes UW Libraries surveys, and library and institutional data.

1. Environmental Scan (Dec 2005 - Jun 2006)
    1. External Environment (Seattle biotechnology hub)
    2. Internal Environment (all biosciences programs on campus)
    3. Funding Sources (chiefly NIH and NSF)
2. Invited Speakers (Jan - Mar 2006)
    1. Key informants on resources, funding allocation, research and grant funding trends
3. Faculty Interviews (Feb 2006)
    1. 10 selected faculty interviews across a wide range of biosciences departments, research and teaching interests, and diverse locations
4. Focus Group Sessions (Mar - Apr 2006)
    1. 3 faculty focus group sessions
    2. 2 graduate student focus group sessions
    3. 1 undergraduate student focus group session
5. Peer Institution Survey (Apr - Jun 2006)
    1. A survey instrument was sent out to 10 public ARL peer libraries
    2. A follow up call after the initial survey questionnaire responses were received
6. Data Mining
    1. Triennial Surveys
        1. Specific data points were pulled from 2004 survey and earlier surveys as appppropriate.
    2. In-Library use survey
        1. Analyzed bioscience faculty and student use of campus libraries from 2005 survey
    3. Other pertinent data and statistics
        1. Institutional data related to faculty, students, awards etc.
        2. Library use statistics (physical and virtual)

What We Found

Bioscience Definitions and Trends

The excitement of the biological sciences today is best seen not in the standard definitions of the field (e.g. study of living things and their vital processes) but in the scope of study outlined by the two major funding agencies for bioscience research: The National Science Foundation through its Directorate for Biological Sciences (BIO) and the National Institutes of Health:

> The Directorate for Biological Sciences provides support for research to advance understanding of the underlying principles and mechanisms governing life. Research ranges from the study of the structure and dynamics of biological molecules, such as proteins and nucleic acids, through cells, organs and organisms, to studies of populations and ecosystems. It encompasses processes that are internal to the organism as well as those that are external, and includes temporal frameworks ranging from measurements in real time through individual life spans, to the full scope of evolutionary time. BIO plays a major role in support of research resources for the biological sciences including multi-user instrumentation, living stock centers, systematic collections, biological field stations, and computerized databases, including sequence databases for plants and micro-organisms.

The National Institutes of Health "Roadmap for Medical Research" notes:

> The human body is dauntingly complex. To truly revolutionize medicine and improve human health, we need a more detailed understanding of the vast networks of molecules that make up our cells and tissues, their interactions, and their regulation. We also must have a more precise knowledge of the combination of molecular events leading to disease. To capitalize on the completion of the human genome sequence and recent exciting discoveries in molecular and cell biology, the research community needs wide access to technologies, databases, and other scientific resources that are more sensitive, more robust, and more easily adaptable to researchers' individual needs.

Trends in the Biosciences

Unification: Scientific progress is based ultimately on unification rather than fragmentation of knowledge. Two types of consolidation are forming today: one extending from the molecule to the organism, the other bringing together population biology, biodiversity studies, and ecology. Kept separate, these domains, no matter how fruitful, cannot hope to deliver on the full promise of modern biology. They cannot lead to an appreciation of life in its full complexity, from the molecule to the biosphere, nor to the generation of maximal benefits to medicine, industry, agriculture, or conservation biology.

Interdisciplinarity and collaboration: Bioscience is becoming increasingly interdisciplinary, with the boundaries between separate disciplines fluid, and advances in one discipline often dependent on progress in others. Bioscience is also a bridge to many other disciplines. Universities are crafting interdisciplinary, cross-functional teams that include engineers, computer scientists, physicists, mathematicians, medical researchers and biological scientists.
Interdisciplinary programs have also arisen, from federal-level initiatives such as the National Institutes of Health Roadmap and the National Science Foundation Integrated Graduate Education and Training program. By establishing new awards aimed at building interdisciplinary research teams, NIH hopes to help accelerate research on diseases of interest to all of its components with an eye toward improving the nation's public health:

> As science has advanced over the past decade and the molecular secrets of life have become more accessible, two fundamental themes are apparent: the study of human biology and behavior is a wonderfully dynamic process, and the traditional divisions within health research may in some instances impede the pace of scientific discovery. . . . The scale and complexity of today's biomedical research problems demand that scientists move beyond the confines of their individual disciplines and explore new organizational models for team science. Advances in molecular imaging, for example, require collaborations among diverse groups—radiologists, cell biologists, physicists, and computer programmers. NIH wants to stimulate new ways of combining skills and disciplines in the physical, biological, and social sciences to realize the great promise of 21st century medical research. (NIH Roadmap for Medical Research)

Biology as an information science. Today, biology is not merely a science, but an information science. The enormous amount of biological data requires a combination of computational power and proper data management to maximize the utility of the data. The acquisition of basic biological data is occurring at an exponential rate, far exceeding our ability at this point to readily organize, analyze and interpret that data by conventional means**.** The process involves: gathering data, integrating data, cataloging data, identifying the interactive network, storing the data in the database for analytical procedure. Biology is one of the most complex natural phenomena that computer system will ever be able to model and capture. Uncovering the modularity and interfaces of evolvable biological systems is a major challenge of biology, such advances in science will rely on the development and application of new conceptural and technological tools of computational science. Networked data-driven science (or E-Science) is fast becoming the standardized research methodology that will organize and enable these large data sets to be used collaboratively for discovery and knowledge building.

Patient Care and Bioscience. Patient care can be thought of as one end of the bioscience spectrum, or as a branch on the life and health science tree. It represents the direct application, in the sphere of human health, of much that is discovered, taught, and learned in the biosciences, and is expressed in the adage “from the (research) bench to the (patient) bedside”. The information needs of a clinician have traditionally been the needs of a problem solver rather than a discoverer. However, even that distinction has been blurred through the growth in clinical research and evidence-based medicine.

Bioscience at the University of Washington

Definitions and Distinctions

Bioscience-related teaching, learning, research and clinical work is pervasive at the University of Washington. The University is world-renowned for the strength of its bioscience programs and research, and bioscience is the foundation for University excellence. While there is a core area for biosciences in the life science departments within the College of Arts and Sciences (Biology, Psychology, Speech & Hearing Sciences), the biomedical sciences programs within the School of Medicine, and the

environmental/resource areas within the College of Ocean and Fishery Sciences and College of Forest Resources, bioscience work is also found throughout the health sciences, sciences, engineering, and several of the social sciences. Indeed, the trend is towards multidisciplinary approaches to bioscience research and teaching and UW bioscience programs see this transcending of traditional disciplinary boundaries as a University strength. For example, the Department of Biology was formed in 2002 by combining the departments of botany and zoology and the undergraduate biology program. The Department provides this cogent and compelling statement on its interdisciplinary approach:

> The Biology Department at the University of Washington is ideal for the student seeking a world-class graduate education in a department without boundaries between disciplines. Our collective intellectual curiosity drives us to employ a wide variety of modern approaches to explore and understand all levels of biological organization, including the molecular, cellular, organismal, ecosystem, landscape, and global levels. We are committed to searching for patterns of integration and interaction across the broad spectrum of biological diversity. We combine experimental, comparative, descriptive, and theoretical approaches to integrate and synthesize newly acquired knowledge and to communicate it broadly. We continue to have strong programs in cellular and developmental biology, physiology, evolution, ecology, and conservation biology, but we are intentionally dissolving traditional disciplinary boundaries to strengthen interdisciplinary study.

Based on the multidisciplinary, integrative and collaborative approaches that have emerged, we concluded that it makes sense to start with a more inclusive definition that includes all the health sciences and biological related sciences at the UW. Associated with these programs are 56% of UW faculty, 41% of graduate and professional students, and 25% of undergraduates with declared majors. Broadening this definition to include the other sciences and engineering would provide a more realistic perspective on the growing research convergence of the biological and physical sciences with engineering and computational sciences. There are striking similarities in the ways these groups work, their dependency on external research funding, and the way they use information and libraries that distinguish them from other academic programs. Nearly 75% of UW faculty and 60% of graduate and professional students are in the sciences, engineering and health sciences. These areas also account for nearly 70% of UW doctorates granted.

Table 1. University of Washington Seattle Bioscience Faculty and Students

	Undergraduates		**Graduate/Profs**		**Phd's Awarded**		**Faculty**	
	Fall 2005		Fall 2005		2004-05		Spring 2004	
A&S biosciences	2455		301		29		165	
Forest Resources	185		158		10		48	
Ocean & Fish Sci	166		235		19		105	
Interdisciplinary	58		461		34		19	

Interschool	121		161		11		24	
Health Sciences	658		3466		104		1725	
Biosciences	**3643**	**14.5%**	**4782**	**40.7%**	**207**	**39.1%**	**2086**	**56.0%**
A&S Sciences	1615		795		73		388	
Engineering	1505		1241		84		288	
Other Science/eng	*3120*		*2036*		*157*		*676*	
Total Sci-Health	**6763**	**26.9%**	**6818**	**58.0%**	**364**	**68.7%**	**2762**	**74.2%**
Total UW Seattle	**25185**		**11763**		**530**		**3724**	
Other	*14414	*46.9%	+11083	+61.5%	**312		+3668	+75.3%
Notes	*Declared Majors		+Without Law		**Prof degrees in Health Sciences		+ Without Law	

The UW is continually forging new partnerships and alliances both inside and outside the university to leverage cooperation, money, and resources and to remain in the forefront of education, research and technology. While the medical, health sciences fields, and libraries have long formed cooperative agreements and alliances, the trend is happening all over the university and has become an expectation.

