

## Executive Summary

In the report that follows you will see that the newly formed Department of Biology is flourishing in terms of research, educational quality, and even in the collaborations with community within and around the University of Washington. Core strengths in evolution, integrated systems biology, and environmental biology have been fostered over the years. Nearly all faculty members have extramural support of their research and additional funds have come in with new endowments that support our activities in a wide range of research and educational missions.

The weaknesses and threats all relate to three fundamental issues: (a) the faculty count has declined in the past 25 years while the number of majors has risen, thus teaching loads are reaching an all time peak, threatening the quality of, and access to undergraduate instruction in the basic biological sciences, as well as compromising graduate education, (b) salaries still lag those of Biology Departments at other institutions of comparable size and reputation and (c) we are operating in buildings that were designed with infrastructure that no longer fits current and projected research and educational missions and maintains a fractured distribution of faculty among four buildings.

Despite limitations we feel that this is a unique moment in the history of the department and this review may help in the transformation to the next level. First, the administration of the University of Washington has expressed strong support for rebuilding the faculty number (45 in 1984; 32 today). Thus we see an exciting time ahead as we forge new directions with new hires. Second, there is strong support for the creation of a new "Building for Life and the Environment" – a project that we began at the onset of the new department with assistance from private ventures. It is aimed at providing state-of-the-art research and instructional infrastructure. Third, the College of Arts and Sciences has worked aggressively to begin the first steps towards ameliorating incredible salary inequities that exist within the department.

Over the next 5 years we hope to build upon departmental and institutional strengths through a series of faculty hires that will amplify three conceptual domains: (1) complex dynamical biological systems (2) determinants of biological diversity from molecular to evolutionary and ecological scales and (3) information processing and content in biological systems. There is significant overlap between these thrusts and all of them are aimed at the strategic goals of:

- Providing contemporary instruction to the largest major on campus – serving approximately 500 annual bachelor degrees per year.
- Integrating biological sciences with quantitative sciences in the various departments in A&S, College of Oceans and Fisheries Sciences, College of Forest Resources (College of the Environment), and in the College of Engineering and the School of Medicine
- Strengthening the core science efforts of the interdisciplinary institutions such as the Burke Museum and Friday Harbor Laboratories as well as those in the Neurobiology & Behavior Program, Cell and Molecular Biology Program, and Environmental programs on campus.

## A. General Self Evaluation

In 1904 the University of Washington formed separate Departments of Zoology and of Botany. Much, later, in the 1960's the Undergraduate Program in Biology began, largely a response to the rapid growth occurring in that major. Then in 2003, nearly 100 years after the formation of the early life science departments at the University of Washington, the Department of Biology officially formed, following approximately 1.5 years of discussions with faculty and staff, planning groups, and action on the part of University-wide committees (RCEP committee), deans, and Board of Regents. It followed from a consolidation of the previous Undergraduate Program in Biology with Departments of Botany and Zoology. Although this present report is formally called a "ten year review" it is only about 5 years old. Interestingly, it is only within this past month (March 2008) that we have formal approval for the Ph.D. in Biology!

Why did this consolidation make programmatic sense now and at the UW? For nearly four decades we had operated as independent entities, attempting to draw in the very best undergraduate and graduate students as well as top-flight faculty to the units. But the national platform has shifted over the recent years with greater emphasis on the questions we ask and less emphasis on the taxonomic affiliation of those questions. Thus we tend to structure our research and teaching collaborations along intellectual areas such as cell and molecular levels of organization, the genetic and regulatory origins of form and function in plants and animals, and the integrative aspects of plant and animal design and behavior. Ecology, conservation, and evolution are naturally studied using both plants and animals as well as abiotic environmental factors. Now with new horizons forming in bio-complexity, in social, legal and ethical aspects of conservation and in biodiversity, as well as with interdisciplinary studies like mathematical biology, genetic network theory, and neurosciences, our new consolidated structure made even more sense.

Attracting the best graduate students and creating the very best national models for undergraduate teaching can only be done as an integrated unit. Students are incredibly smart and see the writing on the wall: those programs with strong cores and strong interdisciplinary sciences are far more attractive to them because they better prepare students for careers in wide swath of disciplines. Here we saw a clear benefit through the consolidation of our programs.

We were incredibly excited about the prospect of combining to form an integrated, forward- looking department that will be core to the mission of the institution. Indeed, no one could imagine a successful future for the University of Washington without excellence in the biological sciences. Blurring the boundaries between scientific disciplines has become *de rigueur* and we see deep and diverse intellectual partnership forming all across campus. From collaborations within the life sciences to those in the physical and mathematical sciences, to law policy and international issues, we lie very much in the center of this mix. These collaborations along with partnerships in the private and federal sectors and in the K-12 world set the stage for our collective future. Driving much of our excitement about a consolidation is a conviction that we will be poised to attract even better students and faculty to an already stellar group, allowing us to provide outstanding educational and research environments.

Our vote to consolidate followed from a yearlong series of discussions and retreats in which the faculty considered how acting as a consolidated unit would facilitate our shared goal of excellence in the biological sciences. In many ways, we have already been acting as a single unit for some time. The list below is a mere sample of the activities we had been doing:

- the prior chairs of the units (Ammirati in Botany, Wakimoto in the Biology Program, and Wingfield in Zoology) had been guiding the faculty through the early planning stages for consolidation
- we had been teaching together in both introductory and advanced level undergraduate and graduate courses for several decades
- we had established a joint undergraduate curriculum committee to condense our major into a single biology major
- we had strong research collaborations in the past and sought stronger ones in the future
- we saw opportunities in multidisciplinary research areas that work better as a single unit than as three separate ones (ecology, conservation, evolution of development, paleontology, physiology)
- we had amassed in our units an incredible constellation of experts in Conservation Biology and in Complex Systems Biology that would be core to many pressing issues at the regional, national and global levels

In short, we were poised to proceed towards the formation a new unit with even greater coordination and greater collaboration than before. Our mission of providing excellence in research and education at all levels remains a guiding principle. With biology at the heart of some of the most pressing technological, societal and ethical issues facing people today, we are deeply committed to making this department and college best able to grapple with these matters.

Since our consolidation five years ago, we necessarily devoted a significant fraction of our time to formulating policies and procedures for the new department. To make sure that our new department is well positioned for the future, we added a new administrative structure, new departmental committees, and a new Ph.D. and its associated requirements, as well as revised our undergraduate curriculum, and established significant efforts in development.

We knew *a priori* that the process of merging three different units would be challenging. Many Botany and Zoology departments across the country had previously attempted mergers, sometimes with divisive consequences. Here at the UW, Botany and Zoology not only had different cultures and traditions, but were also housed in separate buildings, such that personal interactions and collaborations had been limited prior to the merger. These two departments also differed in size and scale: Botany was small enough to make decisions as a group, but Zoology's larger size required a committee structure. In addition, the Biology Program was focused on teaching, whereas Botany and Zoology were dedicated to research as well as teaching. Moreover, the Biology Program had no tradition of self-governance, but was run a tenure-track faculty Director appointed from either Botany or Zoology.

Accordingly, the first order of business was to create a new, larger, and more diverse department, and to find a way to do so that encouraged cohesion and respected different traditions. This took considerable effort of all concerned. Every departmental policy and procedure (and there are many!) needed to be discussed, evaluated, and voted on by all constituents. We needed to consider, for example, how Botany had run graduate admissions, how Zoology had done so, and how a larger and more diverse department should do so in the future.

The process was time and energy consuming, but proved remarkably unifying. Moreover, it enabled us to modernize policies and traditions that – to our surprise -- had become unknowingly anachronistic. Although concerns remain, many of us regret only that we didn't merge years earlier. Rebooting our operating system eliminated a lot of bugs (metaphorically, not physically).

All of this additional organizational effort was done while maintaining traditional excellence in our research and educational missions. Thus the Department encourages its faculty and students to engage in innovative and interdisciplinary research. Benefitting departmental cohesion and research diversity are strong ties with a host of other programs within the institution and the region as a whole. Particular strong ties lie between UW Biology and the UW Burke Museum and the UW Friday Harbor Laboratories as well as the Fred Hutchinson Cancer Research Center.

Concluding remarks. As explained below, we see our unique strength in acting as a truly consolidated and integrated program. Few in the US encompass the breadth and depth of research and education in Biology that we offer. The strengths and qualities that make this Department special, along with the threats it faces, will be documented in the pages that follow, but a synopsis of an important core value may help provide an orientation to this report. ***The Department of Biology has attempted to hire outstanding faculty and staff, to recruit top-ranked students and postdocs, to treat everyone well and equally, to foster an atmosphere marked by good humor and respect as well as hard work, to offer all the maximum possible level of support and freedom, and to interact synergistically within the Department, with other units at the University, and with the community.*** We seek to continue this in the future.

### A.1 Unit strengths

Despite a significant decline in faculty numbers over the past 25 years (see figure below) and the efforts required to coordinate a consolidation, we have managed to build new strengths in research and education and while maintaining existing ones. In our research mission we have seen the crystallization of several exciting new programs:

- The confluence of development and evolution (Evo-Devo) with a molecular basis explaining the origins of form in plants and animals.
- An outstanding constellation of evolutionary biologists with a new (and unexpected) strength in paleontology
- A group focusing on the environment and climate (both current and historic)

- Significant growth of mathematically inclined faculty who address issues of complex biological systems and information processing in biology.
- The penetrance of genetic tools and concepts into a wide swath of biological problems ranging from signaling pathways to conservation biology.

We are in the midst of a wonderfully broadly defined search for faculty with expertise in topics ranging from cellular level processes to physiological and integrative approaches. The support from the UW administration for new hires is clearly helping move our department forward. We intend to build strength in integrative systems (from cellular, developmental scales, neural and organism scales) and in biodiversity (from molecular to ecosystem and evolutionary scales). Our recent hires support this mission and defy the traditional boundaries established by the old departments. They meld math and biology, plants and animals, molecules and ecosystems.

Reflecting this strength is strong extramural research support. In the prior year we generated about 12 M\$ in extramural support from 29 agencies and a total of about 90 proposals. The prior year saw 75 proposals and about 8.5 M\$ in extramural research support. In the past 5 years all of the faculty (with the exception of newly appointed assistant professors) have had extramural research support of funding from University of Washington sources (such as the Royalty Research Support). This current year may see a slight downturn in extramural funding.

Of the 32 tenure track faculty, all are active in research and many have served on NSF or NIH panels or study sections. There are 2 MacArthur Fellows, 4 members of the American Academy of Arts and Sciences, 16 Guggenheim Fellows, 2 Fulbright Scholars, 6 AAAS Science Fellows.

