Department of Biology

Self Study for
Academic Program Review

February, 2008

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THE UNIVERSITY of NEW MEXICO

DEPARTMENT OF BIOLOGY
DEPARTMENTAL REVIEW 2008

EXECUTIVE SUMMARY

Department Overview: The Department of Biology at the University of New Mexico is one of the biggest academic units in the state, with several components of our operation exceeding in size entire UNM colleges. It has remained remarkably successful despite decades of limited resources. The department is comprised of 35.5 tenure track faculty (plus two full-time administrators with biology appointments and a faculty member on long-term leave), 8.5 faculty lecturers, more than 1,300 majors, more than 100 graduate students, and 89 staff and research support positions. Our non-majors courses are heavily subscribed and serve as key entry points for the allied health sciences. Investment in these non-majors courses has increased substantially in the last decade. The Biology major has never been more popular, yet, despite this excruciating demand, many of our majors seek and obtain personalized research experiences in faculty labs. Collectively, our research activities generate more than $13 million per year, and the department is home to some of UNM's most prestigious academic programs and faculty. Our faculty are productive, publishing more than 100 papers per year, including a high fraction of the state's output in prestigious journals such as *Science* and *Nature* (from 2000–2004, 36% of all publications in *Science* and *Nature* from the state of New Mexico came from our department). Unlike many universities of comparable size, on our Main Campus, there are no ancillary, biology-oriented departments other than ours. Whereas in times past it was easier to dichotomize our department into the general realms of ecology/evolution and cell/molecular biology, it is more difficult to do so today. Ecology/evolution embraces diverse programs in ecosystems ecology, plant population biology, behavioral ecology, metabolic ecology and collections-based studies in the Museum of Southwestern Biology. Lying in intermediate positions are integrative programs in parasitology and comparative immunology that cut across traditional disciplines, and at the cell/molecular end of the spectrum are programs in genomics, fungal biology and *Drosophila* development that also are not without interest in evolutionary processes. We have deliberately fostered the concept of a single, large, interactive department covering the spectrum of modern biology, one that blurs traditional boundaries and favors collaborative and multidisciplinary approaches.

Concerns: Several factors conspire to limit our potential. Some of these concerns continue from previous reviews, but others are new. *Continuing Concerns*—Foremost among these is an aging physical plant that limits our growth and recruiting potential and that increasingly is inadequate for modern teaching and research. Efforts are well underway to rectify the most immediate of these problems in the form of recently completely renovated teaching space and a research addition for which construction will begin in March, 2008. But, more effort will be required once the first two phases of the proposed addition are complete. Faculty salaries are also a continuing

and a general concern, in particular avoiding accumulating compression issues. Continued recruitment of top-notch faculty, including provision of competitive space and start-up offers remains a concern. The recent research budget crisis at UNM highlights the point that there are precious few reserves, as in foundation funds, to fall back on: UNM is a soft-money-driven institution and it is imperative that Biology continue to receive its fair share of such incomes. Another continuing concern is how to deal with the ever-increasing demand for undergraduate biology education. On the one hand, we are encouraged in any numbers-driven resource allocation process to continue to accept students, but, of course, this comes at the peril of the quality of education. *New Concerns*—We have in recent years been hampered by a higher administration that has lacked stability, leading to policy reversals that are hard to track, and that, unlike some of our neighboring states, has not provided a cohesive vision and plan (and higher level fund-raising) for the biological sciences. Faculty turnover has been high since the last review, leading to unpredictable needs for replacement faculty and increased costs for start-up and renovation funds. Seizing special hiring opportunities has allowed us to maintain faculty numbers, but has hampered long-term planning for new faculty. In preparation for the review process, we will provide a current vision of our plans for faculty growth by the time the review team arrives. We continue to seek additional faculty lines, but we are already at a size where issues of some type of departmental fission are frequently considered. Another new concern is the decline in graduate applications. Along with the university and with other departments nationwide, we are experiencing an unprecedented decline in applications to our graduate program. These concerns are condensed into a series of five questions we pose below to assist our research team in focusing their review.

Questions for the Review Team

1. **Should the Biology Department encourage additional growth, and if so, how much, and will this imply that it is time for the department to split into one or more units, to assume some kind of division status, or to retain the status quo?**

   Given particularly that a modicum of growth will be allowed when the Biology addition is completed, should we increase faculty size? If a fission were to occur, the specter of two or more, lesser departments competing with one another for funds is not an appealing one, but if we retain the status quo, the department is already of a size and complexity not easily managed, a trend that would be exacerbated by expansion.

2. **How do we ensure maintenance of quality of departmental programs?**

   Much of the strength in our ecology/evolution programs is embodied in our three distinguished professors, all of whom are approaching retirement. How do we replace these faculty and encourage the productivity and competitiveness of our junior faculty. A sub-question is how to fit the needs of large, funded programs into our department? Whereas it would be counterproductive to deny the innovation and resources such programs bring, they also can leave a large footprint that creates extra pressures.

3. **Do we continue to accrue majors, and the impact and societal favor that goes along with them, or do we choose to circumscribe our growth and push for higher standards with an emphasis on higher quality and more personalized instruction?**

   This is an issue that has long bedeviled UNM: continue to have an open-door policy that favors access for all of New Mexico's citizens, or to raise standards and in the process increase retention and improve quality education?

4. **To what extent should the Biology Department reach out to the many programs on campus that regularly seek some kind of collaborative program with Biology, and when is it a good deal for Biology?**

   On a regular basis, programs from engineering or the medical school seek to establish collaborative programs with Biology that could offer the possibility of joint hires or development of new programs and courses. Reaching out to any and all of these programs would further increase campus visibility and our impact, but the risk is a dissipation of critical mass. Clearly, our faculty has split opinions about this.

5. **Given your perspective as outsiders, what are the obvious things we need to do to improve our program that we are altogether missing, or not doing well enough?**

   Here in New Mexico, it is relatively easy to acquire a provincial point of view. Within the spirit that we want to offer something distinctive and special from what everyone else does, what are we missing and what do we need to do differently or better?

GENERAL CHARACTERISTICS OF THE UNIT

Institutional Context

The University of New Mexico is the state's flagship research university. With more than 25,000 students on the Main Campus alone, it is also the state's largest university. The university has 12 colleges and schools, including a School of Medicine and a School of Law. It also has four branch campuses. With 40 doctoral programs, UNM is classified as a Carnegie Research University with Very High Research Activity. Unlike any other university in that category, UNM is an institution with High Hispanic Enrollment and 34.5% of Main Campus students are Hispanic. UNM is defined as a Hispanic Serving Institution by the Hispanic Association of Colleges and Universities. UNM is an urban university with a large number of non-traditional students. The average age of UNM students is 27 years.