Bioscience programs are concentrated on the south end of campus. However campus space constraints are leading UW to expand its "campus" by moving facilities and staff to other locations throughout the greater Seattle area. The UW is moving ahead with plans to more than triple the size of its biomedical research presence in South Lake Union with two new buildings at a cost of $170 million that will be finished by December 2007. Over time, the university hopes to have research teams and support staff filling up a group of six new buildings in the neighborhood with a combined 750,000 square feet.

Major research locations include not only the UW Seattle main campus, but also the Friday Harbor Laboratories, South Lake Union, Harborview Medical Center, Fred Hutchinson Cancer Research Center, Childrens Hospital and Regional Medical Center, and the Veterans Affairs Medical Center. Recently completed research facilities include:

- UW Medical Center Surgery Pavilion: $87.5 million.
- Paul G. Allen Center for Computer Science and Engineering: $67 million.
- UW Medical Center Southeast Pacific Towers: $34.2 million.
- Bioengineering and Genome Sciences: $150 million.
- Merrill Hall Urban Horticulture: $7 million.
- Research and Training Building, Harboview Medical Center, Phase One: $31.4 million.
- South Lake Union Phase One: $51.7 million.
- Center for Celll Dynamics, Friday Harbor Laboratories: $1.5 million

Graduate and Professional Programs: Interdisciplinary Approaches

The University of Washington offers comprehensive graduate programs in the biological sciences, health sciences and related fields, promoting an interdisciplinary approach to teaching, learning and research. The number of interdisciplinary graduate degree and certificate-offering programs within the Graduate School has grown to 16, of which 10 are related to the biosciences. These include biomolecular design, environmental management, molecular and cellular biology, neurobiology, and quantitative ecology and resource management. Molecular and cellular biology awarded 24 doctorates in 2005, the most of any program in the sciences and health sciences. Additional programs such as bioengineering and medical engineering are operated jointly by the School of Medicine and the College of Engineering. Other interdisciplinary prgorams are solely within the health sciences. For example, the Center for Health Sciences Interprofessional Education is a cooperative effort involving all 6 health sciences schools, plus the Information School and the Health Sciences Library. The newly created Department of Global Health is a joint initiative of the School of Medicine and the School of Public Health and Community Medicine. Both schools will share in the funding and governance of the new department. The University of Washington Biomedical Sciences Graduate Programs covers 13 programs within the College of Medicine:

> All of the Biomedical Sciences Programs reflect the cross-disciplinary nature of training in the sciences. Students apply to individual programs, most of which are based in a single department. Several departmental programs have an open rotation policy where first year students can do a laboratory rotation in another participating program. Under this policy, it is also possible for a student to change their degree-granting departmental program early in their enrollment.

Clinical departments in the medical school all have some basic science research activity which addresses the need for translational research to bridge the gap between basic and applied science, and to ensure the free flow of information and new treatments from the laboratory bench to the patient bedside. The School of Public Health and Community Medicine describes its interdisciplinary approach to these issues:

> The topics of research range from the basic molecular approaches to understanding the root cause of disease, to human population-based studies of diseases, to field-based intervention projects to empower communities to improve their own health, to clinical trials of new treatments or medications important for public health protection, to understanding the ethical, legal and social implications of genetic research in populations.
>
> Our faculty work closely with faculty in the many other excellent Schools and Colleges that constitute the University of Washington. Collaborations with Medicine, Nursing, Pharmacy, Law, Engineering and Business are commonplace, as this University prides itself on creating an environment that promotes interdisciplinary teaching and research.

The close connection between health professional education and clinical practice is a distinctive feature of the health sciences – whether through a highly structured system of clerkships and residencies as in medicine, or through a variety of clinical practice

experiences in other professions. No other area of the university has this built-in practice component.

UW biosciences programs have consistently ranked in the top 20 best programs in the nation as measured by a survey of research-doctorate programs by the National Research Council in 1982 and 1993. In the 1993 survey, top ten programs included Cell and Developmental Biology (8), Ecology, Evolution and Behavior (7), Physiology (7), Pharmacology (9), Biomedical Engineering (3), and Biostatistics (6 among programs in Statistics and Biostatistics). A new survey is planned for 2006-07, with results to be released in December 2007. The 2007 U.S. News & World Report rankings also shows UW doctoral programs in the biosciences ranked in the top 20, while top ten programs include medical research (7), primary care (1), clinical psychology (4), nursing (4), audiology (4), social work (3), bioengeering (4), and statistics (6).

The Provost formed a committee in April 2006 to assess the UW's current organization of colleges and schools. The committee is co-chaired by Professors Tom Daniel (Chair, Biology) and Kathleen Woodward (Director, Simpson Center for the Humanities) The focus has been on evaluating the current situation and facilitating more interdisciplinary work. The Committee's report is due Autumn 2006.

Undergraduate Programs

Approximately 25% of UW undergraduate students with declared majors are in the biosciences. Three of the four largest undergraduate degree programs in the College of Arts and Sciences are biological sciences ones: Biochemistry (684 majors), Biology (836), and Psychology (636). Health Sciences faculty have the opportunity to teach some of these courses as the graduate programs in biochemistry and microbiology are part of the School of Medicine.

In recent years, the University has worked to better integrate its world class research programs into the undergraduate experience, especially in the sciences. The Friday Harbor Laboratories, for example, offers a superb, quarter-long research apprenticeship program that involves teams of 5-8 undergraduates working on a focused research area in the biosciences. The students receive a stipend and their work is guided by faculty and research assistants. Other research opportunities are provided on the Seattle campus and 4,000 UW undergraduates (in all areas) incorporated research experiences into their coursework during 2005.

Other University of Washington Programs

The University of Washington Tacoma (UWT) and the University of Washington Bothell (UWB) offer interdisciplinary science programs at the undergraduate level. UWT offers a B.S. degree in Environmental Studies (40 majors) and an B.A. degree in Interdisciplinary Arts and Sciences with a concentration in Environmental Studies (12 majors). Eight faculty are associated with these programs. At the UWB the Interdisciplinary Studies program offers a undergraduate degree with an option in

Science, Technology and the Environment (38 students). UWB has just hired 3 new science faculty who will begin teaching Fall 2006. Undergraduate and Masters degrees are offered in nursing at both UWB (117, 39) and UWT (124, 74) and UWT also offers a Masters in Social Work (98 students).

The University established the WWAMI program in 1972 to provide access to publicly supported medical education across the four-state region of Washington, Alaska, Montana, Idaho, and adding Wyoming in 1996. The UW School of Medicine maintains a Dean's Office in each of the five states. These offices oversee clinical medical education for the School of Medicine within their regions, providing support services for the local clerkships and students rotating among them. WWAMI focuses not only on medical students but on students in K-12, college students, medical school graduates in residency and physicians in community practice.

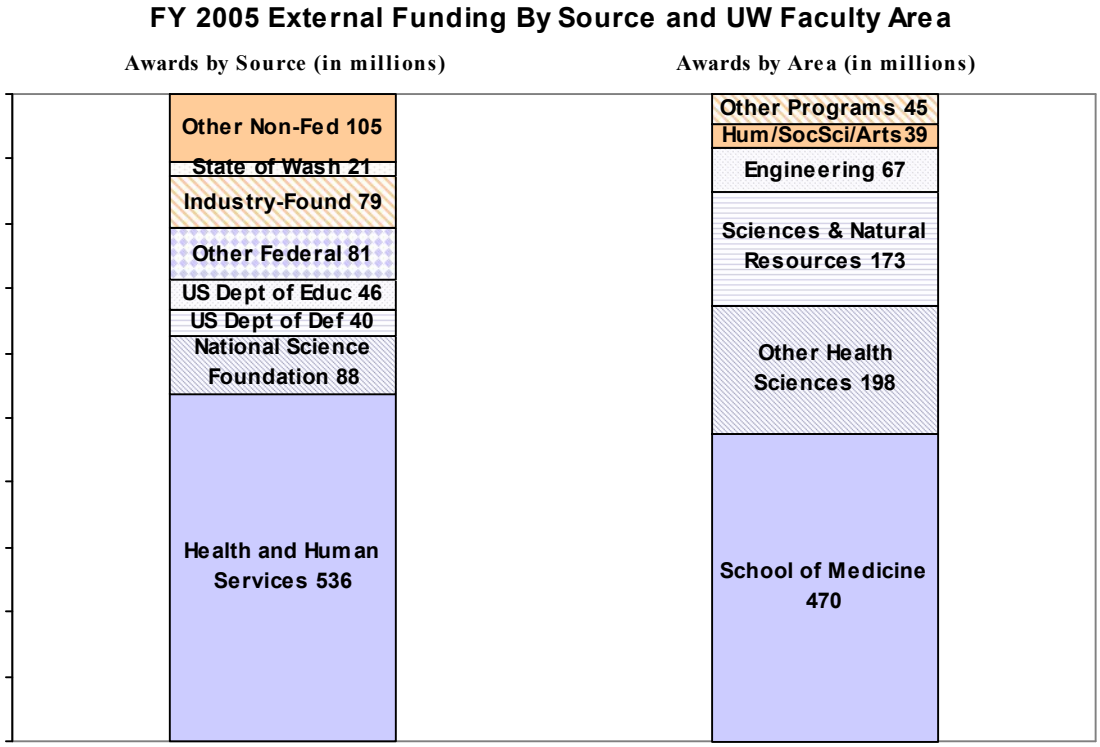
Each of the participating states designates a specific number of medical school seats. These are supported through a combination of appropriated state funds and student tuition which cover the full cost of medical education. Students from Alaska, Montana, Idaho, and Wyoming take their initial year at state universities in their home states: University of Alaska (Anchorage), Montana State University, University of Idaho and University of Wyoming. Twenty Washington students are on campus at Washington State University in Pullman, joining classes with students based at the University of Idaho. WWAMI students then complete their 2nd year at the UW in Seattle. The 3rd and 4th year clerkships can be completed at various sites throughout the WWAMI region.