The department is particularly proud of its graduate program. The strength here is best seen in the standard national scale metrics: of the near 100 graduate students matriculated in the Department of Biology there are 10 NSF pre-doctoral fellows, 4 EPA-STAR Fellows, 4 recipients of NSF Doctoral Dissertation Improvement Grants (DDIGs), 3 UW Excellence in Teaching Award Recipients, 13 ARCS fellows, 4 IGERT Fellows, and 3 PRIME Fellows. We have been ranked by the Chronicle of Higher Education (Jan 2007) as the Nationally top department in the Ph.D. field of Zoology. At the local scale, the Graduate and Professional Student Senate (GPSS) awarded our graduate program the 2006 UW Gold Star Award for outstanding graduate student services. We have one recipient of the UW Distinguished Graduate Mentor award and two honorable mentions for this award.

The Department seeks to defy the conventional wisdom that large state universities do not provide educational advantages that characterize smaller liberal arts colleges. Thus another strength and source of pride is the quality and volume of undergraduate instruction in Biology. We have been awarded a large number of Teaching Awards (faculty Distinguished Teaching Awards and Graduate Student Excellence in Teaching Award). Since the start of the Department of Biology we earned 4 awards in this area: Ben Kerr (DTA), Alex Coverdill, Fernanda Oyarzun and Chris Himes (ETA) along with Julia Parris (DTA), a joint faculty member with the School of Aquatic and Fisheries Sciences. In addition to these awards, we enjoy high metrics of success in regards to instruction at the undergraduate level. In the past five years of course evaluations the Department of Biology ranks among the top science units in the University as measured by the "standardized difference metric" between our department and the UW as a whole

or the Division of Natural Sciences within the College of Arts and Sciences (Attachemt1). We rank about 0.24 (UW) and about 0.34(Natural Sciences) above all other programs, despite large class sizes, access constraints and a high bar held for student learning.

In addition about 50% of nearly 1000 undergraduate majors have been awarded support for research through a variety of mechanisms including Mary Gates Scholars (32), Hughes Research Interns (22/yr), and individual research grants in Biology and myriad units around campus. Four of the past six Presidents Medalists (best undergraduate GPA) for the University of Washington have been associated with our department, either as majors or double majors. Three have been Dean's Medalists.

Our vast undergraduate mission receives support from the Howard Hughes Medical Institute (HHMI). With Biology faculty leading, the past 19 years the HHMI has awarded the UW five grants totaling \$7.8 million through its Undergraduate Science Education Programs. The 2006-2010 award to the Department of Biology of \$1.6 million placed the UW in an elite group of universities that have received continuous HHMI funding since the institute began its investment in undergraduate education in 1989.

The goals of our current HHMI-funded programs are to increase the diversity and success of students and mentors in the biological sciences and drive innovations in biology education and outreach. Our home is the Department of Biology; however, our programs have also supported students, postdocs, and faculty members in additional units in the College of Arts & Sciences, College of Engineering, College of Forestry, School of Oceanography and Fisheries Sciences, and School of Medicine. We also have a deep commitment to teacher training. Since 1990, Biology's outreach programs for K-12 teachers have been fully supported by HHMI funds.

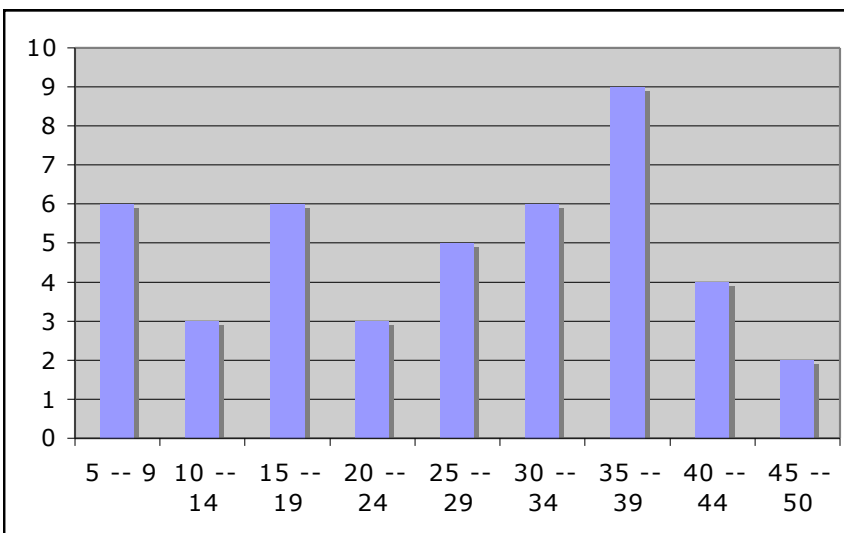
The Department has had a leadership role in providing experiences for Biology teachers. The Master of Science in Biology Teaching program, while under the auspices of the Graduate School, is fully housed in our department with the bulk of its funds derived from our budget. Hellen Buttemer, the director of this program, is member of our faculty (part time) and has worked closely with our faculty, students and the HHMI program. The program was reviewed this year and earned very high marks.

The Department of Biology and its antecedents (Botany and Zoology) have a tradition of fostering interdisciplinary research and education and our current degree programs reflect this societal need. We maintain strong interactions with faculty in other colleges (e.g. Colleges of Engineering, Medicine, Oceans and Fisheries Sciences, Forest Resources). For example new partnerships are forming for an IGERT in Bio-Dynamics with faculty in Biology and those in Aerospace, Electrical Engineering, Computer Science, Physiology and Biophysics and Oceanography. Similarly, we see a deep partnership forming with the possibility of a new College of the Environment.

Interdisciplinary research and education are fostered with numerous interdepartmental programs and training grants, many of which are spearheaded or strongly supported by the faculty in Biology. A summary of these is below in Section D of this report.

## A.2 Unit weaknesses.

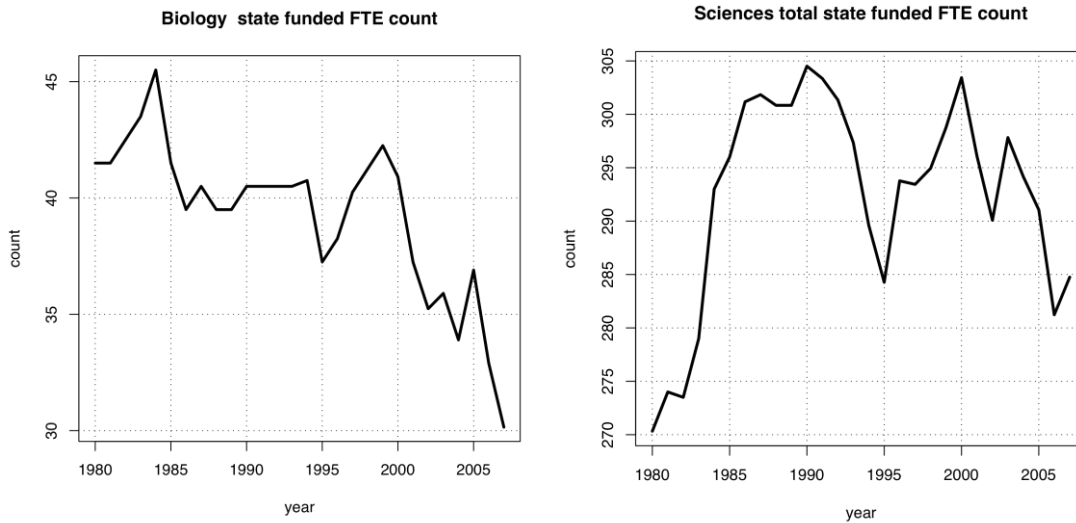
Our greatest challenge for the future lies in the mismatch between the instructional mission we necessarily must provide and the current and projected faculty count. As you will read in the “public” document prepared by the committee charged with searching for the next chair of the department, there is a significant threat of faculty discontent imposed by this mismatch: the teaching load is too high (courses are too large and the faculty count is too low). According to figures recently released by the college of Arts and Sciences (see <http://www.artsci.washington.edu/admin/planning.asp>) we graduate approximately 450 bachelor degrees per year (our data suggest we provide the core instruction for many more students than those in our major). As of the writing of this document we estimate that degrees awarded will increase of about 10% this current year.



Faculty distribution according to years since Ph.D in bins of 5 year intervals.

In the past few years we will have seen several retirements and early departures of critical faculty members. These include Arnold Bendich (cell biology, DNA structure), James Truman (cell biology, neural biology, development), Lynn Riddiford (physiology, cell and molecular biology, development), John Wingfield (physiology, behavior), Sievert Rohwer (behavior, evolution) and Marilyn Ramenofsky (physiology), Benjamin Hall (plant molecular biology and evolution), and Jim Kenagy (physiological ecology, mammology). In addition, we had the unexpected departure last year of Luca Comai. These faculty members represent an exodus of a significant part of our research and teaching mission with their particular expertise focused on physiological and cellular levels of organization.

In addition to the recent departure of a significant number of faculty, the next five years heralds and even greater flux (see age since Ph.D. above). Among this group, Richard Strathman, Benjamin Hall, Robert Waaland, Susan Waaland, Gerold Schubiger, Merrill Hille, Roger del Moral and Rose Ann Cattolico have all spoken about upcoming retirement plans. We will have a cumulative loss of about 15 faculty members retiring in the next 5 or so years – a level of departure far greater than we could possibly fill.



Faculty counts in Biology (left panel) and the Division of Natural Sciences (right panel) since 1980. These data represent faculty FTE count, not the total number of appointments. Thus it is adjusted for partial appointments (e.g. joint, curatorial, and director positions). Source, Werner Steuzle, Divisional Dean of Natural Science.

At the same time we have seen a significant growth in our teaching mission (473 Bachelor degrees in Biology and Neurobiology this past year) and in our research mission (11.5 M\$ in this years new allocation of grants – up 20% each of the last two years). This past year, the Department of Biology graduated nearly 9 bachelor degrees per tenure track faculty member. The average in the College is only about 6 – often in courses that are not laboratory-intensive experiences such as ours. The average in the Division of Natural Sciences is only about 4.5. Although we are excited about our positive learning environment, we feel we could deliver educational opportunities like those in other colleges if our numbers can be brought into greater parity. This would allow upper division courses with fewer students (currently many exceed 50/faculty member) and more focused experiences. It would also allow the re-development of graduate-level courses, which are currently not available on a regular basis.

In the prior five years the number majors has grown from 820 in 2002-2003 to 1,013 in 2006-2007. We are projecting about 10% more in the coming year. Similarly, the Bachelor award rate has increased from 352 to 416 in this time interval. Because we also provide the bulk of the services for the Undergraduate Neurobiology major (graduating about ~50 this coming year), our total Bachelor award rate is about 450. Our total student credit hours have risen from about 34,000 to 39,000, reflecting greater enrollments and great interest in Biology. Thus we have experienced a near 15% *increase* in instructional activity while suffering a similar percentage *decrease* in faculty FTE.