Brief History

The study of biology is fundamental to any university, and biology has been a part of the curriculum at the University of New Mexico since the late 19th century. Early programs focused on organismal level biology of plants and animals. However, courses in ecology were taught from early in the 20th century when this discipline was just beginning to become important in the United States. As the focus on organismal biology waned, the department built, starting the late

1970s, an internationally recognized program in ecology and evolution. Programs in cell and molecular biology were added more slowly, mostly due to lack of funds and space. However, we have excellent individual programs that are gaining recognition in some areas of integrative and cell/molecular biology at present. Recent additions of programs and faculty have continued to build in these areas.

The biology department grew slowly during the university's first half century, having only two or three faculty until the late 1940s, and less than 10 faculty until the early 1960s. Enrollment grew rapidly starting in the late 1950s, but growth in faculty numbers did not occur until the late 1960s. By 1977, there were 27 biology faculty members, and by 1984 there were 30. Numbers of tenure-track faculty reached the mid-30s by 1990 and, despite more than doubling the number of biology majors since that time, tenure-track faculty numbers have never increased significantly since that time. However, the number of lecturers has increased from two in 2000 to more than eight full-time equivalents, with their function largely to accommodate the substantial increase in non-majors students and entry level majors courses.

Mission

The department has a threefold mission: (1) to train undergraduate and graduate students, (2) to conduct high-quality, nationally and internationally recognized research, and (3) to serve the community, the University and our disciplines. This aligns perfectly with the university's mission of education, scholarship and service.

Goals

The department's goals are to:

1) Maintain its nationally and internationally recognized programs in ecology and evolutionary biology.
2) Continue to build national and international prominence in integrative fields such as comparative immunology, and in areas of cell and molecular biology.
3) Have the flexibility in space and resources to allow modest expansion of the faculty to facilitate coalescence and strengthening of particular research groups representing areas of departmental strength and visibility. Part of our strategy is to enhance areas that are distinctive from, and not mere repetitions of, research emphases in other regional universities.
4) Partner with the Museum of Southwestern Biology by working with our faculty who are museum curators so it can attain a higher level of international recognition for its programs in systematics, phylogenetics and conservation biology.
5) Develop high-quality research programs among its faculty, an endeavor that currently is limited by suitable space.
6) Work closely with the UNM administration to ensure that equitable distributions of overhead funds generated by our activities continue to flow back to the department. Without such funds, our ability to offer competitive start-up packages, to provide transitional funding, and to favor new innovations would be severely impacted.
7) Attract top-notch graduate students and to work with the UNM administration to provide them competitive stipends, health benefits, and more options for research assistantships.

8) Continue to work to improve the overall quality of our undergraduate curriculum, particularly at the upper level, by providing more meaningful lab experiences featuring more state-of-the-art equipment and techniques.
9) Involve a substantial number of undergraduates in research in faculty labs or working on faculty-directed projects.
10) Continue to increase faculty diversity.
11) Increase the number of minority students who choose careers in science.
12) Provide an undergraduate education that emphasizes the processes and skills of science in addition to providing content knowledge. To accompany this, we also encourage UNM to increase admissions standards as a way to increase the university's national ranking.
13) Provide effective advising that allows students to progress through the curriculum smoothly, and to enhance our overall retention and graduation rates.
14) Improve its faculty salaries to be competitive with its peers.
15) Improve both the amount and quality of teaching and research space to meet the needs of our growing student population and our many well-funded research programs.
16) Develop partnerships with the community that increase science literacy and improve K-12 education.
17) Devise ways to interface effectively with the many components of UNM (engineering, pharmacy, medicine, to name some) that want to partner with the Biology Department to develop academic or research programs. This must be done in a way to favor innovation without risking loss of focus or identity of the department.
18) Continue to work to improve career development and future prospects for our lecturers, research faculty and post-doctoral associates.
19) Acquire more staff to assist in important activities like outcome assessment, and to do all we can to encourage staff career development and high staff morale.
20) At least from the perspective of the present chair, to continue to function as one large, strong, highly interactive department without barriers, rather than to split into multiple, smaller independent units that would soon be competing for university resources and lose overall cohesion.

Our goals align nicely with goals of the 2001 UNM Strategic Plan, including those of: providing high-quality education for undergraduates, raising the effectiveness and stature of our graduate programs, supporting research, providing NM citizens with access to a quality higher education, improving K-12 education, providing access to our expertise, increasing diversity of faculty staff and students, creating structures and processes to effectively support and provide resources to distinguished programs, improving UNM's competitiveness in obtaining grants and contracts, and aligning physical resources with priorities.

Overview of Faculty, Staff and Students

Faculty

Category	**Number**
Tenure-track faculty:	
Professors	21 (plus two full-time administrators
Associate Professors	5 (plus one on long-term leave)

Assistant Professors	9.5
Non-tenure-track faculty:	
Lecturers	8.5
Research Faculty	
Research Professors	16
Research Associate Professors	10
Research Assistant Professors	11
Post-doctoral Associates	~12

Tenure-track Faculty: Currently, the Biology Department has 35.5 tenure-track faculty with one other faculty member on leave and two additional faculty members who have full-time administrative positions that allow no teaching or service within the department. (See Appendix A for a list of faculty and their brief CVs.)

Over the last 12 years, there has been more turnover in faculty than at any time in the department's history. Of the 32 faculty present for our last program review, only 16 remain on the active faculty. Twelve faculty retired, one left academia, and another became a full-time administrator. Turnover has been even greater than these numbers indicate as another four faculty members were hired and left the university during this interval. Thus, more than half of the faculty present for this review were not part of the last program review.

Of the 35.5 tenure-track faculty currently occupied with departmental activities, 21 are professors, five are associate professors and 9.5 are assistant professors. Although it is increasingly difficult to categorize the faculty along conventional lines, approximately 21 of the faculty are in the general realm of ecology and evolution if physiological ecologists and molecular evolutionary biologists are included, while another nine are in the cell/molecular realm, including immunologists and microbiologists, and another six are museum curators.