The Research Enterprise at UW

Externally funded research, primarily in the life and health sciences, has catapulted the University of Washington to the top rank of research institutions world-wide. The 2006 Academic Rankings of World Universities (The Institute of Higher Education, Shanghai Jiao Tong University) ranked the University of Washington 17th. Indicative of the high scholarly output, the UW ranked 6th in number of articles indexed in the ISI citation indexes. *TheCenter,* which measures the comparative performance of top American research universities, ranks the UW 3rd among public universities and 11th overall in its December 2005 publication. Research productivity criteria show that compared to other public institutions the UW ranks 1st in federal research dollars, 4th in overall research funding, 5th in the number of National Academy members, 6th in faculty awards, and 3rd in the number of postdoctoral appointees.

Grant and contract awards totalled nearly 1 billion dollars in FY 2005, of which nearly 80% came from the federal government**.** This accounts for more than 40% of the University's revenue (excluding patient care). The UW ranks 2nd nationally in total federal research awards - nearly $800 million – with 80% coming from NIH and NSF. In Fiscal Year (FY) 2005 the University of Washington received $995,856,142 in grant funding. Over 65% of those funds were awarded to the six Health Sciences schools and special health sciences programs. Over 47% was awarded to the School of Medicine alone. While the National Science Foundation provides more funding for research in

Arts & Sciences and Engineering than any other external source, NIH is the second largest funder in those colleges, contributing more than 20% of total external research funds.



Research Funding Trends

Available federal and private research funding has increased over time but federal funding is forecast to be flat or decline in future years. Preliminary FY06 figures show federal research awards declined from $792 million to $769 million; however non-federal awards increased from $204 million to $220 million, with the overall total of $989 million down only slightly from the FY05 total of $996 million. As more universities and research institutions build their research programs, especially in the life sciences, the competition for limited federal funds will intensify.

Although research funding from Washington state has continued a long-term decline, Washington State Bio21 vision hopes to tap at least $350 million from state's tobacco settlement funds expected in 2008 for a Life Sciences Discovery Fund that may reach $1 billion. Collaboration with corporations and foundations will play an important role in a diversified research funding base. The Department of Global Health was established with $20 million in Gates Foundation seed money.

The collaborative and multidisciplinary approach is highlighted by these recent research grants:

- $15.4 million from the Grand Challenges in Global Health initiative to develop portable medical devices for areas without access to health care.

- $22 million from the National Institute of Dental and Craniofacial Research to establish a dentistry research network throughout the Northwest.
- $3.9 million from National Science Foundation (NSF) to create a cyber infrastructure that links the UW and other research institutions with ocean observatories.
- $70 million from NSF to form a nanotechnology research network that includes the UW and 13 other major research universities.
- $30 million from the Environmental Protection Agency to lead a multi-site study on the connection between air pollution and cardiovascular disease.
- $4.7 million from the National Human Genome Research Institute to study the ethical, legal and social implications of genomic research in minority communities
- $12.4 million from the NSF to establish the Learning in Informal and Formal Environments (LIFE) Center, which will focus on the human learning process

Economic Impact

Externally sponsored research programs supported 7,600 full-time equivalent employees at the UW during FY05. Based on an economic multiplier provided by the U.S. Commerce Dept., UW research funding generated about 34,000 jobs statewide. 188 new companies have been based on UW research advances. The UW ranked fourth among U.S. universities in licensing income in with $18.6 million generated in revenue during FY05.

Seattle Metropolitan Area: A Major Life Sciences Center

Premiere research institutions such as the University of Washington and Fred Hutchinson Cancer Research Center, coupled with Greater Seattle's spirit of entrepreneurship and innovation, have attracted talent and biotech companies to the region. Many companies trace their lineage directly to the University of Washington. The School of Medicine is among the top ten institutions in the country in technology transfer. The University has licensed to corporations hundreds of new technologies that form the basis of commercial processes and products in use today. It has licensed intellectual property rights for 130 new start-up companies, the majority of which are located in the Greater Seattle area.

Currently, Washington State represents the fifth largest biotech industry cluster in the Nation with 133 biotech firms (behind San Diego, Boston, the Research Triangle area in North Carolina, and the San Francisco Bay area). The vast majority of these biotech firms are located in the greater Seattle area. Since 1995, local companies have attracted more than $400 million in venture capital investment and produced more than $500 million in research partnerships with biotech and pharmaceutical companies. Approximately 7,100 people statewide are employed in the industry, nearly two-thirds of them in smaller companies with fewer than 50 employees.

A number of studies indicate biotechnology will become the dominant economic force of the first half of the 21st century. We are likely to see a fusing of information technology and biotechnology into a highly effective means of disease prevention, detection and finding cures. As a science and industry, biotechnology will mature and create

enormous changes in our lives. It's essential there will be a support infrastructure and biotech innovation pipeline to capitalize on the knowledge and creativity. Washington's Bio21 plan, the aim is to raise the region's profile as a top cluster of biomedical research, to advance human health with predictive and preventive medicine, and to create more emerging companies in the state. To encourage bioscience activities in this region, it's vital to have the academic talent, cost structure, and technical workforce. The key combination consists of intellectual(leading-edge research institutions) and financial capitals(large amounts of public and private funding). Addressing the need for technical training, Bellevue Community College has been named by the U.S. Department of Labor as one of five community and technical colleges to comprise the National Center for the Biotechnology Workforce. BCC is the Life Science Informatics Center of Excellence. The Center's primary goal is to create industry relevant training for Washington's workforce in the field of biomedical informatics.

University of Washington Libraries

Mission

The University of Washington Libraries enriches the quality of life and advances intellectual discovery by connecting people with knowledge.

Vision

The University of Washington Libraries is an international leader in imagining, creating, and realizing the promise of the 21st century academic research library. As the intellectual and physical commons of our great University, we advance discovery and encourage the growth of knowledge. We anticipate and meet the information needs of our diverse communities, at any time and in any place. We prepare students for success in life as information smart global citizens.

UW Libraries Landscape

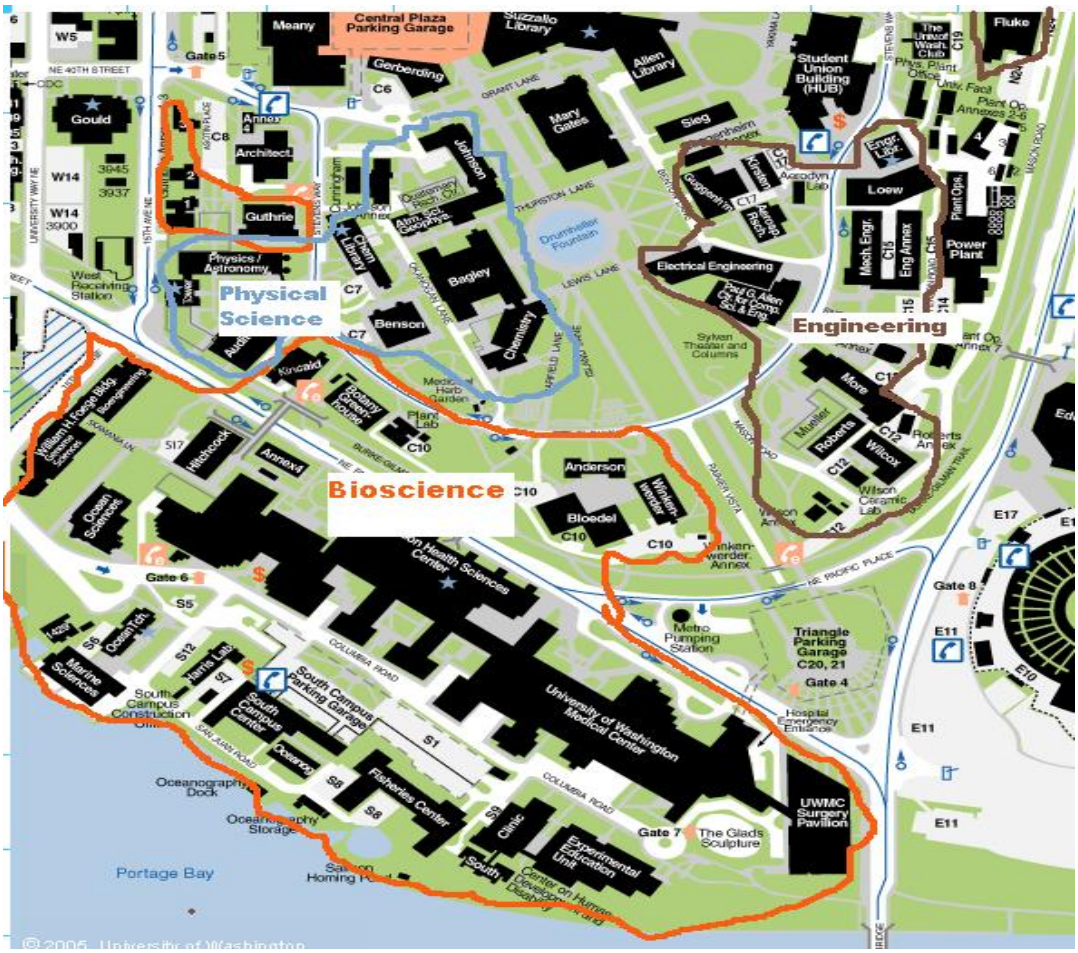
The UW Libraries ranks as one of the top research libraries in North America with extensive digital collections and online resources, print collections exceeding 6 million volumes,and a skilled staff that deliver a variety of innovative services and programs. The Libraries has an extensive Web presence as well as 19 physical facilities that serve as centers for collections and services. The Seattle campus contains a large Health Sciences Library as well as a Social Work Library that support programs in the six Health Sciences schools. There are separate science-related libraries for Chemistry, Engineering, Fisheries-Oceanography, Mathematics Research and Physics-Astronomy. The Natural Sciences Library occupies two floors within the Allen Library and supports earth and atmospheric sciences, life science programs within the College of Arts & Sciences, as well as history of science and general science collections. The Map Collection is located in Suzzallo Library and has an extensive collection of maps, atlases and aerial photographs as well as geospatial data and computers with GIS application software. The facilities housing these libraries range from poor to adequate. [Link to facility data] The Allen Library (1990) and Physics-Astronomy Library (1994) are the newest facilities, with some renovation undertaken in the Engineering Library, Fisheries-Oceanography Library and Health Sciences Library during the past ten years.