About 75% of our undergraduate population focuses on molecular, cellular and physiological (tissue) levels of organization (see section F.2), many with a focus on either the allied health sciences or on biotechnology. This is the domain with greatest recent departures, greatest anticipated retirements, and greatest need in terms of our strategic goals. Thus this domain represents a focus of our recent searches. Bringing our faculty count in line with our educational mission will also significantly help our



graduate instructional program which currently suffers from far too few course offerings at the 500 level.

Infrastructural constraints represent a very significant problem for the department. The facilities built in the 1970s do not reflect current research and educational needs, thus inhibiting research productivity and student throughput (as long as labs are a reasonable part of education), the faculty are physically fractured among many buildings, and the projected future size of the faculty cannot be sustained in the structures we have, and, for many years we struggled with one major building (Hitchcock Hall) that lacked proper HVAC and Greenhouses with substandard controls. That said, the Provost of the University and Dean of the College of Arts and Sciences have committed (a) funds towards renovating Hitchcock Hall and (b) funds for an intention to begin a feasibility study for a new building. These two points herald an exciting future for our department (see Section C.5).

The College of Arts and Sciences is well aware of the salary lag between UW Biology and equivalent units within the institution and elsewhere. [Mid-career faculty who have left were initially tempted to do so in part because of poor salaries here.] Over the past two years there have been adjustments to the unit allocations for salaries, but there remains considerable room for improvement. At the entry Assistant Professor level, we do quite well. Additional information on this is available in Attachment 2.

**A.3 Changes in the field over the last decade – the opportunities.** Biology has become increasingly quantitative, integrated and technical. Indeed, a major underlying rationale for our consolidation and our recent hiring pattern was to position the department to lead in truly integrative and quantitative research and education. Perhaps the greatest changes are seen in (a) ever greater access to genetic and molecular tools for probing research problems that range from issues of conservation biology and biodiversity to signaling pathways and developmental origins of form and (b) computational and mathematical approaches that are used to mine data, form predictive models of biological phenomena and visualize complex systems. These along with pressing environmental issues form the nexus of our interests and those facing the UW as a whole.

Another significant change is the number of departments across campus seeking deeper partnerships with Biology, largely through a nationally recognized boon in interdisciplinary hiring with a biological emphasis. Several departments in the College of Engineering have been looking at more biologically inclined faculty hires. Similarly departments such as Mathematics, Applied Mathematics, Atmospheric Sciences, and even Philosophy have had conversations with us about potential joint appointments. The number of these opportunities has increased over the five years.

At many universities across the country, biological science departments have been increasingly fragmented into specialized competing units. Such fragmentation can be beneficial in allowing a university to develop strong programs in emerging disciplines (e.g. neurobiology, ecology and conservation, developmental biology). Nevertheless, we believe an integrated department is better positioned to deal with emerging topics and technologies. Thus the use of molecular and genetic tools and concepts for ecological scale problems is enabled by such integration. Similarly, deep expertise in evolution informs research on microbial systems, antibiotic resistance, and even neural system

function. Solutions to global problems about the environment, global health and even science education are best dealt with broad biological knowledge and skills. An integrated and diverse department is ideally situated for addressing these matters.

One well known, and disturbing, change is the current and projected funding climate in the US. Recent figures released by the National Institutes of Health point to dramatic six year average lag between the appointment of assistant professors and the onset of first R01 grants. Our record is well above the national average, but this funding issue forces a re-thinking of how programs will support new faculty.

A consequence of a well-known flat or declining funding climate is the strategic (and wise) move towards significant startup packages for new faculty. This has escalated over the recent years and remains a potential impediment for recruiting top scholars to the UW. We have begun to view the start up as a combination of long-range planning of shared facilities and short-range planning by setting aside, from our indirect cost returns, modest bridge funding to cover either lapses in grants for otherwise productive researchers or to provide additional support for junior faculty who have not yet had their first grant. Setup is a special concern for us, because of our need for sustained hiring for many years to come.

#### **A.4 Expectations of our role in the College and University.**

The Biology Department sees its role as the center of basic biological science research and education.

- We provide the core instruction for a host of majors on campus such as Psychology, Microbiology, Biochemistry, Bioengineering
- We see increasing and deep research and educational partnerships with a surprising number of units in most colleges on this campus.
- We maintain an active and central role in a host of interdepartmental programs – such as the Cell and Molecular Biology Training Program, the Developmental Biology Training Grant, the Neurobiology Undergraduate Major, the Interdepartmental Neurobiology and Behavior Graduate program.
- We are excited about how we play a key role the strategic directions that the UW has followed – greater attention to the environment, global health and “e-science”.
- In all of these domains, our faculty are either leading the programs or playing significant roles in their governance.

### **A.5 Faculty participation in governance and strategic planning.**

Current faculty governance mechanisms and policies arose as a consequence of an evolutionary process over the past 5 years. We experimented with various modes of leadership and committee structure and have settled upon a system that seems to work quite well. Like all biologists, we think this is indeed an evolutionary process, subject to natural selection, mutation, and even drift. Thus the system we have now represents a maximum in the local fitness of the department. Changes in the environment (size of the department, institutional support, etc) may lead to changes in governance and in accordant fitness.

The prior Departments were governed by a Chair. However, the Department of Biology has evolved a distributed form of governance consisting of an Executive Committee (EC), which consists of the Chair, the Administrator and the chairs of the five standing departmental committees. Thus, the current EC membership is

- Tom Daniel, Departmental Chair
- Karen Russell, Departmental Administrator
- Ray Huey, Chair of Faculty Appointments
- Toby Bradshaw, Chair of the Graduate Program
- Dee Boersma, Chair of the Curriculum
- David Perkel, Chair of Promotion and Tenure
- Dick Olmstead, Chair of Seminars

The EC functions to help guide and suggest policy as well as a problem-solving group. We meet weekly and review issues that pertain to the functions of each major committee. Examples of EC function this past year include the recommendations that we re-evaluate instructional offerings at the entry level to improve both access to biology courses with more effective deployment of university resources. We also address emergent issues of students performance, faculty funding problems or any matter that comes before the chair. This structure permits a broader leadership base than the historic "chair-does-it-all" model. Additionally, each committee chair serves as a conduit of information between the EC and the faculty members who populate the standing committees.

All faculty members (tenure track and lecture lines) participate in at least one of the five standing committees. We also ask that each committee have one member to represent issues of diversity for that committee (though there is room for improvement here). We have at least one graduate student representative on each of these committees – with the exception of the Promotion and Tenure committee. Staff members relevant to each committee function also participate in the function of each committee. All committees report to the entire faculty and make recommendations for voting or action by the faculty as a whole. Briefly these committee functions are:

*Faculty Appointments Committee:* oversee faculty searches, appointments of adjunct, joint and affiliate faculty, recommend search procedures, manage presentation of faculty appointments for voting at the full faculty meeting.

*General Graduate Committee:* oversee the development of Ph.D. guidelines (approved in March 2008 by the state HEC Board), graduate admissions, graduate student progress, graduate student awards and support, TA assignments, and the general annual faculty review of all graduate students.

*Curriculum Committee:* oversee the curriculum and all of its dimensions including the range of courses offered, consideration of new courses, policy for course development, recommendations for sustainable curricula, suggestions for novel pedagogy, and recommendations for staffing of the instructional mission.

*Promotion and Tenure Committee:* oversee promotional matters for all ladder faculty (tenure track and lecture lines), coordinate annual reviews of all ladder faculty, summarize (in writing and to the general faculty) recommendations regarding promotion, work with the chair to communicate promotion expectations to ladder faculty, help guide the development of portfolios for promotion.

*Seminar Committee:* oversee the departmental seminar committee, coordinate seminars with search committees, coordinate endowed seminars and graduate student invited speakers, help maintain balance of seminar topics.

All committees ultimately report to the entire faculty and make recommendations that are subject to faculty voting. All faculty participate in voting either directly or electronically. Because a large fraction of our faculty are resident at the Friday Harbor Laboratories, we have set up a video conferencing system (imperfect but workable) so that FHL faculty can participate in general faculty meetings, which are held approximately twice per month during the academic year.

Each year a general departmental retreat focuses on largely on strategic directions for hiring and curricular development. These retreats are commonly day-long events that culminate in a recommendation for the types of faculty lines we would seek in subsequent years. Last year, for example, the retreat culminated resulted in a recommendation that we seek broadly a number of positions to be filled over a number of years (approximately two per year for six years). This new mode of faculty recruiting allows (1) selection of the best in 5 years in a number of fields rather than the best in one field in one year, (2) opportunistic hiring in which we can build diversity, and (3) a means by which we can recruit national leaders who may be moveable in any given year.

#### **A.6 Mentoring junior faculty – general**

The department takes as its one of its most serious duties the hiring, mentoring, and promotion of ladder faculty. This is because positioning our new colleagues to be successful is a logical means for guaranteeing the department's future success. As mentioned elsewhere in this report, we are active participants in the ADVANCE program, part of which provides materials and information for ladder faculty.

Additionally, we follow the mandated annual reviews of all ladder faculty. This review process evaluates contributions to teaching (via student and collegial review), service, and research. It is coordinated by our Promotion and Tenure (P&T) Committee, which assigns one of its members and recruits additional faculty to meet individually with each ladder candidate and to discuss progress and concerns. The summary of this review is

discussed in a general faculty meeting by those colleagues hold ranks senior to those being considered. It culminates in a written summary and a meeting with the chair. This is aimed at advising ladder faculty of ways to position themselves to be successful as well as to solve potential problems. Inclusion of all ranks of faculty in the P&T committee serves as a mentoring guideline for their own careers.

Over the past few years, the chair has also met with assistant professors as a group to review promotional materials, using successful and recent promotion packages of faculty in the department as templates for discussion. By this method we try to make as transparent as possible the steps towards building successful portfolios.

Promoting faculty is more than merely following rules and regulations for annual reviews. It involves nominating them for University and National level awards. We aggressively do so and have been quite successful in getting these. Over the past few years we have nominated faculty for Distinguished Teaching Awards, Mentor Awards, Packard Fellowships, Sloan Fellowships and many other opportunities. These have the dual benefit of promoting the quality of individuals and the department as a whole.

Promotion pertains to all faculty ranks, not just those holding tenure track lines. To our knowledge, we are the only department that formalized internal guidelines for promotion of those faculty holding lecturer ranks. It was motivated by the lack of any clear guidelines in the institution for promotion in this rank. We thus initiated a working group charged with formulating departmental guidelines for the promotion of lectures to ranks of senior or of principal lecturer.