Non-tenure-track Faculty: In addition to the tenure-track faculty, the department now includes 8.5 full-time lecturers. These faculty handle the entire non-majors curriculum, part of our undergraduate majors core and occasional upper-division courses. Most of these lecturers also have significant participation in the research and/or service missions of the department. This represents a substantial change since our last review. It also creates an obligation for the department to provide better long-term career tracks for Lecturers. Towards this end, our department is leading the way for the College of Arts and Sciences to implement new promotion and hiring policies for our Lecturers.

Research Faculty: Another constituency in our department that deserves mention is faculty on a research track, of which we have approximately 30. These faculty are usually funded on research grants, often their own. Not only do these individuals play an instrumental role in bringing research expertise, international visibility and dollars to our program, they also serve as a considerable reservoir of specialized expertise, including both for mentoring students and potentially for teaching classes. These faculty brought in 36% of the departments grant dollars in Fiscal Year 2006–2007.

Postdoctoral Associates: In a similar category to our Research Faculty are our ~12 Postdoctoral Associates who play both major roles in enhancing our research visibility and productivity, but who also are part of the essential "glue" that holds departments together. They frequently interact with one another, crossing disciplinary boundaries in the process, and thus dramatically invigorate and enrich our intellectual climate.

Staff

Currently, the department has 89 staff members, 26 of whom are paid in full or in part by state I & G funds (Appendix B). The remainder are paid through grants, overhead funds and foundation funds. These staff include core departmental staff that run the Main Office, keep track of department finances, advise students, and manage our buildings. State-funded staff lines have always been a limiting resource for the department.

Students

Graduate students: Currently, the department has 103 graduate students, 85 Ph.D. students and 18 Master's students. The graduate students can be roughly divided into 81 working in ecology, evolution and organismal biology and 22 working in cell and molecular biology.

Undergraduate Students: The department has a very large number of undergraduate majors, currently more than 1,300. These numbers have nearly doubled since our last program review. We also are training at least 300 minors, and we have a large non-majors program that supports core requirements in natural science, the nursing and pharmacy programs, and pre-medical students who are not biology majors.

We offer two undergraduate degrees, a B.S. and a B.A. In both, it is possible to earn a formal concentration in Conservation Biology.

Leadership, Governance and Organizational Structure

The department is led by a chair and two associate chairs. Typically, one of the associate chairs handles primarily graduate issues and the other primarily undergraduate issues. Oversight of our construction projects also has become an important duty of the associate chairs. Faculty meet regularly and a number of faculty committees handle departmental responsibilities (see Appendix C).

Major Research and/or Creative Endeavors

All of the faculty engage in individual research programs in their areas of expertise. In any given year, the majority hold externally funded grants. In addition, the department hosts large research endeavors, including the Sevilleta Long Term Ecological Research (LTER) Program, the LTER Network Office and the Center for Evolutionary and Theoretical Immunology.

Public Service

In addition to individual efforts in public service, frequent tours are provided, the museums answer innumerable questions about identification of organisms, the LTER program hosts teachers and K-12 student programs, we involved graduate students in K-12 outreach through an NSF-funded G K-12 program, and minority high school students are invited to our annual Research Day. In addition, the department hosts the Bosque Ecological Monitoring Program, which involves K-12 students in ecological research in the Rio Grande Bosque.

Other Major Initiatives

The department has been involved in a virtually continuous program of renovation and expansion of space since the last program review. In 1995, we were granted permission to renovate space in the old bookstore building in order to create new space for the Museum of Southwestern Biology and the LTER program. After years of planning and construction delay, that project was completed in 2004–05. This fall we are just completing a spectacular renovation of basement space freed up by the move of the museum collections. This space is entirely for the use of our teaching programs. We are just beginning to occupy 20,000 sq. ft. of completely renovated teaching space. Construction will begin in Feburary/March 2008 on the first phase of what is currently envinsioned as a 35,000 sq. ft. addition to Castetter Hall. The addition will include a new research greenhouse and faculty research labs.

Previous Program Review

Based on our history of program reviews, the faculty view this process with considerable skepticism. A review in the early 1970s resulted in a recommendation to seek excellence in one area of biology. In 1974, the then Dean of the College of Arts and Sciences made a decision to build an excellent program in Ecology and Evolution, because of resource constraints (at that time ecologists needed smaller setup packages), our location that made field work attractive, and the availability of qualified faculty. That decision has affected the composition of the faculty until the present.

Subsequent reviews, however, although initially viewed optimistically by the faculty, resulted only in change that could be accomplished internally by the department. Change that required resources from the university did not occur.

In 1985, outside reviewers recommended some internal changes in curriculum and availability of computers. The department heeded these recommendations. However, the outside reviewers also recommended doubling the faculty size, increasing salaries, decreasing graduate student teaching loads, and increasing TA stipends. These were areas that required commitment from the university and nothing was done about them in the following decade. (See details in Appendix D.)

In 1995, a new team of reviewers recommended both internal improvements and changes requiring university support. For the department, they recommended revising the graduate curriculum, reducing TA workloads and split teaching assistantships, and more strategic planning. They recommended that the university provided improved salary support. They were particularly concerned about a group of mid-career faculty that engaged in significant admini-

strative work to improve their salaries. They were also concerned about the amount of space available for teaching and research, lack of university support for facilities, and poor support for teaching assistants.

The department acted on the recommendations that could be handed internally. We experimented with changes in the graduate curriculum and reduced TA workloads in our new core curriculum. In addition, TA stipends are somewhat better (now $16,600/year for Ph.D. students) and health insurance is now included in their compensation. However, attempts to plan have all been foiled by unexpected losses of faculty.

Additional support from the university has been difficult to obtain. Although numbers of undergraduate majors now exceed 1,300, the number of tenure-track faculty has not increased significantly.

Our space situation has improved considerably. After more than a decade, new space for the museums and LTER staff was completed. At present, we have just finished a renovation of former museum space in the basement that substantially improves teaching space, and construction of a new research addition will begin in March, 2008. The addition will provide at least eight new faculty research labs, office and conference space, a new research greenhouse, and eventually, new quarters for the biologists currently occupying the antiquated Annex. The addition will enable us to make the argument for immediate recruitment of new faculty. Much of the funding for the new addition is in place, but more state support is needed and is actively being sought. Construction of the addition will create back-fill opportunities in our existing building. It is challenging to find funds for renovation at UNM, but we will seek them aggressively. Until that addition is complete, we have very little space for new faculty. Maintenance of existing space also remains a struggle. Faculty have lost books, journals and equipment to leaking water pipes that were repaired only after substantial damage had already occurred.