While these new and renovated facilities have improved collection and user spaces, they generally remain centered around print-based collections.

Away from the Seattle campus, UW Tacoma and UW Bothell have separate libraries and libraries are also located at Harborview Medical Center (K.K. Sherwood) and the Friday Harbor Laboratories on San Juan Island. The K.K. Sherwood Library is virtually "collection-free" and has refocused on expanding liaison services. Off-site storage is maintained at the Sand Point shelving facilility with nearly 700,000 volumes. Renovation and expansion of Sand Point will add shelving for another 500,000 volumes in 2007-08 with the potential for housing nearly 2 million total volumes in later years.

While the Libraries has a long-time goal of moving towards a more consolidated physical presence, (closing and consolidating 3 social science libraries in 1995, and the Forest Resources Library in 2004) the continued operation of a number of branch libraries reflects a more traditional mode of providing collections, workspace, and services close to the primary user community. This was especially true for academic programs with extensive laboratory and studio commitments such as the sciences and fine arts. However, the growth in interdisciplinarity combined with access to online services and collections have led to significant changes in the ways researchers, especially science researchers, use libraries. Traditional measures of use – gate counts, use of library materials, number of reference questions – have shown a substantial decline during the past 5 years, especially in libraries supporting the sciences and health sciences. [Link to data] During the same period the use of online resources has skyrocketed (nearly 5 million article downloads in 2004-05) and the frequency of remote visits has increased substantially.

The still extensive network of branch libraries is now viewed more as a liability than an asset by many faculty and students. Academic programs in the biosciences are clustered towards the south end of campus, many at a substantial distance from the main life sciences collection in the Natural Sciences Library. Physical sciences and engineering programs are also located on the south central part of campus as the map below shows.



The maintainence of separate collections in related science areas hinders multidisciplinary research at a time when online access to information resources have enabled users to transcend disciplinary-based collections. Survey data and information from interviews and focus groups confirm that going to the physical library to use collections is a last resort for most faculty and those graduate/professional students in the sciences and health sciences who have work space outside the Libraries. If it's not available online or specifically assigned by instructors, undergraduate students are unlikely to make the effort to come to the library for material. However, the physical library is still important to undergraduates who use it as a work and meeting place. Complicating the use of physical libraries are different policies and procedures dealing with such matters as loan periods, reference, hours, services, copying/printing, and equipment among others.

Libraries Organizational Structure [in lieu of a current organization chart]

The University Libraries has periodically changed its organizational structure with the most recent restructuring taking place in early 2006. However, there has been little change in those parts of the organization that provide services and support directly to the health sciences and sciences. The Health Sciences Libraries is part of the

University Libraries and the Associate Dean of University Libraries and Director of Health Sciences Libraries, reports to the Dean of University Libraries. The Health Sciences Libraries consists of the main Health Sciences Library, K.K. Sherwood Library at Harborview Medical Center, and the Social Work Library. These libraries support the schools and programs within Health Sciences. The science libraries are administratively part of Research and Instructional Services, which also includes Reference and Research Services, Access Services, the Architecture, Arts and Business Libraries, Special Collections and the Odegaard Undergraduate Library. The heads of the individual science units report to the Head of the Science Libraries who reports to the Associate Dean for Research and Instructional Services.

There is a separate structure for collections/information resources management and development. An Information Resources Council composed of 21 people and led by the Director, Information Resources, Collections and Scholarly Communication, serves as the coordinating body for selection, development and management of information resources. There is one representative each from sciences and health sciences on IRC. The IRC Budget Sub-Committee consists of nine members, with one each from Sciences and Health Sciences. This group allocates the budget for all areas except Health Sciences and UW Bothell and UW Tacoma.

The budgetary allocation for the Health Sciences Libraries comes directly from the Dean of University Libraries and traditionally has been around 20% of the total budget for the University Libraries. When the Health Sciences Library became part of the University Libraries system in the early 1960s (??), having been part of the medical school prior to that, the Libraries inherited a separate budget line item for Health Sciences collections and resources. The intent was that this would ensure adequate collections and resources specifically in support of health sciences education, research, and patient care. The budget for the science libraries is part of the allocation to Research and Instructional Services while the Information Resources Council Budget Sub-Committee allocates funding for collections and information resources.

Service availability and cost may vary according to whether the provider is the Health Sciences Library or other libraries or if the faculty or student is affiliated with health sciences or from other programs. While there may have been historical reasons for the separate development of these services, the dissolution of traditional disciplinary boundaries coupled with the increase in multidisciplinary research have created a situation where UW bioscientists working on the same research project may have different access routes and costs for specific services.

Changing Patterns of Library Use

UW triennial survey data clearly shows the substantial change in how the UW community, especially faculty and graduate students, uses library collections and services. Faculty, graduate students, and undergraduate students have traditionally used the physical library in different ways and value different aspects of the library as a place.

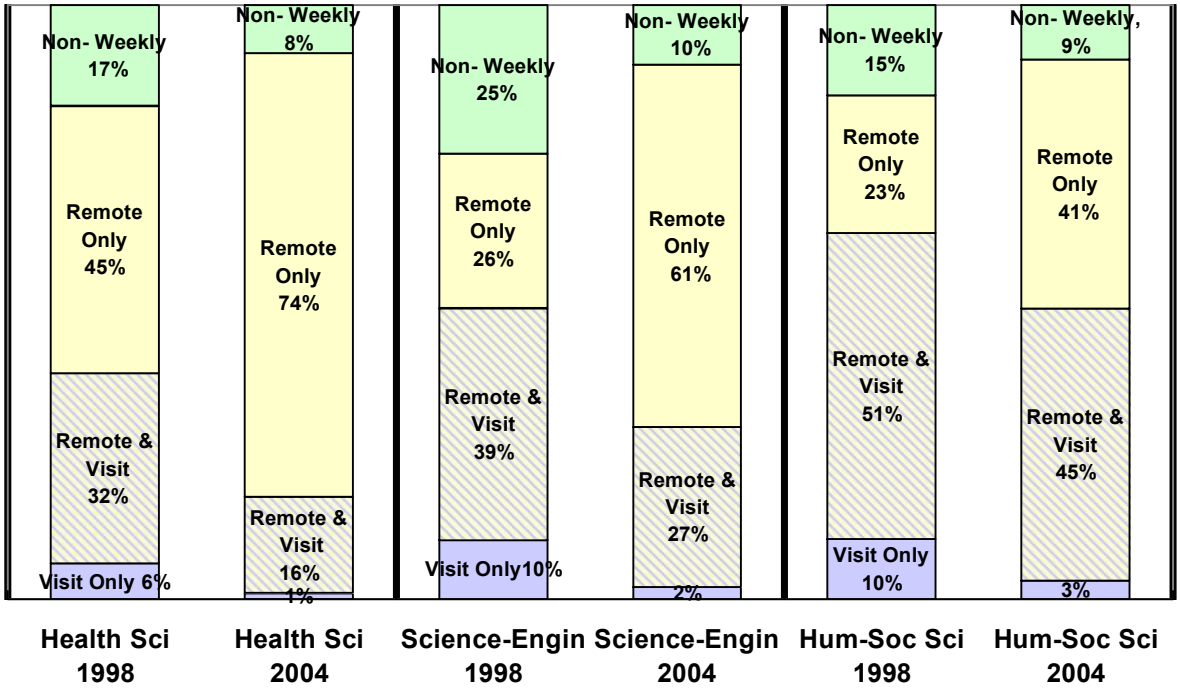
- Faculty. To get material and leave to work in office.
- Graduate. To get material. Either work in office or at in library
- Undergraduate. The library is their campus work place.