The most relevant, yet most difficult to quantify, component of our mentoring is the open door culture that is strongly held by all members of the faculty. We expect all ladder faculty to be able to have open and candid access to senior members of the faculty.

There is always room for improvement, of course. Some units formally appoint faculty mentors to each ladder faculty. Others, such as ours, rely on the combination of committee evaluation, individual annual meetings with the chair and representative faculty, and the open door culture. However, our success rate in promotions demonstrates that our approach works.

## **B. Teaching**

As mentioned above, all state supported faculty participate in both undergraduate and graduate teaching. It is a mission for which we have garnered strong recognition within the institution and at a national level. Moreover, we have been aggressive in securing extramural and internal support for innovative educational missions (e.g. HHMI grants, College of Arts and Sciences Learning Initiative)

### **B.1 Courses taught per year by all faculty.**

A typical three-year teaching plan is summarized in Attachment 3. Our nominal teaching load for faculty holding tenure track lines includes contributions to introductory level teaching [nominally five weeks of 100-200 level (freshman, sophomore) or 10 weeks of 300 level (junior) level), to senior-level teaching (5 or 10 weeks of 400 level, depending on lab, and various offerings of 500 level (graduate) courses or seminars. On top of that direct contact for traditional instruction is the one-on-one mentoring and instruction of graduate students, undergraduates and postdoctoral students in the laboratory.

The nominal teaching load for faculty holding lecture ranks is slightly higher, with a combination of laboratory coordination and direct lectures. For example, Dr. Susan Waaland's teaching assignment has been: Autumn Quarter – half of the lectures and coordinating the labs for Biology 161, Winter Quarter – coordinating labs for 162, Spring quarter – half of the lecture for Biology 220.

All ranks of faculty contribute to all levels of undergraduate instruction – from introductory levels to the 400 level. All participate in TA coordination and mentoring in their classes. Moreover, there is a strong departmental culture of faculty participating in the laboratories – even in those at the introductory level.

### **B.2 Involvement of undergraduates in research.**

The Department of Biology may never have the relative resource allocation and faculty/student ratio that is commensurate that at a small liberal arts college. That said, we play to our unique strength of involving students in intensive research experiences. *Approximately 50% of our undergraduates become involved in a research laboratory.* This extraordinarily high incidence of undergraduate research experiences is made possible by several key ingredients

- Our undergraduate advising staff strongly encourage students to contact faculty.
- Our faculty has a tradition of including undergraduates in their research and take pride in publishing with them.
- Our colleagues in departments in the School of Medicine and in the institutional partners elsewhere in the region (e.g. the Fred Hutchinson Cancer Research Center, the Allen Institute of Brain Science, the Institute of Systems Biology, government agencies; see section D) have been critical in providing supplementary research opportunities for the burgeoning majors we oversee.
- The HHMI program has provided direct financial support for research opportunities for students..

- The Mary Gates Fellowships supporting undergraduate student research has become part of the fabric of this department, and we are the single highest recipient of these fellowships at the UW.
- The new Levinson Fellowships support basic research in the life sciences.

Although we are thrilled with the high incidence of research experiences in the laboratories, we want to expand these opportunities. Our long term goal is to enable all Biology majors to have a significant experience in independent research. Because some students are financially disadvantaged, financial issues are impediments to this goal. Clearly the Gates and Levinson Fellowships, along with funding through our Federal and Private grants, is making headway. Additionally, we have established a number of internal awards and endowments to help in this regard.

### **B.3 Evaluation of instructional effectiveness and student learning.**

We use several metrics to measure our instructional effectiveness. Chief among these are the traditional student evaluations (see Attachment 1). As you are aware, these evaluations reflect a combination of student views and instructor effort. Data for our unit reflect exceedingly positive rankings, scoring consistently higher than the average of the Natural Sciences and the UW as a whole.

Other measures of the effectiveness and attention to undergraduate learning include Distinguished Teaching Awards, Excellence in Teaching Awards, Graduate Mentor Awards and faculty involvement in the National Academy

We have been one of few departments to establish formal learning goals for the major and were recipients of College funds for this activity (Attachment 4). This appendix outlines how we define learning goals and measure our effectiveness in moving towards them. We developed these goals for single courses and for the curriculum as a whole.

We also study how students learn so that we hone our instructional mission and communicate best practices. In a multi-year, College-funded project, our faculty and graduate students have been analyzing how students learn in the major – specifically how various teaching practices are seen in metrics of student learning (e.g. exam grades, retention, Attachment 5).

We have also promoted innovation through the support of new teaching styles such as the new “Experimental Evolution Course” taught by Kerr, Tewksbury and Bradshaw in which learning is done in teams conducting independent research over several quarters. This course, along with outstanding instruction at introductory level, earned the 2008 Distinguished Teaching Award.

Part of evaluating instructional effectiveness requires developing a “sustainable curriculum”. That means making difficult decisions regarding the deployment of resources (faculty, lab space, TAs). This past year we re-evaluated our entire entry level series so that we could provide a more streamlined instructional mission and to increase access, despite faculty losses. Thus, until next year we will have offered three separate tracks for introductory courses: the 100 level track for non-majors, the 161/162 track for pre-allied health sciences and a modest number of environmental science majors, and the 180/200/220 track for majors. We are discontinuing the 161/162 track but increasing the access to (a) 180, with more sections and a reduced Chemistry pre-requisite and (b)

more sections of 118 (Human Physiology). Thus we can not only accommodate more students, but also make more effective use of faculty and laboratory spaces.

#### **B.4 Graduate and Postdoctoral Teaching.**

At the graduate level (as you will read in more detail in sections F and G), we have a formal first-year course that focuses on graduate student life and the issues that surround defining research projects, scientific ethics and selecting a laboratory for study. This, combined with a compulsory weekly seminar representing the wide breadth of science in our field, lab-meetings, advanced courses in graduate education, and of course, one-on-one mentoring in research constitute the bulk of our efforts in this educational mission.

This prior year two faculty (Hille Ris Lambers and Nemhauser) offered a graduate course in grant writing aimed at securing prestigious NSF predoctoral fellowships. This course and the outstanding class we had admitted received **6 of the 25** NSF fellowships awarded this year to the University of Washington.

We are concerned with the continued paucity of graduate lecture courses. In the 70s and 80s, both Botany and Zoology regularly many offered graduate level course. But with the huge increase in undergraduates, coupled with the decline in faculty, our graduate lecture courses are at risk of extinction. This is not a new issue: the Department of Zoology raised it as a key concern in the 1993 Review of the Department. This needs to be rectified if we are to continue to attract and mentor top graduate students.

Postdoctoral education and mentoring is gaining greater recognition in the department and the UW. Many superb postdocs join the Biology Department, some arriving with their own fellowships, others supported by faculty research grants. Postdocs in our department and others in the life sciences now have access to an outstanding program sponsored by our HHMI grant and coordinated by Professor Hille. This program fosters the development of small, topical, courses for undergraduate instruction. From course design to actual teaching, these trainees gain both experience while improving their portfolios. The Department has also begun to incorporate postdocs into its formal teaching mission, paying them to participate in courses that need to be covered as faculty either retire or take sabbatical leave.



## C. Research and Productivity

The department has seen a relatively constant level of research productivity as measured by grant expenditures or by the acquisition of new grants, despite a well known effective decline in federal research dollars and the accordant increase in competition for those funds (Attachment 6A) Over the past five years we have averaged about  $115 \pm 19$  submissions per year to about 25 different funding agencies resulting in an average of  $79 \pm 15$  awards or supplements each year with approximately  $10 \pm 3$  M\$ in annual award and supplement allocations.

### C1. Overview

A snapshot of the past year (Attachment 6B) shows the bulk of our extramural funds derived from the National Science Foundation (4.6 M\$), the National Institutes of Health (3.2 M\$), the HHMI (1.7 M\$) and DOD (1.0M\$). The remaining funds are derived from a wide range of private, public and local sources.

While there are some considerable fluctuations in awards (about a 30% standard deviation), expenditures over the years have generally risen showing a consistent trend towards increased extramural support (see figure below)

QuickTime™ and a  
TIFF (Uncompressed) decompressor  
are needed to see this picture.

Annual grant expenditures over the prior ten years. Source <http://www.artsci.washington.edu/admin/planning.asp>

This grant activity supports a wide range of research topics best measured by scanning the CVs of our faculty. They include new or expanded programs at the interface of evolution and developmental biology, cell signaling pathways and form, paleobiology and climate, information theory and neural systems, and much more.

The Department has been successful in obtaining equipment grants from private organizations (e.g. WRF, NSF) that support cross-disciplinary research resources such as a Confocal Microscope Facility and our Comparative Genomics Center. These provide state-of-the-art infrastructure for research activities that span the department, from ecological research (genomic data) to neural and developmental research (confocal).

Funds (federal, state, and private) also support the University of Washington Biology Department Greenhouses where research, educational, and outreach missions serve a wide range of interests in the region.

Both federal research grants and their associated indirect cost returns also support shared facilities and equipment including growth chambers, environmental chambers, ultracentrifuges, gel readers and much more.

All of these funds and resources support faculty and student research directions that are well aligned with the strategic goals of the institution – there is increased interdisciplinary research (the number of faculty involved in interdepartmental programs and multi-investigator grants),

## **C.2 Mentoring junior faculty**

Today's funding climate for junior faculty is vastly different from that of even 5 to 10 years ago. The 2005 study published by the National Academy of Sciences (<http://www.nap.edu/books/030909626X/html/>) points to the six year time lag between the initial appointment of an assistant professor and their first R01 grant, with only 4% of the funds awarded to first grants. Accordingly, mentoring junior faculty and providing the appropriate support for preparing their first grant is critical to their success and, thus, our success.

At the local scale the Department of Biology provides competitive start up packages for our new colleagues. These provide the critical initial funds to equip a laboratory, support personnel and initiate research projects for the first grants. We have also relaxed the time over which start up funds must be spent: there is no expiration date for start up funds. We have internal funds that support graduate students and have preferentially awarded competitive graduate recruitment support slots to new faculty. Moreover, because graduate students form such a critical part of our research domain, we provide preferential admission to high quality graduate students aimed at new faculty.

Additionally, we do not burden new faculty in their first year with extensive teaching assignments. We further make every effort to insure a stable teaching load in the first years to maximize the time available for developing research programs while improving teaching. We also are full participants in the Junior Faculty Development Program sponsored by the College of Arts and Sciences. In the first three years and the second two years prior to tenure, the College funds a month of summer salary (or its equivalent in research dollars) and the department matches with a quarter off from teaching.