Average salaries are somewhat higher due to an increasing number of faculty seeking outside job offers and due to leveraging grant funds to accommodate raises. Faculty with special raises have been exempted from the state-funded raise pool in that year, so it has been possible to give somewhat larger raises to the remaining faculty. However, the state-funded raises are rather small, so, while the mean salary increases, the potential for inequities also has increased. The concern about mid-career faculty engaging in administrative activities to improve salaries is still valid. The same faculty who were of concern before are still doing administrative work to improve their salaries. The recommended presidential initiative to provide a substantial investment in biology never occurred.

It is important to note that the entire upper administration has changed since we started preparing our self study. Initially, we were told to expect no input of resources based on the review process. However, the current administration promises to make more use of the review process. We hope that is the case. Turnover in UNM's administration is an impediment to our progress, so we are hoping for stability and a progressive and responsive new administration.

DEGREE PROGRAMS AND CURRICULA

Undergraduate Degrees

Overview: The Biology Department offers two undergraduate degree programs, the B.S. and the B.A. (See Appendix E for the complete degree requirements). In addition to these programs, we offer a minor in Biology and a substantial non-majors program that serves both the university core curriculum requirements and a variety of health sciences programs.

The primary mission of the undergraduate curriculum in biology is to provide an education that teaches the fundamental information of biology while providing students with the skills needed to appreciate the complexity and beauty of living systems, as well as to understand the methods and evidence upon which science is based. It is recognized that many students enter this curriculum with specific career goals, and therefore the special missions of the department include:

(1) Preparation of biology majors for successful entry into graduate education programs in biology and related disciplines.
(2) Preparation of students for successful application to medical school, veterinary school, and dental school.
(3) Preparation of students for employment in positions in industry or governmental agencies (biotechnology, conservation policy), as laboratory research technicians and field biology workers and, in part, as teachers in secondary schools.

The B.S. is a traditional degree and the one sought by most of our majors. A number of years ago, a group of faculty thought that we were missing a chance to serve a population of students who had more interdisciplinary interests. These students, it was argued, would be well served by a less intense biology degree so that they would have time to pursue substantial work in another discipline. Therefore, the B.A. program was created. This degree requires four hours less biology, less math and less rigorous training in physics. While many faculty still believe that the B.A. program serves the original purpose, those who do undergraduate advising have another opinion. Students who are unable to complete the more rigorous parts of the B.S. degree, often at the last minute, opt for the B.A. Alternatively, some students seeking preparation for graduate programs in Physical or Occupational Therapy find the B.A. a useful option. Advisors virtually never see students use the B.A. to pursue an interdisciplinary program. Given the enormous number of biology majors, the department should reconsider the wisdom of offering the less rigorous degree.

Curriculum and Assessment: In the mid-1990s, the department developed an assessment instrument to test the learning objectives of the four-course core curriculum required of all majors and minors. That curriculum consisted of a two-semester introduction to biology (Biol. 121 and 122), cell biology (Biol. 219) and genetics (Biol. 221). The assessment instrument was a multiple-choice test using questions submitted by the faculty who taught in the core series of courses. The test was given after the completion of Genetics. Students were required to take the test, but there was no performance incentive. Generally, faculty were dissatisfied with the scores on the tests. For example, in Spring 2000, the test was administered to 257 students. The mean score was 57% correct. In some areas, students performed even more poorly. For example, if

plants were mentioned in a question, students scored very low, even if no particular knowledge of plants was required to answer the question. The results of this test caused the department to re-evaluate its introductory sequence of courses.

At the same time we used the assessment test, we did some program evaluation. We discovered that students who took chemistry earlier in their degree program were more likely to pass Cell Biology, and that students who took the optional problems sessions in Cell Biology and Genetics performed better in those courses. We also noted the substantial resources invested in labs for Biol. 121 and 122 for students who often failed these courses or did not become Biology majors. Furthermore, we determined that students who were not our majors (either non-science majors or health sciences majors) often took Biol. 121 and 122 rather than the courses that were designed specifically for them, Biol. 110 and 123, respectively.

As a direct result of our outcomes assessment and program assessment, the department proposed a new four-course introductory sequence (for a complete rationale and description, see Appendix F, the department's proposal to the university for a new curriculum). The new sequence of courses—Cell Biology, Genetics, Ecology and Evolution, and Plant and Animal Form and Function (Biol. 201–204)—covers the breadth of biology. The first two courses include lectures and discussion/problem sessions. The discussion/problem sessions focus on homework directly related to the lectures and a few demonstrations/labs. Biol. 203 and 204 have full labs. The Biol. 204 lab, in particular, focuses on using inquiry so that students develop skills in making hypotheses, designing experiments, and using the primary literature. Thus, the goals of this new core curriculum include broad content knowledge and skills in the practice of science. Students who take this curriculum are required to take two semesters of general chemistry before or concurrently with Biology 201 and 202. Students are required to start their calculus sequence before or during Biology 203.

As part of the implementation of the core, we held many conversations with University College advisors and advisors and faculty in the health sciences. Our intention was to direct students to the appropriate introductory biology course.

The new undergraduate core was fully implemented in 2005–2006. Once the work of implementing the core was completed, we began to think about assessment. Because our original estimates of enrollment proved incorrect (Biol. 201 and 202 had much higher enrollments than expected, while Biol. 203 and 204 had somewhat lower enrollments than expected), our first task was a program assessment to discover who was taking our courses. A T.A. was assigned to develop and implement a survey of students in Biol. 201 and 202 during the 2006–2007 academic year. The T.A. consulted with relevant faculty and staff to create the online survey that was administered in Spring 2007. The complete survey and report are provided in Appendix G.

The survey of Biol. 201 students (42% response, no incentive from instructor) revealed a number of useful points. Thirty-point-one percent (30.1%) intended to take only Biol. 201 and 202; thirty-seven-point-two percent (37.2%) were not Biology majors. This was interesting as the series was designed primarily for our majors. Also, 92% of the students reported that they attended all or nearly all of the lectures. Instructors would not make the same estimate.

A higher proportion of students responded to the survey of Biol. 202 (86.8%), probably because the instructor offered homework credit for responding. Thirty-four-point-four percent (34.4%) intended to take only Biol. 201 and 202, and 43.5 % were not Biology majors. These were surprising numbers. Of the non-biology majors, some were in related fields such as

chemistry and biochemistry. A substantial percentage, 37%, were in health sciences, especially pharmacy. In prior years, pre-pharmacy students were advised to take Biol. 123, but the Pharmacy program now requires their students to take Biol. 201 and 202. This has a significant impact on enrollment in those courses.