As a greater proportion of information resources, especially journals, in the sciences and health sciences becomes available online we would expect a decrease in the frequency of visits by faculty and graduate students. And that has happened with a consistent decline in the percentage of faculty and graduate students who say they visit the libraries in person at least weekly, while the frequency of undergraduate use is little changed:

	1998	**2004**
Faculty	47%	29%
Grad/Professional Students	78%	52%
Undergraduates	67%	61%

Even more striking is the shift to remote only use among faculty during this period, especially in the sciences and health sciences. The chart below also shows a substantial increase in weekly or better use among those in the sciences and health sciences.

UW Seattle Faculty Mode of Use by Academic Area 1998, 2004 (at least weekly)



Among faculty and graduate students in the Health Sciences and Sciences the decline is even more pronounced among those who visit at least twice per week. At the same time there has been a sharp increase in the frequency of remote use.

	Visit in person 2x week or more		Use remotely 2x week or more	
	1998	**2004**	**1998**	**2004**
Health Sciences faculty	12%	3%	47%	78%
Sciences faculty	16%	8%	30%	68%
Health Sci grad/prof stu	42%	26%	25%	78%
Sciences grad student	29%	15%	24%	61%

While there is no significant difference in remote use from campus between those in health sciences and sciences, health sciences faculty and graduate students frequency of remote use from home is twice that of those in the sciences.

Data from the 2005 In-Library Use Survey confirmed these differences in use among those who visit in person. Among the nearly 4000 UW users who returned surveys, 70% of the respondents were undergraduates, 24% graduate students and less than 6% faculty or staff. Undergraduate students came primarily to work alone (61%) and use library computers (58%) while faculty came predominantly to look for library material (60%). [46]. The most important services for undergraduates were access to computers, computers with application software, a place to work individually, and access to online library resources. Installation of wireless capability was completed in all main campus libraries by June 2006 (with exception of Mathematics Research).

Collections and Information Resources

The Libraries has made a major effort during the past five years to provide online access to information resources in the sciences and health sciences wherever possible. E-journals in the sciences and health sciences are heavily used and account for about 80% of the nearly 5 million journal articles downloaded in 2004-05. These articles came from titles provided through Highwire, Science Direct, Nature, Blackwell, American Chemical Society, Wiley, Science Magazine, and BioOne among others. Online access has also led to much higher interdisciplinary use as the geographical and other physical barriers are no longer evident. For example, many chemistry journals and bibliographic databases enjoy substantial use from those in the health sciences. Many faculty and graduate students see provision of e-journals as the Libraries most valuable contribution to their research.

While most major scientific and medical journals began making online versions available by 2000, publishers and other organizations are also digitizing journal backfiles before that time. JSTOR, for example has more than 75 titles in its biological sciences collection and expects to have 100 by 2007. These include many of the major society published titles and general science ones as Philosophical Transactions of the Royal Society (beginning in 1665) and Science Magazine (1880). Commercial publishers such as Elsevier have also digitized older backfiles.

Users appear to be generally satisfied with the collections. No significant complaints or shortcomings were expressed with the exception of online access to more journal titles as well as back files. Triennial survey results confirm satisfaction with collections and the priority for online access to older journal issues. While journals continue to be the most important information resource, books are used for teaching, reviews, and background reading. Several faculty commented that books are especially useful for getting a quick synthesis of research and issues in disciplines outside their area. There were also some complaints about the time it took the Libraries to acquire books and how to make purchase recommendations. Some faculty mentioned that they often buy books rather than wait for the Libraries to get them. Several faculty suggested the need for expanded geospatial imagery and data for use with geographic information systems (GIS).

During the past four years the University has provided an annual average of $650,000 in new funding to cover most of the annual price increases associated with library materials and information resources. Approximately 25% of the new funding has gone to Health Sciences, a slightly higher percentage than their proportion of the overall resources budget. The table below shows resources budget expenditures for the 2005-06 fiscal year (through June 30) and the 2003-05 biennium by format and by broad academic area. It does not include expenditures from direct grants, endowments and other special funding which primarily goes to "other areas." A small portion of funding included in "Other areas" goes to support multidisciplinary electronic resources such as Web of Science.

Table 2. Resources Budget Expenditures (in millions) UW Seattle

2005-06 Expenditures	**Serials 05-06**		**Books 05-06**		**Total 05-06**		**Total 03-05 Biennium**	
Science-Engineering	3.384	41.3%	0.222	14.8%	3.606	37.2%	7.422	36.8%
Health Sciences	1.972	24.1%	0.091	6.1%	2.063	21.3%	4.381	21.7%
Other areas	2.830	34.6%	1.189	79.2%	4.019	41.5%	8.379	41.5%
Total	8.186		1.502		9.688		20.182	

Price increases for Science-Technology-Medicine (STM) journals have moderated, especially for those that are part of packages with negotiated annual increases but overall are rising 6% to 8% per year. The last major serials cancellation took place in 2003. However, there has been little additional funding beyond serial inflation which have made purchases of new titles dependent on serial cancellation or reduction in already small unallocated (book) budgets. Purchasing power has also declined as a result of a policy decision to freeze main library fund groups percentage of the overall resources budget. This policy tends to penalize those funds that depend primarily on higher inflating serials and has reduced the non-serial renewal budgets (i.e. books) to less than 7% in the sciences and health sciences. A similar policy has often been used in the resources allocation for the Health Sciences Library. While Allen Endowment for the Collections funding has been used to purchase backfiles and monographs in emerging fields, the heavy dependence on serial resources limits the usefulness of funding as Allen funding which has not been used for ongoing obligations.

The Libraries collection development allocation process is still structured around individual subject funds and fund groups. This has made it difficult, at times, to purchase interdisciplinary materials or to support newly emerging fields such as bioinformatics, computational biology, genome science, and global health, especially when there is no new funding beyond inflation. It also undervalues the role that basic science areas such as biology, chemistry, mathematics, and physics play in supporting research and learning in all areas of the sciences as well as engineering, natural resources, and health sciences. The separation between the Health Sciences and "main"budget complicates the purchase and retention of bioscience information sources that lie outside the areas defined as core for each fund. For example, 82% of psychology faculty in the 2004 triennial survey reported using the Health Sciences Library (in-person or remotely) on a regular basis, but Health Sciences in the past has been forced to cancel titles of interest to psychology because they weren't considered core. Some were picked up with psychology or science funds but there is no additional funding to do this. There has been more success in cooperative funding of high priced resources such as Web of Science.

Information Discovery

Users are experiencing information overload – there's too much out there and traditional library search tools are too cumbersome and don't seem to provide results in a way that facilitates use. They depend on online access, but want easier to use and better integrated search systems (e.g., the simplicity of the Google search box, and searching across multiple databases). Faculty and graduate students often use Google Scholar and PubMed as starting points as well as some broader scope bibliographic databases such as Web of Science. They search primarily for journal articles with the Libraries catalog used much less frequently. According to the 2004 triennial survey, 67% of health sciences faculty look for e-journal articles at least twice per week while only 18% use the catalog at least twice per week. The number of logins to subject specific bibliographic databases generally declined from 2003 to 2005. For example, Zoological Record, was down 68%, Biosis 46%, and Embase 52%, while Web of Science logins increased by 65% during this period.

Faculty may use graduate students to do their library research for them. They assume students know how to do it, but that's not necessarily true. Faculty acknowledge that they need more database training, but are unlikely to make time for it or take advantage of it if provided. Faculty who teach undergraduates note that students often will use only Web sources unless specifically assigned to read print. There's a sense that many students lack the critical thinking skills and perseverance needed for effective information discovery. Current undergraduates seem to process information differently from their predecessors. Their knowledge base is online rather than in their heads or in their notes. They rely on general search engines like Google or aggregators like Web of Science or Proquest and are less likely to use subject specific databases. They also want to be directed or guided to the "best" sources similar to their experiences with searches that provide relevance ranking or recommendations from others. The redesign of the Libraries Information Gateway in 2003 added "starting points" that listed

a limited number of electronic resources for those beginning research in a particular area in addition to the longer, more complete lists for each subject area.

The role-based "toolkits" on the HealthLinks site (http://healthlinks.washington.edu/) developed by Health Sciences librarians/liaisons are pages of selected resources based on an understanding of the information needs of the target audience. This is one model of adding value to the discovery process.

Information Delivery

Faculty and students express a clear preference for online delivery of information. The overwhelming top priorities for faculty and graduate students in the sciences and health sciences on the 2004 triennial survey were for access to more online journal titles and to journal backfiles. These preferences were confirmed in interviews and focus groups held in early 2006. Indeed, they want all of their journal information delivered in that manner – regardless if it is available locally in print. While books generally are a secondary source of information, they would like to see online delivery of specific book chapters and reference works, as well as faster, self-initiated intralibrary or interlibrary loan that would also deliver books to preferred locations.