We also encourage new faculty to share their grant proposals with senior faculty who have more experience writing proposals. Moreover, in the mandated annual review of faculty, we review funding and the challenges each member faces and discuss plans for future funding and impediments that may be in place.

If the combination of support above is not sufficient to preserve productivity in new faculty labs, we can provide bridge funds (and have done so for junior ladder faculty). The department has also reserved emergency funds to help support for labs where productivity has been extremely high and the tight funding climate caused a temporary lapse in funding. These funds are matched by the Dean of the College of Arts and Sciences and the Office of Research (our faculty were involved in the creation of this

university wide Bridge Funding Program).

### **C.3 Impact over the past five years.**

In addition to a relatively stable funding portfolio for the department, we also note that the impact of our research program has been consistently high and can be measured in terms of

**(i) awards and recognition** of research excellence (2 MacArthur Fellows, 4 American Academy of Arts and Science Members, 4 National Academy members (emeriti/joint), 6 AAAS Fellows, 16 Guggenheim Scholars and 2 Fullbright Scholars),

**(ii) requests to serve on panels and scientific review and advisory boards** (e.g. study sections, NSF panels, Advisory boards too numerous to indicate here), and

**(iii) the publication in the most widely read journals** (in the past five years the tenure line faculty were authors on 32 papers in PNAS, Proc.Roy. Soc, Science and Nature) as well as many top level specialized journals.

Impact of our research program can also be measured by the placement of trainees into faculty and postdoctoral positions as prestigious institutions around the country, including Harvard, Caltech, UCLA, Berkeley, Princeton, Yale, Davis and Microsoft (see Appendix E).

Our research program increasingly leads to innovations that have potentially commercial benefit. Starting with the significant contributions of Ben Hall and the concepts he developed that lead to major breakthroughs in health care to recent disclosures for discoveries with intellectual property potential (Laird: hairpin bisulfite technology; Daniel: neurochip; Cattolico: biofuels). Thus research in Biology is more than a purely intellectual venture, it has potential impact on the state economy.

### **C.4 How have advances in the discipline modified our program?**

To a large extent we addressed this question in the opening section (A) of this document, outlining the intellectual basis for the reorganization of the basic biological science departments in the College of Arts and Sciences. We recognize that the most pressing open problems pertain to diverse taxa and multiple temporal and spatial scales of organization – how complex systems function, evolve and relate to one another. Additionally there are major technological advances enabling change such as (a) increased access to powerful genetic and molecular tools that permit deeper understanding of cellular and molecular processes as well as evolutionary and ecological scale issues, (b) increased access to powerful computational methods and concepts, driving new understanding of how biological systems acquire, process and store information, as well as permitting the exploration of massive data bases that emerge from genetic, neural, and ecological (e.g. GIS) scale studies, and (c). These advances, combined with the emergence of pressing global problems about the impact of climate change on future (and historic) life on the planet have driven much of the pattern of hiring we have followed. The research domains of our current assistant professors attests to this need for integrative and contemporary approach to biology:

- Veronica Di Stilio melds genetic and molecular tools to understand the developmental determinants of floral form.
- Horacio de la Iglesia melds neural, imaging, and molecular methods to understand the cellular basis of time keeping in biological systems.
- Janneke Hille Ris Lambers uses powerful statistical methods to understand the impact of climate on the spatial and temporal patterns of species abundance and distribution in terrestrial systems.
- Ben Kerr combines mathematical and genetic methods to understand real time evolution and ecology in both natural and laboratory populations.
- Jennifer Nemhauser brings bioinformatic methods to bear on understanding signaling pathways that determine plant growth and form.
- Christian Sidor uses morphological and geological methods to unravel the influence of historic climates on the past global distribution of mammal like reptiles.
- Caroline Stromberg combines geology, palinology, and microtechniques to recreate past climates and understanding the historic “greening” of the planet.
- Joshua Tewksbury seeks to understand the evolution and ecology of complex tropical systems and uses methods that range from biochemistry and genetics to massive manipulation of field sites.
- Greg Wilson combines 3D morphometrics with data mining and large collections to understand the origins of early mammals.

These great colleagues collectively show the breadth and depth of interdisciplinary research that is a direct consequence of our consolidation and reorganization.

### **C.5 Steps to preserve research productivity and overcome impediments.**

As mentioned elsewhere in this document, several major issues seriously impede research productivity in the unit: (1) the mismatch between the instructional mission and the faculty count, (2) the downtick in federal funding and (3) space and infrastructure that fractures the unit and does not reflect the current and future research needs. Since each of these have been discussed elsewhere, we thought it best to highlight steps we are making to overcome these impediments.

#### *Instruction/faculty mismatch.*

We have used a two-pronged approach to this thorny issue. First, we have worked and will continue to work to create a “sustainable curriculum” – one that fits the faculty size we have, that incorporates faculty from other units, and that most effectively utilizes faculty for the greatest instructional impact while maintaining research impact. Thus, we have worked with faculty in the School of Medicine in our instructional offerings for our introductory majors sequence (Bio 180,200,220): two of the three academic quarters of Biology 200 are taught by faculty from the SOM. This arrangement is by a formal Memorandum of Understanding between the SOM and the College of Arts and Sciences and followed from the departure of the Genetics Department to the School of Medicine. It is an adequate solution, though plagued by rather weaker instructional performance from that part of campus.

We have also streamlined our overall introductory sequence offering by eliminating Biology 161/162 – a two-quarter offering that served dominantly majors in Psychology, Environmental Sciences, and Allied Health Sciences. We shared this course with one faculty member from the School of Aquatic and Fisheries Sciences and one from the College of Forest Resources. We have expanded the seats in Biology 180 (serving environmentally inclined students) and Biology 118 (human physiology) to accommodate this reduction. We eagerly await the contribution of those faculty in any or all of this sequence – though remain skeptical that they will do so.

We have also been working with our Divisional Dean, Werner Steutzle and our prior and current deans (Irving and Cauce) to recruit new faculty who will contribute to the teaching and research mission. We wish to make very clear that the recent administration has been both encouraging and supportive of our need to rebuild the faculty number to close to our historic levels. Thus recruitment will provide critical research partnerships while supporting the burgeoning instructional mission.

#### *Funding.*

We have, as mentioned elsewhere here, established several research funds that can bridge faculty at those critical times when extramural support may lapse or not have started. These bridge funds are largely derived from our indirect cost return, so cannot be very large.

We have also aggressively built a development program that is aimed at supporting students (graduate and undergraduate) who, in turn, can have significant impact on the research activity of the department. For example, we are in the final stages of securing and endowment totaling 2.5 M\$ that will support graduate student research, with a preference towards funded rotation quarters in diverse labs. This has a double advantage of buffering research support at tight times while promoting interdisciplinary (and high risk) research. We have also earmark funds for an endowment that supports undergraduate research in faculty labs. Lastly, we have begun a campaign to create faculty endowments for term professorships with the same payoff as endowed graduate funds – these support research during tight times and encourage novel and high risk approaches.

#### *Space.*

The faculty members in the Department of Biology are divided among many buildings on campus: the Burke Museum, the Greenhouse Annex, Otolaryngology, Johnson Hall, the basement of the Physics/Astronomy Building, Hitchcock Hall, and Kincaid Hall. This physical division of the faculty imposes an inexorable stress upon the need to remain an integrated unit. Office functions are dispersed, it is difficult to coordinate resources for common research domains, faculty interactions are inhibited by this fractured space, and there is a stunning absence of common spaces, shared labs, and effective core facilities. This impedes the function of the department and the effectiveness of both the research and educational missions.

While our four faculty labs in Johnson Hall were recently remodeled, the remaining spaces are out of date and, in the case of Hitchcock Hall, armed with a completely dysfunctional HVAC system (research labs exceed 90 F in the summer!). The labs are more than 30 years old and were built for a kind of science that we rarely do anymore.

Thus when we hire new faculty, we face daunting and sometimes prohibitive remodeling costs.

The type of science we will be doing, the need to recruit top researchers to the University of Washington who need contemporary infrastructure, a need for more efficient use of space with shared labs, more effective instructional space, and the hope of fully integrating the unit all make a compelling case for a new building.

Thus began our efforts to (a) provide a temporary solution to the HVAC system of Hitchcock Hall and (b) make the case for a new "Building for Life and the Environment". We are pleased that the Provost and the Dean have agreed to cover the emergency costs associated with cooling Hitchcock Hall. With a 1.8 M\$ budget, we hope to have air conditioning working in HCH by the summer of 2009. This project followed from nearly six years of discussions and negotiations with prior deans.

The new building has recently become one of the main thrusts of the UW Capital Construction request. We began this discussion at the onset of the consolidation department, just at the time the first chair was appointed. The building represents a significant partnership with Vulcan NW, the State of Washington and many departments on campus. The idea began with a building that integrates research labs, teaching labs and spaces, greenhouses, the massive biological collections of the Burke Museum, and a consolidation of faculty. With a charette sponsored by Vulcan, the concept evolved into a building that is exceedingly green and "intelligent", heavily imbued with sensors that can inform the building on its use and interaction with its environment.

At this time, the University of Washington is proceeding with a formal feasibility study for the building and is placing it as one of the major items for the 2009-2011 capital projects request.

In sum, while challenges and impediments to research exist, we feel the administration and the department are proceeding along the right path.

#### **D. Relationships with other units**

The faculty in Biology have had longstanding and significant involvement in many other departments and interdisciplinary programs at the University of Washington as well as with those beyond the walls of the institution. This involvement is reflected in the list of faculty holding joint, adjunct and affiliate appointments. Formal joint appointments are held by Brenowitz (Psychology), Felsenstein (Genome Sciences), Olmstead (Burke Museum), Parrish (School of Aquatic & Fisheries Sciences), Perkel (Otolaryngology), Schindler (School of Aquatic & Fisheries Sciences), Sidor (Burke Museum), Stromberg (Burke Museum), Wise (Physiology and Biophysics). In addition, there are 31 Adjunct (from other departments in the UW) and Affiliate (non-UW) faculty members from other departments (e.g. Psychology, Oceanography, UW Bothell, Physiology & Biophysics, Dentistry) and other institutions in the region (e.g. Fred Hutchinson Cancer Research Center, Institute of Systems Biology, The Nature Conservancy, NOAA, NMFS).

These joint, adjunct and affiliate appointments are more than mere titular. We expect continued involvement in our research and educational mission and evaluate these annually for reappointments. Some affiliate and all adjunct faculty may hold graduate advisory positions.

Just as Biology welcomes these appointments, so too do our faculty hold adjunct or interdisciplinary appointments in other units such as Genome Sciences, BioEngineering, and the Neurobiology and Behavior Program.