As expected, many of the students in Biol. 202 plan to attend medical school (32%) or pursue another health-related profession (33%). At the end of Biol. 202, only 9.5% plan to attend graduate programs in biology.

As a result of this program assessment, we have continued to work to add seats in Biol. 201 and 202. We also know that the unexpected students are coming from outside our program and, in some cases, from outside our college. Thus, when programs in the health sciences increase in size, it is important that funding be included for support courses in the biology department. Programs like Pharmacy and Nursing, that place severe demands on our resources, have not been forthcoming with financial assistance.

The numbers of students planning to take Biol. 203 in Fall 2007 provided a reasonable estimate of the numbers who actually enrolled. Thus, this survey was helpful in planning the number of lab sections needed. By Fall 2007, the numbers of students enrolling in Biol. 203 and 204 had reached our predicted enrollment.

Because the survey of Biol. 201 and 202 was funded as a one-time T.A. assignment, it was finished at the end of a semester when there were no further faculty meetings held. Since no one was funded the following semester to work on this, no further discussion on the study has occurred. This points to the need for more staff help in advisement and assessment, so that we can revise and continue the program assessment.

We are still considering how to assess learning outcomes for our majors core sequence. Our first idea was to use the Major Field Achievement test as it is nationally normed. However, it costs about $25 per student. Using this test provides two challenges. First, we would have to find funds to purchase the test: testing the 200 or so majors that graduate each year would cost at least $5,000. We requested funds from the College of Arts and Sciences and were turned down. An alternative would be to use a course fee. The second challenge would be getting students to make an honest effort on the test. We can imagine this happening only if the test was part of an existing or new course. Thus, we would need to test all majors, not a random sample. If we add a new, capstone course, where the assessment test would be required, we would have to find faculty to teach it.

We next considered developing a local assessment instrument and using that in conjunction with a continuation of our program assessment survey. Our new core intends both to provide wide content knowledge and to develop skills in hypothesis testing, experimental design and scientific writing. We could assess content by developing our own test of content. We could test skills in scientific writing by doing an item analysis of the grading rubric for papers in the Biology 204 labs (Appendix H). The grading rubric was developed by faculty and TA's associated with Biol 204. It is already being used to grade papers for the skills we intend to teach. Taking a sample of these grading sheets for analysis would be an excellent assessment project. We asked for PTI funds to collect and score these data. However, we were once again turned down. Given the constraints of our budget (see section 4) and our high student to faculty ratio, we cannot simply add an assessment program to the department. It will require additional resources.

Upper-Division Curriculum

All of our majors take one organismal biology course and at least two 400-level courses as part of their major. Four-hundred-level courses are arranged in four categories and students must take a course from two different categories. Because of a concern that some courses are interdisciplinary and that many students take the minimum number of upper-division courses, the faculty voted last spring to change the requirements somewhat. Five categories of 400-level courses will be provided and students will take courses from three of these categories. These changes still have to be worked through college and university curriculum committees.

Overall, many faculty feel that the upper-division curriculum needs an evaluation. Although new courses have to be approved, most new faculty add one or two new courses such that we have a very diverse array of offerings that can be offered only infrequently. There has been no evaluation in more than two decades of how the upper-division curriculum fits together and how many courses are really needed. Having recently overhauled our lower-division offerings, this is the next curricular item that needs serious attention. One particular concern is that more of our students may benefit from upper division lab and field courses.

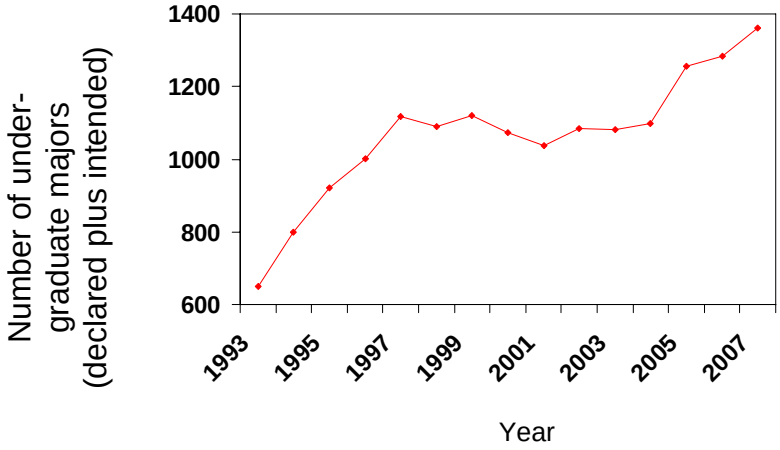
Assessment of the upper-division curriculum also is difficult as the courses are so diverse. A program-wide assessment does not make sense until we have revised the upper-division curriculum and have programmatic goals. However, using classroom assessment techniques in these courses can provide valuable feedback to individual instructors. In fact, some instructors already use these methods to get student feedback on the most difficult aspects of the courses.

Data on the Undergraduate Program

The number of undergraduate majors in biology has more than doubled since 1993 (Fig. 1). There were dramatic increases from 1993 to 1997, followed by a plateau until 2004. Over the last three years, substantial increases in number of majors have resumed. These large numbers of students drive many aspects of our undergraduate program as neither faculty numbers nor materials and supplies budgets have kept pace with these increases. We have dealt with the need for instructional funds by adding course fees to all of our courses (See section 4). By 2001, the Biology Department included more than 20% of the majors in the College of Arts and Sciences. This fraction has not declined, but the department does not garner 20% of the College's

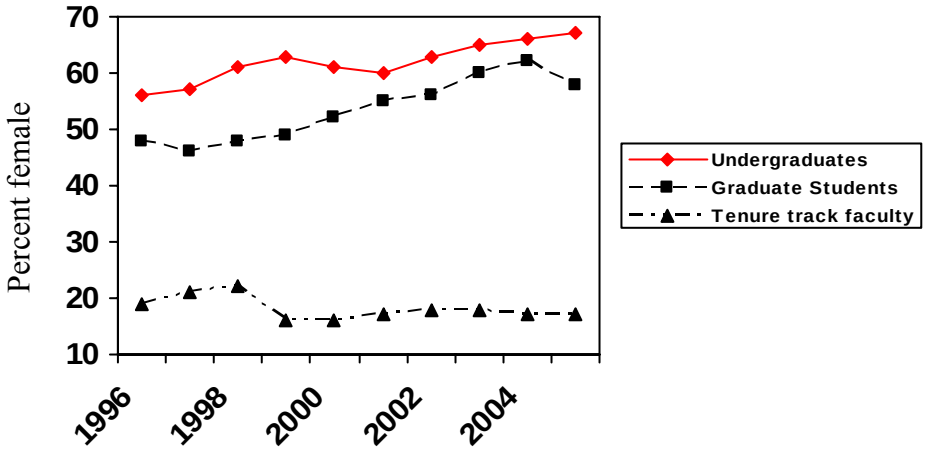
resources.