Information Management

Faculty and graduate students have a need for personal information management tools and services. Faculty use Table Of Contents services from vendors, but would like to have more organized TOC delivery. Faculty and graduate students want more support and training for software such as Endnote, Stata, and other types of information management software. The 2004 Triennial Survey revealed that 32% of health sciences faculty and 21% of science graduate students reported using reference management software at least weekly. Bioscience researchers want the libraries to continue to support and provide access to bio-informatics software tools. The BioResearch Liaison is part of the innovative BioCommons initiative which brings together a suite of specialized resources, consulting services, and training, in support of bio-informatics work. The BioResearcher Toolkit on HealthLinks is an example of the resources developed for this user group, which enable researchers to make use of molecular sequence analysis tools, expression analysis tools, and data mining tools. These are heavily used by a broad segment of bioscientists. Most users of these services are from School of Medicine basic science departments but many are from other non-health science schools such as Ocean and Fishery Sciences, Forest Resources, and Arts and Sciences.

Bioscience researchers are generating vast amounts of data and have difficulty managing it. Faculty are aware of the potential of self-archiving but it's not a priority for them. Faculty are interested in data management services but may not see the Libraries as a potential provider. At least some think the institution should manage the enormous data files that are generated from research.

Librarian Liaisons

Library liaisons provide a personal connection between the Libraries and academic programs. While responsibilities vary somewhat between liaisons in the Health Sciences Library and other libraries, most have responsibility for instruction services, specialized reference, selection of journals and other information resources, and communication with those in their academic programs. The 2004 Triennial Survey revealed that only 40% of the biosciences faculty could rate their satisfaction with the librarian liaison to their program. The remainder either marked "dont know" or didn't answer the question. This result was a factor in the formation of The Task Force on the Public Service Expectations of Library Liaisons. The final report of the Task Force (August 2005) noted:

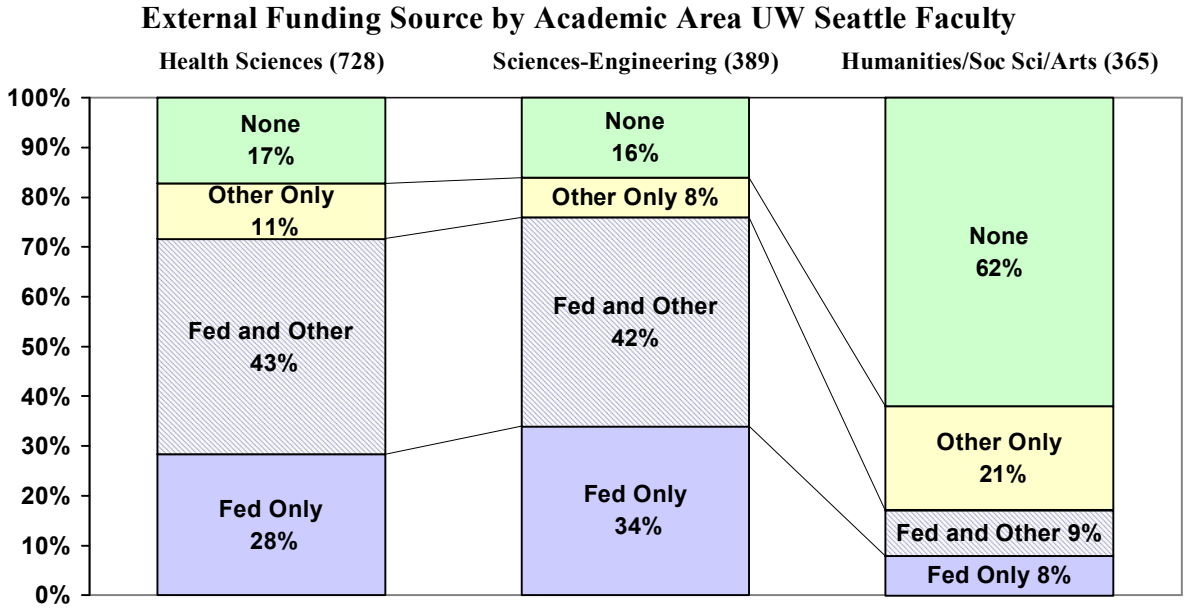
> The single most important factor in a liaison's ability to perform these public service responsibilities effectively is establishing and maintaining personal contacts with faculty members, students, and staff of the academic departments and programs. Being visible in the department/program, determining communication methods that suit the preferences of individual departments/programs, involving faculty in important decisions regarding collections or library ambience, connecting faculty and departments with specialized services of the Libraries such as the University Archives or Digital Initiatives, and awareness of faculty scholarly interests is essential to build value and recognition of the Libraries among the faculty.

Within the biosciences, the Forest Resources librarian maintained office hours in the College after the 2004 consolidation of the Forest Resources Library into the Natural Sciences Library. The Biology/Zoology librarian, Nancy Blase, will be based in the Biology Department in her post-retirement employment. Librarians in the Social Work Library, K.K. Sherwood, and Fisheries-Oceanography Library are located in close proximity to their primary programs they support. The Health Sciences Library has long supported a Clinical Medical Librarian position. This librarian, Sherry Dodson, works closely with the Medicine Residents at UW Medical Center. She attends Morning Report with the residents as they report on difficult patient care problems. She works with them to mine the medical literature for answers and assists in teaching the residents the basics of evidence-based practice. This is an example of a librarian working closely with a user community, understanding their culture, language and issues, and developing a strong connection with them.

Libraries Connection to the UW Research Enterprise

The UW Libraries portion of the Facilities and Administrative Rate for overhead on federally funded research is fixed at 1.8% annually as of July 1, 2005 through June 30, 2009. This represents an increase from 1.5% that had been in place for many years. A 2001 study done by the UW Office of Research showed that among ten other peer libraries in public institutions, the library portion of the Facilities and Administration Costs ranged from a low of 1.0% to a high of 2.0%. Funds that come to the Libraries through the F&A rate go to support collections and services throughout the Libraries.

The 2004 triennial survey asked faculty and graduate students for the first time whether the respondent had received or worked on federally and other externally sponsored research during the past academic year. The chart below shows the percentage of UW Seattle faculty (excluding Law) who reported receiving research funding. The similarities in response by those in Health Sciences and faculty in sciences and engineering are striking.



Analysis of triennial survey data shows that those who receive federal research funding are more likely to rate the Libraries higher in importance to their work, and tend to use resources such as electronic journals more frequently. For example, 74% of faculty in the Health Sciences who receive federal funding look for library provided e-journal articles at least twice per week compared to 50% of Health Sciences faculty without federal funding [link to data].

The majority (55%) of the Libraries expenditures for resources goes towards STM serials, nearly all of which supports graduate level and sponsored research. During the 2005-07 biennium the estimated expenditures of STM serials will exceed $11 million.

The Research Funding Service, funded by the School of Medicine and located in the Health Sciences Library, and the Grant and Funding Information Service, a collaborative effort of the UW Libraries and the Graduate School, provide assistance to those looking for external funding.

While the Libraries recognizes the importance of sponsored research to the University and endeavors to provide resources and services to support these efforts, there does not appear to be effective advocacy for the research enterprise and the Libraries connection to it.

Serving the External Bioscience Community

The UW Libraries collections (print and electronic) are accessible to those external bioscientists who visit the Libraries in person, except in a few cases where licenses prohibit non-UW access. Both UWorld Express and Document Services (Health Sciences Libraries) provide document delivery services for a fee to the external bioscience community.

The Regional Medical Library program, based at the Health Sciences Library, is officially known as the National Network of Libraries of Medicine, Pacific Northwest Region. The program is funded through a contract with the National Library of Medicine (National Institutes of Health). The UW has hosted this regional service program continuously since its inception in 1968. Originally focused on developing medical libraries and promoting cooperative collection development and then regional interlibrary resource sharing, the focus has shifted with the times. It is now geared toward working with community organizations and institutions to plan and develop ways to meet the health information needs of underserved groups, such as patients, families, and others facing decisions about health behavior and health care. The public health workforce and public libraries are other key partners in the program's outreach efforts. For more information see http://nnlm.gov/pnr/.

Peer Libraries

Ten peer libraries were selected from the list of 24 institutions compiled by the Washington State Higher Education Coordinating Board which also ranked in the Top 30 ARL Libraries as determined by the 2003-04 Index. [Link to peer libraries] A short survey was prepared and sent to these ten libraries asking about aspects of library organization and support for the biosciences. These peer libraries represented a mix of organizational structures including some where the health sciences libraries did not report to the main library. Five libraries returned the survey and all indicated that they saw increased interdisciplinarity among the health and biological sciences which has led to greater collaboration in library support for these areas, especially for electronic information resources. These libraries saw continued need for greater collaboration in services and resources to these communities and they were interested in the results of our review.

One example of this increased collaboration and interest in digital partnerships can be seen at the University of Minnesota (Twin Cities). Minnesota plans to hire a cohort of 3 librarians for the Health Sciences, Agriculture, Biological and Environmental Sciences, and Physical Sciences and Engineering. The library sees this cohort as more closely integrated into academic departments and research groups and their initial project will be study the research needs of science faculty and graduate students. Additionally, the position announcement states:

> The cohort will support the research, knowledge management, and instructional and life-long learning needs of undergraduate and graduate students, faculty and staff in a team-based, interdisciplinary approach that spans the boundaries of individual schools,

colleges and disciplines. This cohort will be expected to forge new relationships and create new initiatives that respond to trends in scientific research, including exploring with faculty new models of scholarly communication, publishing, and the challenges of data curation. They will work closely with the University Libraries' Digital Library Development Lab to create innovative tools and services for managing the collaborative research process and scholarly output of University of Minnesota scientists.