We also are involved in a number of formal interdepartmental programs, some of which are mentioned above. These include:

##### Interdepartmental Training and Degree Programs

- Interdepartmental Graduate Program in Neurobiology and Behavior
- Interdepartmental Undergraduate Neurobiology Major
- Interdepartmental Cell and Molecular Biology Ph.D. Program
- Interdepartmental Cell and Molecular Biology Training Grant
- Certificate Program in Conservation Biology
- Certificate Program in Computational Molecular Biology Program
- Training Grant in Developmental Biology
- Interdepartmental Astrobiology Ph.D. Program

##### Significant involvement in interdepartmental facilities

- The Burke Museum
- The Friday Harbor Laboratories
- Big Beef Creek Field Station

##### Scientific regional organizations with affiliate and advisory roles

- The Fred Hutchinson Cancer Research Center
- The Institute for Systems Biology
- The Allen Institute for Brain Science

We are also actively engaged in a number of relatively new collaborative efforts across the campus as a whole, quite separate from the myriad multi-investigator grants that typify any current Biology Department. Some of these include:

- A new collaborative Integrative Graduate Research and Education Program (IGERT) on “Biodynamics” with faculty in the College of Engineering (PI K. Morgansen, Engineering)
- A new NSF GK-12 proposal (PI K. Sebens, Biology) recently awarded to the UW integrates Biology with marine sciences on campus and at the Friday Harbor Laboratories
- The Center for Cell Dynamics (PI G. Odell), and NIH Center of Excellence, housed at the Friday Harbor Labs promotes the integration of computing and technology for solving fundamental cellular and developmental problems

As mentioned elsewhere in this document we also partner with many other individuals across many units on campus to provide undergraduate education:

- Biology 161/162 (now discontinued)
- Biology 200 includes faculty from the School of Medicine
- Biology 180 will be welcoming faculty from all units on campus
- Faculty in Biology are major contributors to the Undergraduate Neurobiology Major (Moody is the Director and teaches NBIO 301, Perkel teaches NBio 302).



## **E. Diversity**

Diversity is at the heart of biology. Our faculty and students study diverse creatures, use diverse approaches, and worry about maintaining biodiversity on the planet. Also, we go to great lengths to ensure that our departmental personnel at all levels (students, staff, faculty) fairly represent human diversity at every level. Still, there is ample room for improvement, and the efforts outlined below should help.

We believe that faculty and student diversity is vital for every aspect of our research, teaching, and outreach missions. Diverse faculty and students help us recruit the widest range of new faculty and talented graduate students and postdoctoral fellows, all of whom are central to the research enterprise. Our undergraduate teaching and research missions are enhanced by having a diverse faculty and graduate student population to serve as mentors and role models for students from every background. We believe that the public perception of the UW is strongly influenced by this diversity – public universities can play a leadership role in demonstrating that academic excellence is not bounded by gender or skin color.

At the time of our consolidation, the new Biology Department had about 50 regular and research faculty members of which 36% were women; of the approximately 100 full-time Ph.D. students 52% are women. In all three original programs, building diversity and changing culture were prominent themes. We continue to further refine these traditions in faculty recruitment and retention, graduate recruitment, undergraduate experiences and departmental climate. Each is described below.

### **E.1 Faculty Recruitment and Retention.**

Aggressive recruitment and retention plans enacted by the department were instrumental in attracting Horacio de la Iglesia, Veronica Di Stilio, Jennifer Nemhauser, Janneke Hille Ris Lambers, Caroline Stromberg, and Greg Wilson. In hiring these individuals, we deliberately sought to make appointments that would enrich both the cultural and academic environment in the department.

Another key factor in diversity is our department's strong involvement in the ADVANCE established by the prior Dean of Engineering (Denice Denton) and now under the supervision of the Dean of the College of Arts and Sciences (Ana Mari Cauce). We participate in their leadership training for our faculty, write grants to support cultural change (see below) and were involved in the search for its administrative director.

### **E.2 Graduate Program**

Our graduate program is a source of great pride in the department. Of our *ca.* 100 graduate students, 52% are female, 2% African American, 2% Native American, and 12% Hispanic. While this diversity does not reflect that in the society around the UW, it is much higher than that encountered in many Tier 1 Biology Programs. In many of the same ways that we develop diversity in hiring faculty, we do so in the graduate program.

Our admission process is, at this time, gender blind because of the near equal mix of males and females. However, like all Biology departments, we must be aggressive in recruiting highly qualified applicants that build diversity in the department. To do so we:

- were awarded a special ARCS recruitment for minority applicants;
- have received GO-MAP fellowships from the Graduate School;
- invested \$2000 in a recruitment brochure for building diversity in the biological sciences;
- have several departmental fellowships that have been, and continue to be, used to attract diverse students; and,
- devote departmental resources to fly in applicants of color for interviews.

A major part of our graduate program focuses upon building a culture of tolerance and vision for diversity. To support this we have been awarded a “Departmental Cultural Change Award” [from the ADVANCE Program] to create a seminar series and symposium entitled “Transformations in Biology: Uncommon Leaders”. The purpose of the seminars and symposium was to elevate awareness of the important contributions of women and minorities as leaders in biology. Our own graduate students will take the leadership role (see appendix) in identifying scientists who have transformed their disciplines through a combination of research excellence, outstanding leadership, and cultural change.

To help incoming grad students adjust to the substantial differences between grad school and their undergraduate experience, the Department Chair and Associate Chair for the Graduate Program have developed a new team-taught course entitled “Graduate Professional Life.” In this course we discuss issues of special interest to underrepresented groups, such as how to develop professional contact networks, find and cultivate a supportive student-mentor relationship, and strike a balance between personal and professional life.

### **E.3 Undergraduate Program**

Our undergraduate program is burgeoning and we graduate nearly 500 students each year. The size is both a source of great pride and a source of great anxiety. Part of the challenge is that students who come from backgrounds that did not benefit from the facilities of top primary schools can get lost in the shuffle. To offset this we have a variety of programs in place. There is room for improvement in each.

We offered EOP classes, BIOL 110, 111, 112 under the leadership of Dr. Millie Russell who was a half-time lecturer in Biology (she retired in 2006). These classes, open only to EOP students, introduced biomedical concepts and vocabulary, in an effort to provide enhanced background to students who want to go on in a health science but need additional preparation. In addition, professionals of color from the community are brought into the classroom to talk about career possibilities and pathways. Also, Dr. Russell, who was half-time in the Office of Minority affairs, was deeply involved both in a variety of UW diversity programs and in the African American community. She attends many community functions, professional meetings, and provides formal and informal contacts for students of color with other UW programs and personnel.

Biology 113 was an outgrowth of this program and was fostered by the department and the activity of *two graduate students* (Fernanda Oyarzun and Christopher Himes). The goal was to address the challenges faced by under-represented students in our largest courses – those associated with our major and the pre-medical requirements. Students who come from under-represented groups often have not had the advantage of learning skills and scientific backgrounds that many traditional students enjoy. Relying on both their direct experience in the classroom and on prior research, Chris and Fernanda suggested that we should put together a course that parallels our introductory series to offer such students study skills, classroom and laboratory skills and basic college survival skills. Further, they offered to teach this and put together a wonderful course that lies outside the domain of the classroom itself. Thus was born Biology 113: “Learning to Learn in Biology 180”

It began as a modest effort, with Chris and Fernanda serving as both TA/instructors in this course. They met with students regularly with a beautifully thought out series of topics ranging from understanding diverse learning styles to time management to studying for exams and much more. It was made all the more relevant to our students by how Chris and Fernanda relayed their direct experiences as students with uncommon backgrounds.

The program has been a success in two regards. First, students who took the course while enrolled in Biology 180 were generally successful. Second, the course has now become a fixture in our department and several graduate students have been recruited into it. It is well integrated with Biology 180 and is serving everyone (our department and our students) wonderfully. A consequence of this is that Chris Himes and Fernanda Oyarzun were awarded the 2008 University of Washington Excellence in Teaching Award.

In addition, the The Howard Hughes Medical Institute Grant encompasses several programs that aim to increase a student's passion for learning or teaching science, while concomitantly increasing and retaining the number of participating women and underrepresented minorities in science. Our programs are connected through direct interaction with one another and through outreach programs that aim to establish pre-freshman bridging groups. We support our students to remain in science by providing them with new opportunities for both learning biology and doing research. Our students are strongly encouraged to participate in the other Hughes programs for which they are eligible. We also attempt to provide as many opportunities for students to get involved in research by creating new programs for undergraduate research and by providing students with information about University of Washington and other national research programs that target undergraduates.

Our various Hughes Programs are as follows:

(1) Biology Fellows Program--We recruit 48 students (primarily freshmen, who come from a variety of backgrounds, are interested in a biological science major and show some need for extra help) to participate in this 3-quarter program. Students take a special seminar class (BIOL 106), taught by Dr. Clarissa Dirks, in which they discuss possible careers, what it's like to be in a lab, as well as work on gaining critical thinking, quantitative, and writing skills that will help them get through our rigorous introductory biology sequence. They are provided with one-on-one and small group tutorial help (BIOL 113) as they go through BIOL 180, 200, 220. Former Fellows and members of

TriBeta, our student group, provide guidance and mentoring to the younger students as Peer Mentors.

(2) Research Internship Program--We pay 20 selected students, about half of which are drawn from the Biology Fellows Program, with a faculty mentor and pay them a stipend to do independent research for up to 2 years.

(3) Leadership Program--A new program that provides a unique opportunity for 12 U.W. undergraduates (selected Biology Fellows, Peer Mentors, and Research Interns) to participate in research while discovering the Costa Rican tropical rainforests. A group of 12 students, 3 local high school biology teachers, and 3 scientists will spend 2 weeks in Costa Rica where they will conduct an original research project and a community outreach project. Participants will experience how science is done as a team while learning about the culture and ecosystems of Costa Rica and building community amongst students of differing level and sophistication. The majority of travel expenses are covered

Biology Tutor at the Instructional Center--The Hughes Grant, in conjunction with Mary Lidstrom's National Human Genome Research Institute and the Office of Minority Affairs Instructional Center (IC), provides salary for a professional biology tutor, housed in the IC, to help students who need help in biology classes. This tutor works closely with IC staff and biology faculty and staff to help especially students struggling with BIOL 180, 200 and 220.