Figure 1. Number of undergraduate majors from 1993-2007. Includes declared majors in the College of Arts and Sciences and students who are not yet able to declare a major, but intend to declare a biology major.



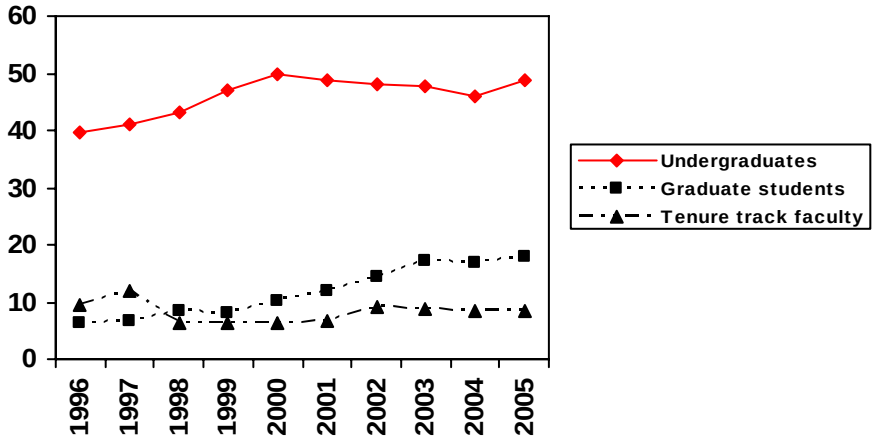
The percent of undergraduates who are female has increased rather steadily and by 2006, ⅔ of the undergraduate majors were female (Fig. 2).

Figure 2. The percentage of undergraduate biology majors, graduate students and faculty who are female.



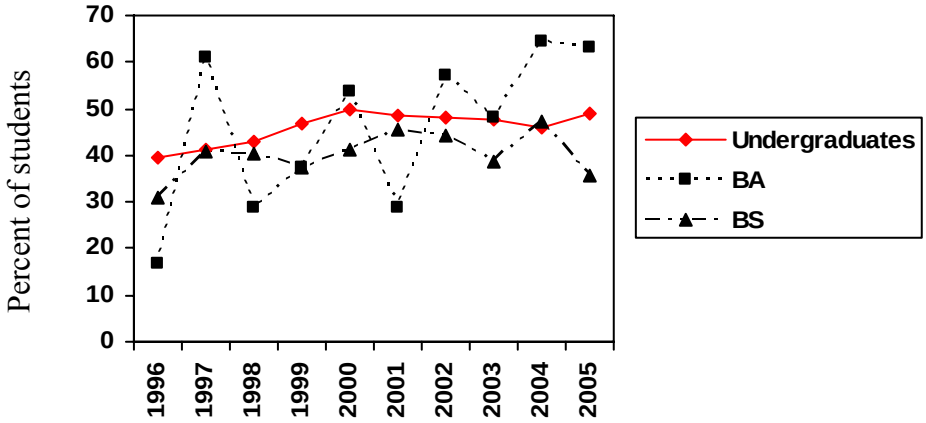
The percentage of minorities among undergraduate majors has also increased over time and by 2006, 48.9% of undergraduates were from minority groups (Fig.3).

Figure 3. Percentage of minorities among undergraduates, graduate students and faculty in the Biology Department from 1996 to 2006.



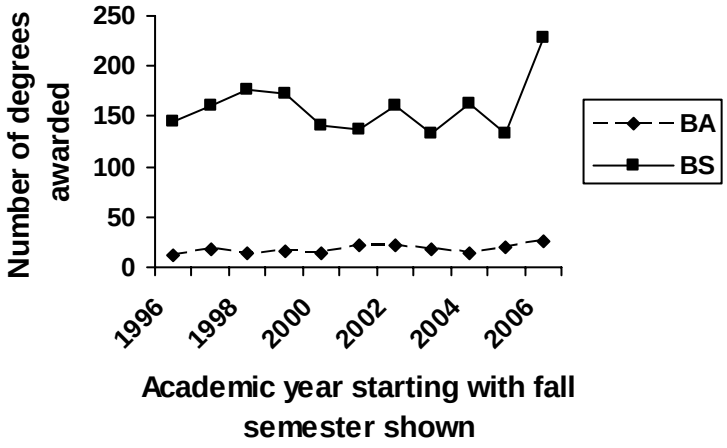
Interestingly, the percentage of minority students often is higher among those seeking the B.A. than those seeking the B.S. (Fig. 4). This is important because the B.A. degree is not meant to lead to graduate school and provides a less intense exposure to biology.

Figure 4. Percentage of minorities among all students, among those seeking the B.S. and among those seeking the B.A.



The Number of Degrees Awarded: The number of B.A. degrees awarded has always been very small, usually less than 20 per year. The number B.S. degrees awarded annually is much higher, ranging from 132 to 229 in recent years (Fig. 5)

Figure 5. The number of undergraduate B.A. and B.S. degrees awarded in each academic year.



Curiously, although the number of Biology Majors continues to increase, the number of degrees awarded has only begun to show the same pattern. This concerns us and we are searching for explanations, of which there are several possibilities. First, this may be a temporary problem, because some students were confused by the change to a different undergraduate core curriculum (they waited for the old curriculum to reappear). Second, there is a lag time between entering the university intending to be a biology major, declaring a major, and graduating. So, the number of degrees awarded should increase more slowly than the number of intended and declared majors. Third, we think that some of the students categorized as biology majors do not intend to graduate as biology majors and this is likely to be the most important factor. That is, some students awaiting admission to nursing or pharmacy school declare a biology major, take our courses, and use our resources (faculty time and space), but do not graduate as biology

majors. Other students who originally intended to go into nursing or pharmacy school become biology majors late in their undergraduate careers, only to discover that most of the courses they have taken do not apply to a biology major, and so take extra years to graduate.

We have no way of telling how many of our majors really intend to be biology majors and how many are waiting for other programs to open up. This is, in part, an institutional problem determined by the requirement that all students declare a major after a certain number of hours. We do know, however, that all of these students use our classes, our space, our faculty time, and, especially, our advisors' time.