What It Means for the University Libraries

Library as Place

As more information becomes available online and only online, on-site collections become less important and use inevitably declines. For example, the number of items used within the Health Sciences Library has fallen from more than 700,000 in 1995-96 to 106,000 in 2005-06. Most of these were journals, with many current titles now available online only. The rapid transition from print to online and the decline in use leads to high overhead costs for maintaining separate print-based library facilities. The availability of increased off-site space for housing seldom-used but still valuable print collections provides an opportunity to reconfigure library space to support student learning and consolidate collections and services.

The concentration of life sciences programs on the south and southwest parts of the Seattle campus place them at a distance from the major biosciences collection in the Natural Sciences Library. The growing interdisciplinarity and convergence of bioscience and scientific research is another factor calling for a reduction in the number of physical facilities housing life sciences related materials. Consolidation of life sciences library collections and services in that region of campus would seem to offer advantages not only in bringing similar resources together but in moving them closer to where the users are. The availability of increased capacity for the Sand Point shelving facility could lead to substantial relocation of print volumes to Sand Point which would enable campus library and collection consolidations. Use of more compact shelving or other dense collection housing in campus libraries, where this is possible, would also allow for greater flexibility in accommodating print materials as well as providing services that better support learning.

Library spaces are already being reframed as learning and community spaces to meet different user needs – collaborative, individual study, instruction, technology dependent services and social. A greater focus on collaborative learning will accelerate this movement and perhaps bring other campus learning support groups into library facilities as well. To maintain effective support for undergraduate learning and provide consultative services in proximity where faculty and students work, some library spaces might be reconfigured without print collections. The K.K. Sherwood Library at Harborview Medical Center is an example of a library that has largely shed its print collection and become more of a “reference station” and a center for writing and study. Remote access to the online resources of the Health Sciences Library and the Libraries vastly more than replaces the collection that had been on site. The Library is accessible

by Harborview staff 24/7 and the librarian, Ellen Howard, keeps office hours there and in other departments at the medical center that she is the librarian liaison to.

Libraries Organizational Structure

The Libraries organizational structure has traditionally been based around facilities that house collections and deliver services. As physical facilities decline in importance, especially in the sciences and health sciences, an organization structured around addressing the needs of user communities with similar interests would offer the most value to the University. Understanding those differences as well as the needs are crucial to maintaining the library's relevance to the academic enterprise. Above all, the libraries organizational structure should facilitate library support and partnership with teaching, learning and research, not produce barriers or confusion as to policies, procedures and services. Our users shouldn't need to understand how we're organized in order to gain access to the appropriate suite of services and resources. With the blurring and merging of traditional disciplinary boundaries in the biosciences it makes sense for the Libraries to provide the UW community with a consistent set of high quality services regardless of program affiliation or where the initial contact is made.

Information Discovery

As users increasingly interact with the Libraries resources and services virtually rather than physically we need to understand the best ways to facilitate discovery and delivery of bioscience information and services. The findings raise a number of questions where more information is needed. How much should be invested in local development or how can we best leverage meta search tools that are already used by bioscientists to access both content and services? How much information about local or customized services do we provide in our own Web spaces? How do we collaborate with faculty to create new services and to better integrate our resources with research and teaching. Do we need a more uniform Web presence or the capabilitity for extensive user personalization? Is a single, common Libraries Web site for the biosciences desirable? How do we simplify the D2D (discovery to delivery) process? Does the decrease in use of subject specific databases mean that we can begin a review for possible cancellation?

Information Delivery

Most bioscientists don't want to visit libraries in person to get their information. Our task is to make it as simple as possible for them to have that information delivered to them at their location of choice. The user preference for digital delivery is overwhelming, whether the original format is print or electronic. However, providing digital copies of items owned only in print by the Libraries (within the limits of fair use) would require changes in policies, procedures and staffing, especially if we deliver without direct costs to the bioscience community. The differences in policies and procedures for information delivery that currently exist between the Health Sciences Library and rest of the University Libraries should be examined. If it is not possible to provide the information

in digital format, then the print item should be delivered in a timely and convenient manner.

Collections and Information Resources

While the bioscience community finds the Libraries collections of journals and other information resources generally support their work, they have also identified areas where improvement is needed – specifically in the acquisition of new journal titles, journal backfiles and books. An approach that takes a broader view of bioscience information resources will be needed to ensure acquisition of information needed to support multidisciplinary and emerging fields as well as items that fall between disciplinary boundaries. Good access tools that link to this content are crucial in discovery and delivery.

The current method of allocations based on a constant share of the overall budget should be reviewed.

Reference and Liaison Services

As the frequency of in-person library visits continues to decline among faculty and graduate students, in-library reference and consultation transactions with these groups also falls. While there are remote alternatives to in-person service, we find continued value in personal contact and interaction as noted in the triennial survey, recent interviews and focus groups, as well as the report of the Task Force on Public Services Expectations of Library Liaisons. If bioscientists are not coming to “our” space, we must meet them in theirs. Reference services will take place in shared virtual space as well as where people work. Rather than reference transactions representing “failure” on the part of users, library staff can work closely with research groups, students and others to integrate information seeking and finding skills into the research and learning process. The cohort approach being applied at the University of Minnesota appears to address issues that will help build and define these partnerships with scientific community.

Assigning librarians to work with particular groups of faculty, students, and staff is one way to facilitate the dissemination of library resources and services to a user community, rather than expecting them to come to us and our spaces. This liaison role can be an effective communication channel. Most obvious is the library-to-user direction: the librarian informing users about library services. Being close to a user community affords the librarian opportunities to learn about their needs. The librarian can then complete the bi-directional loop by communicating those needs back to the library, which can lead to better alignment of services to meet those needs.

Another model being tried at the UW and other life and health sciences libraries is using information specialists with subject expertise as library liaisons. Mark Minie, the BioResearch Liaison for the Health Sciences Library, holds a Ph.D. in immunology and is an expert in bio-informatics. He consults with a diverse group of users from a variety of bioscience areas and trains people in using bio-informatics tools and resources. His

subject expertise ensures that he understands the technical and complex information needs of this audience at a deeper level than he would with a library and information science background alone. Another model in use at other institutions in support of the bio-informatics user community is a professional librarian with master's level training in biosciences. In these instances, the advanced subject expertise is vital for research consulting and training rather than for collection development.

e-Science

The flood of scientific data generated by ongoing sensors, automated simulations, or by experimental research illuminates the need for data selection, organization, curation, and preservation that can be analyzed and reused. Concerns with scientific integrity also call for open and secure organization of and access to data. The organization, curation, and preservation of this data will require collaboration "between scientists and librarians. A vital part of the developing research structure will be digital repositories containing both publications and data." [Hey and Hey]

The Libraries can play a vital role in the data life-cycle, from creation, archiving, use, and re-use of data. Librarians can work with researchers at the beginning of their research to prepare for preservation and re-use and help them design and create standards-compliant meta-data. Establishment of standards results in better documented data ready for deposit in a library or archive and ready for re-use, and the interoperability of this standard allows data to be shared among different disciplines.

While the Libraries works to build the digital knowledge base of staff, developing a program and partnering with the research community will require additional resources and staff with skill sets that aren't available now.

Teaching and Learning

While there have been some successes in the integration of information literacy related competencies within the academic curriculum (e.g. Oceanography), there is clearly room for improvement. Interviews and focus groups pointed out the need for undergraduate students in particular to gain both a conceptual and practical understanding of how to locate and use information effectively in their scholarly work. Coupled with the lack of critical thinking skills mentioned by a number of faculty, there is an opportunity to work collaboratively with instructors and others involved in providing learning support in fashioning a more integrated approach to developing and sustaining learning competencies.

As discussed elsewhere, Health Sciences librarians serve as liaisons to assigned schools and departments. Several of these liaisons have become embedded in instructional programs, especially in teaching research methods. Librarian liaisons working with the Schools of Social Work, Nursing, Dentistry, and Pharmacy are regularly called upon by faculty to teach sessions of numbered courses. They become resource experts for the students. The librarian liaisons also develop web-based

resources to accompany and reinforce the classroom sessions. Web-based tutorials and online video clips are often part of this offering.

The External Bioscience Community

While the greater Seattle bioscience community continues to expand it is not clear how they get access to and delivery of information resources necessary for their work. The diversity of that community - from small start-ups to large companies or their subsidaries - creates a range of needs and options. A number of these entities have connections with the University through participation in joint research projects or affiliate appointments. Many appear to also employ UW students. It is interesting to note that the other top biotechnology clusters in the U.S. have a wealth of public and private university and other research library resources available within their areas. This region, with the exception of the UW Libraries, is information resource poor in comparison. Further research is needed to gain a better understanding of how these companies get their information and whether there is a role for the Libraries to play in supplying that information.

Off-campus access for UW physicians based at non-UW sites such as Children's Hospital and Regional Medical Center, Seattle Cancer Care Alliance, and the Fred Hutchinson Cancer Research Center also present challenges. UW physicians and clinicians are involved in a number of projects with non-UW health providers and researchers. Again, this is an area where more information is needed on the library and information needs of the non-UW collaborators and how they get information needed for their work.