Recruitment for the Biology Fellows Program is accomplished through several avenues, many of which allow us to reach as many women and underrepresented minority students as possible. The university admissions office helps us to identify incoming freshman who are interested in science and provides us with contact information for a direct mailing list. Prior to the start of their first quarter, we send postcards to all eligible students. The postcards describe the Biology Fellows Program and invite students to apply. We also conduct a freshman orientation workshop that informs students about the program and other Hughes opportunities. Our Biology Tutor at the IC has helped us to work closely with the Office of Minority Affairs to encourage these students to apply to our programs. Through all of these methods we have been able to achieve our goal of recruiting a diverse student population. During the first year of the Biology Fellows program, *72 % of the participating students were women and 56 % of all students were from underrepresented minority groups*. Retention of these students in science and medicine is achieved by maintaining contact with our Biology Fellows, supporting them in their subsequent scientific endeavors, and encouraging them to participate in other Hughes opportunities that we offer.

Recruitment of women and underrepresented minorities into the Undergraduate Research Internship Program and the Friday Harbor Laboratory Apprenticeship Program is primarily accomplished by informing as many students as possible about these opportunities for doing undergraduate research. Throughout the year, we advertise our research programs at campus events such as: career symposiums, scholarship fairs, undergraduate research seminars, educational conferences, and the annual Hughes symposium. We also inform students of our programs through the Instructional Center, newsletters, bulletin boards, handouts, websites, and student organizations such as the Tri Beta Biological Honors Society. Using a broad advertising approach to inform numerous students, as well as directly recruiting from the Biology Fellows Program,

helps us to recruit both women and underrepresented minorities into our research programs.

One of the most important aspects of the U.W. Hughes Undergraduate Programs in Science is to create a fundamental group association among all Hughes-based programs. To better create this sense of unity, we have developed the Biology Fellows Leadership Program, a program that allows undergraduates to work on a research project in Costa Rica. Upon completion of their research project, these students are placed in a leadership role for high school students and incoming Biology Fellows. Hughes Interns in the Leadership program serve as scientific mentors for the Biology Fellows. The overall goal of the field trip is to excite students about doing science and to allow them to learn how science is done as a team. The Mentorship program will allow students from our various Hughes programs to have quality interactions that will ultimately provide them with a sense of community. We feel that these scientific and personal interactions at an academic level will encourage students to get involved in other Hughes programs and help us to retain these students in the biological sciences.

TriBeta, our student-run organization, has developed a peer-tutoring program, again aimed primarily at students who want help with BIOL 180, 200 and 220. The department and the Hughes program join together to provide financial support for this community. Under the energetic and inspiring leadership of Marcel Tam, this program group is a source of great pride in the department.

Pipeline Project--We work with the Pipeline Project, providing a class and supplies for undergraduates who want to volunteer in the public schools. We also provide support for a team of biology students to work in the Alternate Spring Break Program, providing help and encouragement, and serving as role models, to kids in rural schools over Spring Break.

Summer Institute for Teachers, Quarterly Institute for Teachers--We provide hands-on evening and weekend workshops and a summer institute for middle school teachers, whose classes can be instrumental in inspiring kids to go into science careers. We also fund requests for supplies, small equipment, and field trips from public school teachers who need help instituting inquiry-based projects. We hope to have a high impact through teachers, showing students that science is fun, interesting, rewarding, and accessible to them.

UW-Community College Partnership--We have a 1-week summer and quarterly Saturday workshops for community college biology instructors. We hope to provide instructors with up-to-date information on new advances, better linkage to our classes for transfer students, and an opportunity to network and share ideas. The community colleges are often the stepping-stone between University of Washington and high school or return students.

#### **E.4 Climate and Culture in the Department.**

Leadership in the department needs as much diversity as any other segment. Here we have made efforts to have women take leadership roles through committee chairships,

associate chairships and related activities. The historic Zoology Department went further and prepared collective statement about our value for diversity that is part of our strategic plan:

“..the department has a long and valued tradition of respect for peoples of diverse views, ethnic groups, and backgrounds. That tradition evolved from a conviction that intellectual and personal growth is feasible only in a positive, communal, and diverse environment that understands and encourages human differences and that fosters the constructive expression of ideas. Traditions can be maintained and enriched, however, only by constant vigilance and effort. Accordingly, the Department states its commitment to these traditions and values. Specifically, we will pursue an increasingly and collegial community of peoples, of ideas, and of approaches to our science. To implement this statement, we commit ourselves to the following:

- Members of the Department, individually as well as collectively, will promote and foster diversity. We seek to maintain an environment that promotes freedom of inquiry, freedom of expression, and freedom of exchange.
- The Department sponsors periodic forums to address issues of diversity, thereby ensuring that we remain sensitive to them. Moreover, we will apprise incoming graduate students, faculty, and staff of these issues and traditions.
- Members of our Department are expected to conduct themselves in ways that do not discriminate against individuals or groups based on sex, race or ethnic background, age, sexual orientation, marital status, disability, nationality, religion, or economic circumstances.

We take immediate action should any member of the Department feel that she or he is the recipient of discrimination of any type. In the future, complaints will be forwarded immediately to the offices of the Chair of Zoology and the Dean of the College of Arts and Sciences. We also emphasize that all members of the Department should feel free to raise any issues of discrimination, including complaints, without fear of reprisal.”

As mentioned above, we are among the first departments to become involved with the ADVANCE program and have aggressively sought support for cultural change through grants to raise awareness of the potential for leadership and diversity (Attachment 7).

We have a long way to go to promote greater diversity in the leadership of our department and in building a more diverse faculty in general. In the sciences, this requires changes in the way we conduct searches and in how we encourage involvement in the governance of the department. Much of what is outlined above is aimed at moving us in that direction.

## F. Degree Programs

The Department of Biology offers BA and BS degrees in Biology and a Ph.D. degree that was very recently approved by the Higher Educational Coordinating Board (HECB) of the State of Washington. We also offer a Masters of Science degree that can either be a thesis or course based masters. Because graduate admissions are made for the Ph.D. degree, the MS degree is not the focus of our department and is structured to provide a stepping stone for those students for whom the Ph.D. may not have been the optimal fit. The formal proposal for the Ph.D. in Biology is in Attachment 8. The detailed curricular structure of the BA/BS degrees and their tracks are in Attachment 9.

### F.1 Doctoral programs

**Objectives and benefits.** The primary objective of our advanced degree programs in Biology is to provide interdisciplinary training in research and teaching in the basic biological sciences. Upon graduation, most of our recent doctoral students have gone on to take postdoctoral fellowships, followed by academic careers in research universities, four-year colleges, and government agency, non-governmental organization, or industry.

Washington State benefits directly from our advanced degree program in biology. Three of Washington's largest industries -- agriculture, forestry, and fisheries -- are dependent upon developing an increasingly sophisticated understanding of basic biology. The tremendous growth in "knowledge sector" businesses, exemplified by the biotechnology industry, requires leaders and workers who are at the forefront of biological research. The entire health care system, from consumers to physicians, benefits from basic biological knowledge. Global environmental issues, from climate change to invasive species, present ongoing challenges to humanity that need to be addressed by voters and policymakers informed with the best available science. In all of these areas the UW Department of Biology graduate program provides leadership, cutting-edge research, teaching, and public outreach.

**Standards of success.** Graduate students are expected to acquire a broad background in biology, and be able to integrate ideas from different disciplines within biology when formulating a research plan. They will learn to identify important unsolved problems in biology, explore and synthesize the relevant scientific literature, and to design, execute, and analyze experiments to address these problems.

Students learn to communicate their research findings to other scientists through publication in the peer-reviewed literature, and through oral presentations at professional scientific meetings.

Our graduate students participate with faculty in teaching undergraduate students in introductory, mid-level, and upper-division courses.

### **Career guidance for graduate students.**

Most graduate students have a clear idea of their career options when they enter our program. All first-year students meet weekly for the BIOL 500A course "Graduate Professional Life," organized by the Graduate Program Coordinator, in which career paths are discussed at length.

Those students interested in research-oriented careers will network at professional meetings with faculty from R1 universities. Those grads interested in smaller, 4-year colleges have the opportunity to serve as the instructor of record in Biology undergraduate classes taught in summer, providing invaluable teaching experience. Students whose career path sends them into the public agencies or non-governmental organizations are networked with our former grads who have taken such positions.

### **Assessment of the job market for doctoral degree holders in Biology.**

In addition to the existing local agriculture, forestry, fisheries, biotechnology, and health care industries, the Life Sciences Discovery Fund grants approved by the State Legislature in 2005, and the Gates Foundation initiatives in public health, hinge on the training of professional scientists. Basic Biology lies at the intersection of all these enterprises. Essentially all of our doctoral degree graduates find a position in their chosen career, usually after a postdoctoral research experience.

## **F.2 Bachelor's degree programs**

**Objectives and benefits.** Our department identifies four primary areas of expertise that we expect of our students: (1) scientific reasoning, (2) information literacy/technology fluency, (3) communication, and (4) social responsibility. We see these are core to success in society and science. Moreover, these four domains of proficiency are integrated into the 7 tracks in our major (the requirements for each are in Attachment 9):

Degree Track	Number of Majors in Winter 2008
BA General Biology	8
BS General Biology	374
BS Ecology and Evolutionary Biology*	44
BS Environmental and Conservation Biology*	47
BS Molecular, Cellular and Developmental Biology	336
BS Physiology	213
BS Plant Biology	18
Neurobiology**	106

TOTAL = 1047

\*Will be consolidated into a single track in future years.

\*\* Director and Advising located in Biology

As with our Ph.D. program, Washington State benefits directly from our BA/BS degree programs in biology. Three of Washington's largest industries -- agriculture, forestry, and fisheries -- depend upon an increasingly sophisticated understanding of basic biology. The tremendous growth in "knowledge sector" businesses, exemplified by the biotechnology industry, requires leaders and workers who are at the forefront of biological research.



Additionally we provide the pipeline education for all students planning careers in the health sciences and allied health sciences. Indeed, the largest growth sector of all jobs in the US is associated with the allied health fields (nursing as well as physical and occupational therapy). We estimate approximately half of all Biology majors are aimed at careers in these domains. Moreover, many of the majors such as those in Microbiology, Chemistry and Biochemistry are aimed at the health sciences and depend upon our curriculum.

Another serious role for education in the basic biological sciences derives from the very pressing social and ethical issues facing all of us today and often require a deep understanding biological processes: from the issues of teaching evolution in our schools, to stem cell research, to genetic engineering of biological systems, to bio-fuels, climate impacts, there is increasing public awareness of, and need to understand, the basic underpinnings of life sciences.

#### **Standards of success and assessment.**

Several measures are used to assess and monitor the success of our program. Among these metrics are the student evaluations that were described elsewhere and are appended to this document. We also hope to improve access and graduation rates. We monitor these and note that the rate at which we are awarding bachelor degrees is indeed increasing over the recent years, despite a loss of faculty.