Besides these institutional problems that can only be addressed at the college or university level, we are considering whether there are problems within the department that slow the time to graduation. Maggie Werner-Washburne has asked the university to provide data so that she can evaluate how students progress through our core curriculum. Recent lecturers in Biol. 201 report a 15–20% failure rate, which is far less than in the first course in our previous curriculum.

Support for Undergraduate Students

Financial: Most financial support for undergraduates is administered through the University of New Mexico Financial Aid and Scholarships Offices. The department has no input into the function of these departments and no control over these awards. Thus, we will not discuss data about these types of awards.

The department offers a small number of scholarships funded by donations to the Biology Department. The department has five scholarships available that may award from $500–$1,500 per year (details available on the Biology web site, http://biology.unm.edu). In recent years, we have had trouble attracting qualified applicants for the scholarships. These scholarships, if awarded, are figured into a student's existing financial aid award, and thus obtaining a scholarship results in the deduction of some other part of the award. Thus, the awards are only attractive to students who cannot obtain financial aid through the usual means.

Advisement: The Biology Department employs a full-time staff member whose duties include undergraduate advising and recruitment. She handles the bulk of the advising, but obviously one advisor is not enough for the more than 1,300 majors in biology. Additional advising is provided by faculty and staff who offer a few hours of advising time each week. This is supplemented by information on our web site and by handouts that explain the required coursework.

The full time advisor position became a regular, state funded position only in Summer 2006. Previously, it was funded by a variety of soft-money sources. The staff advisor has a number of duties in addition to working directly with students. She is involved in catalog revision, curriculum development/implementation through curriculum form tracking, registration issues, recruitment events, training of faculty advisors, scholarship and honors programs, publications and data acquisition. She is on three main committees: Scholarships, Undergraduate Policy Committee, and Advisement.

Because of the large number of majors to advise and the additional duties required, this single staff member is unable to get to know students or keep records on them. **A second part- or full-time staff advisor would help with that endeavor.**

Students are required to seek advice only twice: when they declare a major and when they do a degree check after 90 hours of work. The department's advisement workload has increased due to the complications of a new university database system. Advisors do additional work in evaluating transfer credit, in helping student obtain overrides in the new system, and in communicating to the administration about problems with the new system.

Undergraduate Research Opportunities: Undergraduates may participate in labs in a variety of ways, including volunteering, work-study jobs, regular student employment, independent study, and the Biology honors program. There are also special, funded programs (IMSD, MARC, NSF Site REU programs) described below.

Because of the number of ways that students can be involved in research, it is difficult to get a complete count. In a survey in the late 90s, 30% of graduating seniors said that they had been involved in research in some way. This semester, however, only 36 students are registered for independent study (Biol. 499). One problem for faculty is that independent study students do not count toward the regular teaching load.

The honors program is meant for students with a serious interest in research. Students conduct research over one–two years, write a thesis and present the work in some public format. A very small number of students participate in the honors program. From 2003–2007, a total of 33 students completed the honors program.

Graduate Degrees

Our graduate program is based on breadth and diversity rather than on specialization and concentration. We have tried consciously to maintain a faculty whose research interests span much of the breadth of modern biology. This enables us to recruit graduate students with diverse backgrounds, and to encourage them to pursue a wide variety of individualistic, interdisciplinary research and training programs.

Ph.D. Degree: The majority of our doctoral students still aspire to obtain jobs in academia that require some combination of teaching and research; these range from primarily teaching positions at community colleges and small private colleges, to research and teaching positions at major state and private universities, to curatorial positions at museums. Increasingly, however, our students are seeking and obtaining positions in industry (e.g., biomedical, environmental consulting, risk assessment, bioremediation, genetic engineering), government agencies (e.g., forensics, environmental health, and environmental management with Albuquerque Police Department, New Mexico Departments of Health and Environment, and U.S. Environmental Protection Agency, Bureau of Indian Affairs, Fish and Wildlife Service, Forest Service, and Bureau of Land Management), and non-government organizations (e.g., Nature Conservancy, World Wildlife Fund, Audubon Society).

Master's Degree: Most students in the Master's degree program aspire to obtain additional training to prepare themselves for further graduate study, either in professional areas, such as medicine, dentistry and law, or in the natural, social and engineering sciences. Some M.S. students seek employment in secondary education, with government agencies, and in the private sector.

Graduate Student Training: Students are required to complete a specified number of hours of coursework, depending on the degree. The details are listed in our graduate handbook (Appendix I). Required coursework includes both lecture courses and problems courses and must be completed with more than one faculty member. The department has experimented with various requirements for coursework across disciplines. At the time of the last review, students were required to take at least one course in three of nine categories. The review team recommended a different approach so that students would take some coursework across the major divisions in the department (Ecology and Evolution or Cell and Molecular Biology). At that time, three categories of courses were created and students were required to take coursework in at least two. That system failed. We were able to offer coursework in either of the two major areas, but we could seldom offer courses in the third, more interdisciplinary category. At present, there is no distribution requirement for graduate courses. Rather, students with interests in Ecology and Evolution are strongly encouraged to take our two graduate core courses in this area (Biol. 516, Basic Graduate Ecology, and Biol. 517, Basic Graduate Evolution). No similar core courses exist for students interested in Cell and Molecular Biology, but they take particular courses germane to their special interests in cell or molecular biology.

Courses available to graduate students fall into three categories: (1) courses that were originally developed at the 400-level (senior undergraduate), but are available for graduate credit if some extra work is done; (2) courses originally developed at the 500-level (graduate student only) that may or may not allow advanced undergraduates to enroll; and (3) special topics courses that usually focus on reading the literature; some of these also allow undergraduate enrollment.

While faculty in ecology and evolution have been able to routinely offer formal courses that were developed specifically for graduate students, faculty in cell and molecular biology rarely have been able to do so. This is because so many undergraduates wish to take upper-division courses in cell and molecular biology, and because fewer graduate students specialize in cell and molecular biology. This has been a continuing source of frustration to faculty in cell and molecular biology.

The ecology and evolution faculty proposed graduate core courses in ecology and evolution so that students in these areas would have a common intellectual framework to foster discussion and collaboration. Thus, Basic Graduate Ecology and Basic Graduate Evolution were created. However, the faculty are having difficulty sustaining these courses, as they have been taught mostly as an overload and not counted as part of regular faculty teaching loads. Because of the smaller number of graduate students in cell and molecular biology, there has been no opportunity to develop similar core courses for the graduate students in these areas.