Library Communication and Marketing

Many faculty and students are not aware of services and resources offered by the Libraries. New faculty, graduate and undergraduate students see a need for library orientations, tutorials, and training sessions but timing and context are crucial factors. People already suffer from "information overload" and blanket email messages seem ineffective. As many of the resources and tools used by bioscientists don't require use of Libraries' generate Web pages, library web sites may not be that effective for communication and marketing. The role of the library liaison in personalizing the connection to library services seems critical in this environment. We need to have a presence where are users are and not requiring them to come to us (physically or virtually).

Preferred Futures

Rather than list a set of detailed recommendations, the Task Force believes that presenting a framework of "preferred futures" would provide the best structure for broader discussion within the Libraries and with appropriate stakeholders on developing ways to address the issues identified in this report. These preferred futures are predicated on the idea of putting information into the hands and minds of those engaged

in biosciences work – whether for teaching, learning, and/or research – more easily to enhance their productivity. This means such things as making the process of identifying and locating (discovery) information resources easier and more seamless; to, improving the ease and speed of delivering books, articles, or other information objects, to the user (delivery). Support for such endeavors requires we develop an integrated service framework, partner with other UW departments, reexamine/revise our organizational structure and reconfigure library space. Many of the actions outlined in this section could also apply to library services to the broader University of Washington community.

Discovery and Delivery

The bioscience community has a strong preference for online access to and delivery of information. They expect that the information needed to support their teaching, learning and research can be found and delivered to them anytime and anyplace. There is growing evidence that they are finding much of what they need without going through a Libraries designed or maintained Web site or intermediary presence. Whether it's Google Scholar, Pub Med, or Science Direct they can complete an information transaction without knowing the content they're receiving is licensed by the UW Libraries. As a growing proportion of the scientific and medical literature is made available without direct cost through open-access, the use of common or generic search tools will only increase. However, as noted above, at times users are frustrated because they haven't been able to find what they need when they don't use the appropriate Libraries sites to gain access. Our goal should be to make it convenient for users to gain access to quality information using general discovery tools.

As the scenarios showed, integrating discovery tools and delivery services is important. It is vital that we make this integration apparent to the user where they are working; whether through search engines, library webpages, course management tools, MyUW, electronic laboratory notebooks, etc. Reducing the complexity of the information landscape will contribute greatly to the academic and research enterprise. In order to reduce complexity for the user and leverage our investment in resources we need to;

- Provide easier access to and delivery of information resources. It shouldn't matter to the user whether what they need is library owned and licensed resources; available through consortia such as Summit; or through traditional interlibrary loan. We would like users to focus more on the resources they need for their work rather than determine who owns them or which delivery tool they need to use.
- Make library resources discoverable through non-Libraries search engines and other tools which will enable users to be guided to our collections and services.
- Provide as much digital content as possible, this would include acquiring additional materials such as e-journal backfiles, new titles, and e-books. Digitize locally held materials.
- Provide an easily initiated range of user defined delivery options for print resources owned or held by the Libraries. As the University's community is increasingly less campus based we need to have services that do not put people at a disadvantage because they are not close to the print collection. We have great depth in our

collections and making users aware of what resources are available to them will leverage our investment in collections.
- Provide easier access to and delivery of resources not owned or licensed by the Libraries; wherever possible use patron initiated services. Integration of service links within discovery tools is important.
- A single set of Libraries service policies and procedures for the UW community. The increasingly interdisciplinary nature of biosciences requires that we no longer divide users based on our definition of "who they are". We create barriers to service and ambiguity for users and library staff. Students, faculty and staff may have different valid statuses depending upon their point of contact with us. They shouldn't be concerned with how services vary depending on the role they are in at the point of need.

Integrated Service Framework

The Service Framework Steering Committee of the Digital Library Federation [http://www.dlib.org/dlib/july06/lavoie/07lavoie.html] has stated that research libraries are undergoing foundational change but do not yet have a widely shared understanding of how a library and its services are organized in an increasingly networked environment. The DLF group argues that without a common service model, the research library community will be unable to develop and design systems efficiently, to engage in large-scale collaborative activities, and to communicate the value of libraries to others. Being unable to do this, or to do it well and consistently, will make it less likely that library services will be integrated with course management systems (enabling integration with learning workflows). It will hinder our ability to articulate a clear and compelling vision of the value and potential of library services in a digital networked environment. There is a sense of urgency to this since the future of the research library is believed to be dependent on this.

What does this mean for the Libraries and its support of bioscience at the UW? Our users are generally unclear about the role and value of the research library in their work, especially as their work increasingly takes place in a networked environment. A service framework is a tool that helps organize community attention around library services in a changing environment. It provides a pattern that assists strategic direction, resource allocation, and design and development of systems and services.

A true digital repository, and involvement in e-science efforts, cannot be done by the Libraries alone. They require partnerships with campus leaders in science and health science research and teaching, and information technology, as well as external organizations involved in similar work. They also require a commitment to shared governance and budget support. A Libraries advocate is needed who, along with partners from the UW science community, can raise the awareness of the campus community on networked information resources, knowledge management, and the Libraries role in this complex emerging environment.

An Integrated Service Framework would lead to a preferred future for the Libraries where there is:

- A shared, consistent vocabulary to discuss library goals, services; resources, and processes;
- Common ground to communicate library goals and library value to other communities;
- Common ground for communicating with e-learning and e-research communities about how to take advantage of library services;
- Large-scale collaborations with key partners;
- Library services are benchmarked and critical needs and gaps are identified;
- Alignment of business planning with systems development;
- Standardized and consistent service policies that are well aligned with the needs of user communities
    - Specialized knowledge management services – such as those offered through the Health Sciences Library's BioCommons effort – are supported and provided by a cohort of librarians/specialists that work closely with the bioscience community.
    - Library resources are integrated and accessible through consistent policies.

Preferred partnerships and e-science future:

- The Libraries leads many and is actively engaged in other campus-wide initiatives involving e-science and scholarly communication.
    - Libraries position responsible for planning and implementing e-science programs and services. This position advocates, internally and externally, on behalf of the Libraries role in supporting e-science.
    - As part of an e-science strategy, data scientist and data curation positions are recruited for, through internal reallocation if new funding is not available. These new positions require knowledge and skills not now represented among Libraries staff.
    - As some positions that are focused on managing print collections/resources come open, the opportunity is taken to substitute e-resource management knowledge and skills.
- With a critical mass of digital content expertise in place, a robust and integrated digital library is developed to support science research, teaching and learning. The digital library is a partnership with faculty and students.
- Libraries staff (librarians or other) liaisons are part of the curriculum development process, leading to the integration of information literacy/competency skills at all levels of curricula.
- Information resources and the Libraries' discovery tools are well integrated in the virtual environments of user communities across campus. This integration allows users a more seamless discovery and delivery process, without having to go through a Libraries site.

Organizational Structure and Footprint

We see an organizational structure focused on user communities not facilities or organizational entities. The evidence is clear that bioscientists, other scientists and engineers, and those in the health sciences utilize a similar approach in their use of scholarly information sources and knowledge management applications to support and document research and discovery. They differ from other scholarly communities in their reliance on sponsored research funding, dependence on peer reviewed journal articles, preference for online access, and rapidly growing importance and application of computational techniques. They also work together and it is the norm for scientists to be involved in a number of different as well as overlapping research groups that transcend disciplinary boundaries.

We find the Libraries current organizational structure outdated and inefficient as it relates to support of this large community. We need to break down our own "disciplinary" barriers and silos and move away from the unit centered service approach to an integrated one. We spend too much time maintaining print-centered physical facilities and not enough in providing innovative services. We need to be in the space of our users rather than require them to come to our physical or virtual spaces. We need to be more aggressive in ensuring that our collective knowledge and skill base keeps up with the rapidly changing information environment and user needs. While a sizeable majority of UW faculty and graduate/professional students are in the health sciences, sciences and engineering – the areas where the overwhelming majority of sponsored research is based – we do not find that the Libraries organization or services reflect this, or that there is a high level advocate and contact for the University's research enterprise. We need to provide an organizational environment that allows us to support and enhance discovery and learning in the sciences and health sciences, or the Libraries will become of secondary value to the University's foundation of excellence.

Our preferred organizational future and footprint sees:

- Our physical facilities occupy fewer locations and lie within the primary user communities.
- Our satellite facilties are configured to meet the needs of members of their user community rather than housing print collections.
- Most librarians and professional staff are organized in relation to broad user communities, allowing greater connection to and customized support for these communities.

Implementation Timeline

1. Forward the task force report to the Dean of University Libraries – Sep. 2006
2. Revise as needed for distribution to the Libraries Cabinet – Oct.-Nov. 2006
3. Discuss the report and recommendations with the Cabinet – Dec. 2006
4. Revise report and recommendations as needed – Jan.-Apr. 2007
5. Work with Strategic Planning Team and related groups to incorporate findings into plan structure – Feb.-Apr. 2007

6. Report to Libraries Council – Feb. 2007
7. Article in *Library Directions* – May 2007
8. Conduct a series of review and discussion sessions with staff and Faculty Council on University Libraries – Jun. 2007
9. Revise as needed for distribution to other stakeholder audiences – Jun.-Jul. 2007
10. Work with Stategic Planning Team and related groups on relevant implementation steps – 2007-2010

Appendices

References