Access to our courses remains an challenging issue and we are continually working our curriculum to improve access given (a) the finite number of faculty we have and (b) the increased interest in Biology among the incoming undergraduate population.

We are also developing and employing assessment tools and have received funds to coordinate this effort. Existing models for assessing skill sets tend to be labor-intensive, for instance faculty review of individual students' capstone experiences, or faculty-mediated exit interviews. These sorts of approaches are not feasible in Biology given the large number of students in our major. We therefore developed an alternative form of assessment to measure student progress towards Biology's learning goals. It involves rating course materials (syllabus, assignments, exams, and laboratory exercises) as to which learning goals they address and their level of academic challenge.

This assessment will initially focuses on the introductory biology series for majors. A graduate student RA is responsible for collecting materials and compiling data; several additional graduate students were hired hourly to carry out the rating. Interpretation of data (how well do courses align with goals?) and modification of this assessment method were the responsibility of faculty leaders in teaching. The curriculum committee oversees this portion of the project. At the end of the year, we will offer a workshop on the assessment tool – effectiveness of the workshop would be seen by measuring changes to course materials in subsequent years.

#### **Career guidance for undergraduate students.**

Our Biology majors find an extremely diverse array of career choices available to them. These vary in scope from numerous Health Sciences and Allied Health professions to a wide spectrum of field and ecologically related careers in various federal, state, and local

government agencies. Depending on the option choice within the B.S. degree in Biology, our students are accepted into some of the best professional schools (Medicine, Dentistry, Veterinary Science, Naturopathic and Osteopathic Medicine for example) and graduate schools in the country. This degree, with its various options, is an excellent preparation for the teaching field. It is often combined with an elementary or secondary teaching certificate leading to rewarding careers as a K-12 teacher. It is an outstanding foundation for pursuing a Master's degree or Ph.D. in preparation for an academic career in many fields of Biology. Biology majors have obtained entry level technical positions doing bench science in local biotech or consulting companies. This degree is a great preparation for such paramedical careers as Physical Therapy, Laboratory Medicine, and Physician Assistant. Still others have established careers in pharmaceutical, instrument, and other sales fields.

**Alumni Networking Night/Career Discovery Week** Every year in late January, takes place on the Seattle UW campus. Career Discovery Week is the answer to, "What do I want to be when I grow up?" Come explore career options and hear panel discussions by professionals working in fields of interest to you. Get the inside scoop on what their jobs are like, how to get into their field, and other trade secrets! Meet successful alumni in fields you're interested in pursuing. Career Discovery Week is a way to get insight into the many options you will have when you join the working world, however, it is not a career fair. There is something for everyone no matter what your class standing. Every year fascinating new speakers come talk on the career topics that interest you most.

**Career Connections** is a worldwide network of more than 4700 alumni and friends, available to current students and UWAA members. These contacts have volunteered to answer career-related questions and serve as networking resources. Typically, Career Connections users interact with each contact once or twice, usually via email or phone. Currently, there are 104 contacts whose UW department was Biology, Zoology or Botany. Career Connections is already available to all students 24/7, with a search engine that will allow them to zero in on the contacts who were Biology majors at the UW and/or are currently working in biology-related fields.

### **Assessment of the job market for doctoral degree holders in Biology.**

In addition to the existing local agriculture, forestry, fisheries, biotechnology, and health care industries, the Life Sciences Discovery Fund grants approved by the State Legislature in 2005, and the Gates Foundation initiatives in public health, hinge on the training of professional scientists. Basic Biology lies at the intersection of all these enterprises. The job market component of our program has also been formally integrated into a relatively new, multi-quarter, internship course (Biology 390) that coordinates student interests with the private biotech and government sectors. This course connects students to real-world job experiences that require education in biological sciences.

## G. Graduate Students

The Department of Biology views graduate education as one of our central missions, and certainly one of our most rewarding activities. Graduate students enrich and enliven the intellectual environment, create bridges among faculty research programs in different subdisciplines, foster a culture of inclusiveness and openness, and help convey the excitement of scientific discovery to the undergraduate students in our laboratories and classrooms. Two of the three major departmental social events of the year are focused on our graduate students – a “New Grad Welcome BBQ” in the autumn and a “Grad Awards and Recognition BBQ” at the end of the academic year. In many ways, our department revolves around our graduate students, in no small measure because the high quality of our graduate students is one key to recruiting and retaining top faculty.

Our department devotes very substantial financial resources to our graduate program, sponsoring >\$12K/yr worth of grad travel to scientific meetings (with additional ~\$8K/yr support from the Graduate School), funding independent grad research projects with >\$60K/yr in endowed fellowships and grants, supplementing TA salaries to match RA compensation (total cost ~\$100K/yr), bringing top grad recruiting prospects to UW for interviews (~\$20K/yr), awarding departmental fellowships as recruiting incentives (~\$144K/yr), and supporting grad-organized events such as the annual Graduate Student Symposium.

### G.1. Recruitment and retention.

In graduate recruiting we compete not only with the other top-tier Research 1 public universities (*e.g.*, UC Berkeley, UC Davis, UCSF, Arizona, North Carolina, U Wisconsin), but also with private universities having strong basic biology grad programs (*e.g.*, Duke, U Chicago, Stanford, Yale, Harvard). What makes our grad program competitive with these (and other) premier institutions?

1. Our department is truly integrative across all biological scales from the molecule to the ecosystem. Visiting grad recruits immediately grasp the interconnected, collaborative environment that characterizes our department (and the whole UW, for that matter).
2. Graduate students are admitted to, and supported by, the whole department. Students are not committed to any one faculty lab or disciplinary area at the outset, as is the case in many programs elsewhere. Students feel free to pursue their research across disciplinary boundaries, seeking advice and expertise from anyone and everyone as the dissertation project is defined and developed. The program of study is individually tailored to each student's needs and interests. Graduate students are treated as junior colleagues, rather than as pupils.
3. Our current graduate students are very accomplished scholars and entrepreneurial grant writers, with more than two-thirds holding a fellowship during their grad career, including the largest number (and proportion) of NSF Doctoral Fellowships of any department on campus. When grad applicants interview here, they are strongly attracted to our community of young scientists, producing a very desirable positive feedback loop.
4. Our graduate student body is extraordinarily welcoming for new students from all backgrounds and nationalities. More than half of our current grads are women,

- approximately 9% are from other groups of Americans historically underrepresented in the sciences, and more than 10% are international students (with at least one of our students born in, or being a citizen of, a country on every continent except Antarctica).
5. Seattle is a wonderful city in which to live, especially for the many graduate students with interests in outdoor recreation and the cultural amenities found in urban centers.
  6. Students have communal offices and are not sequestered in their advisor's laboratory. This promotes diversity of exposure to biological disciplines.

Of the approximately 200 applications to our grad program we receive each year, 40-50 applicants are interviewed and 20-30 offers of admission are made. Each offer comes with five years of support (stipend and tuition waiver) guaranteed by the department. In any one quarter roughly one-third of the students are supported with their own fellowships, another third are supported as RAs on faculty research grants, and the final third are fulfilling their obligations as TAs for our large undergraduate program (>1000 majors).

Top grad applicants are identified by groups of faculty representing various subdisciplines within the department (*e.g.*, cell/molecular biology/developmental biology, ecology/evolution/conservation biology, physiology/morphology/neurobiology, paleobiology). Many faculty belong to more than one of these "interest groups," which is appropriate since many of the best applicants will also span these traditional disciplinary boundaries. The department's Graduate Program Committee (with representatives from all of the subdisciplines) prepares a list of admissible applicants (which is put to a vote of the whole faculty), decides which applicants to bring in for interviews, and makes recommendations for admission considering faculty feedback from the interviews. Of the offers of admission made by the department, approximately two-thirds are accepted (range: 50-75% over the past 5 years).

Retention rates in our program are high. More than 95% of our entering graduate class finishes with a Ph.D. A few students elect to leave with a M.S. degree. Most of our graduates go on to academic positions at research universities, with most of the remainder taking faculty positions in four-year colleges, and with a smaller number working in industry, government, or non-governmental organizations.

## **G.2. Advising, mentoring, and professional development.**

All incoming graduate students register for the "Graduate Professional Life" course, with the Grad Program Coordinator and Department Chair as instructors. The class meets once a week for an hour and a half, covering topics from "How to navigate through grad school" to "Professional ethics" to "Balancing personal and professional life." Guest speakers drawn from the faculty, postdocs, and grad students in the department lead discussions on various subjects of mutual interest. In addition to smoothing the transition to grad school, the Grad Professional Life course gives students across the disciplinary spectrum a chance to form a cohesive group that organizes journal clubs, social events, and the annual Grad Student Symposium.

The typical graduate student supervisory committee consists of four faculty members, including the committee chair (the student's advisor), two other Biology faculty, and a

Graduate School Representative (a faculty member outside the Biology Department). Many of our graduate students have a formal co-advising arrangement, usually with co-advisors from different subdisciplines.

Biology encourages adjunct and affiliate faculty to supervise Biology grad students. This further broadens the options available to students.

As part of their professional development, nearly all of our grad students spend considerable time in labs other than their advisor's. Some students rotate through faculty labs in their first year; others spend a quarter or two in the middle of their grad career in another lab to learn a particular experimental technique or analysis method. The department also funds student travel to a collaborator's lab elsewhere in the country (or abroad). We recognize the value to students of experiencing other labs and other approaches to research.

Students meet at least annually with their supervisory committee, whose members are responsible for guiding the student's progress towards the degree. The whole faculty conduct an annual review of grad student progress, to be sure that all students are on track.

### **G.3. Graduate student inclusion in departmental governance.**

All departmental committees, except the Executive and Promotion/Tenure Committees, have graduate student representatives. Graduate students meet with every faculty candidate being recruited (which itself is a powerful recruiting tool for us, given the quality of grads), invite several seminar speakers supported by special endowments for this purpose, and participate in faculty meetings.

Many departmental initiatives have been spearheaded by grad students, including a recently-developed undergrad course designed to help underrepresented students succeed in our very challenging Intro Biology course series. For developing this course, two of our grad students (Fernanda Oyarzun and Chris Himes) won the campus-wide Excellence in Teaching Award.

G.4. Graduate student service appointments. All UW grad students serving as RAs and TAs are represented by the United Auto Workers. The union contract was written and accepted by all parties, and has not changed the fundamentally collaborative nature of the relationship between faculty and grad students. Determination of academic progress is entirely up to the student's supervisory committee and Graduate Program Committee, while evaluations of professional performance in the RA or TA positions are provided by the supervisor. This has proven a very workable arrangement, and no grievance has been filed against our department since the contract was adopted.