Graduate Student Demographics: For a number of years, the total number of graduate students in the program has remained at slightly more than 100. Numbers of female graduate students have increased over time, and now the percentage of our students who are female hovers around 60% (Fig. 2). Likewise, the percentage of minority students has increased over time and we now have 17–18% minorities among our graduate students (Fig. 3).

Graduate Student Financial Support: The department has a policy of not admitting Ph.D. students unless financial support can be guaranteed. We guarantee five years of support that may be in the form of teaching assistantships (T.A.), research assistantships (R.A.) or fellowships. Occasionally, Ph.D. students are admitted who have guaranteed outside support from another

agency, such as a national laboratory. M.S. students may be admitted with or without guaranteed support. If support is guaranteed, it is for two years. Students without guaranteed support—usually because they have exceeded the time limit for completion of their dissertations or theses—may ask to be in the T.A. pool. These students may be offered T.A. support, on a semester-by-semester basis, if T.A. slots are available after all students on guaranteed support have been accommodated. In recent semesters, most students who wish to have T.A. support have been accommodated. In fact, we often hire a few T.A.s from outside the department.

The workload for T.A.s was a concern of the last graduate review. Typically, students taught each week three lab sections of 24 students each. Some T.A.s had lab sections split between two courses, requiring additional prep time. We have made some progress in reducing the T.A. workload in our new undergraduate core courses. T.A.s for Biol. 201 and 202 run three, 75-minute problems sessions a week (rather than three 3-hour lab sections). However, these T.A.s also are expected to attend lectures so that they can answer student questions. T.A.s for Biol. 203 and 204 teach two 3-hour lab sections a week and also are expected to attend lectures. We work each semester to limit the number of split T.A. assignments; only two students have split assignments this semester. Further reductions in the T.A. workload are limited by available funding.

The size of the T.A. stipend has increased over time (see data in Appendix M), making our financial support more competitive with other schools. At the time of our last review, no support for health insurance was available to T.A.s, which was a major concern for graduate students. Currently, the stipend for Ph.D. students is $16,660 for the academic year for 0.5 FTE. The T.A. contract also includes tuition, fees and the supplemental student health insurance.

Fellowship Support: Our limited ability to offer graduate research fellowships has been a continuing source of concern. This is particularly a problem because many students teach every semester, limiting their ability to conduct research and write manuscripts. The other important aspect of this problem is the need for summer support. While a few summer T.A. positions are always available, graduate students need time free from teaching to conduct their research. A dramatic improvement in summer support was achieved through the Grove Endowment. This gift to the university in 1998 allows the department to offer summer fellowships to several students per year, a one-semester dissertation fellowship each year, and research support to additional students each year. Several other endowments have been made so that each year we now have $40,000–$45,000 for a dissertation fellowship, several summer fellowships, and a number of research awards.

Applications: One area of concern for our graduate program has been a decline in the number of applications received (Fig. 6a). After peaking at nearly 160 applications per year, numbers have declined into the 60s and 70s. We don't fully understand the reason for this decline. UNM graduate programs in general have experienced a decline in applications (Fig. 6b), and other programs, such as the program in Ecology and Evolution at the University of Colorado, have seen a 50% decline in applications in recent years (Jeff Mittion, pers. comm.), so this may reflect a nationwide phenomenon. National data suggest that jobs for Ph.D.s in biology may be scarce, reducing the incentive to apply for graduate programs.

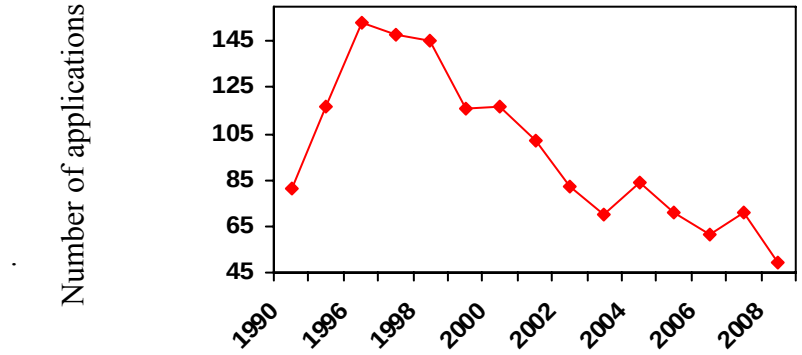


Figure 6a. Number of graduate applications to the Biology Department from 1990–2007.

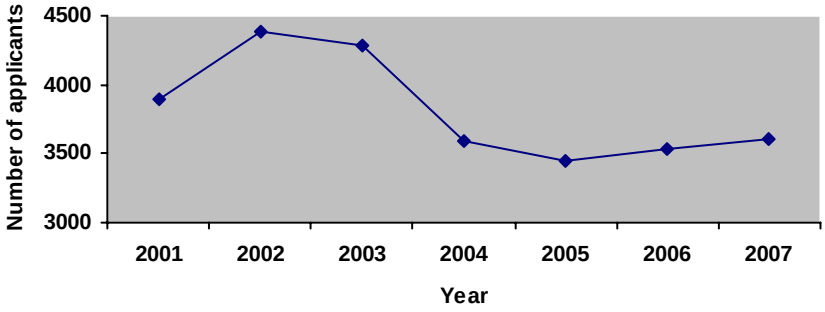


Figure 6b. Number of applicants to all UNM graduate programs from 2001–2007.

The faculty are very worried about the decline in graduate applications and discussed this problem extensively at a faculty meeting on February 19, 2008. Suggestions to reverse the trend include: (1) an earlier decision date to compete with the many schools that make earlier offers, (2) an interview program that brings in a number of prospective graduate students at one time, (3) higher stipends, (4) lower teaching loads, (5) a continuous admissions process, (6) a better web site, and (7) advertising research themes. The department intends to allocate funds to work on this process this year.

Graduate Student Outcomes: By and large, the faculty view an appropriate measure of graduate student outcomes as gathering information on the fates of our students. Because of the individual nature of graduate student programs, short-term measures of outcomes during the training process have not generated much enthusiasm among the faculty.

Just after the last program review, the university, as part of its preparation for an accreditation review, pushed to develop outcomes assessment plans. To comply with university goals, the department developed questionnaires to be filled out by faculty after comprehensive exams, dissertation defense seminars and reading of theses and dissertations. Although faculty filled out these forms for a few years, no compilations or analyses of the data were ever undertaken and the faculty did not have a plan to use this information.

Most faculty, however, do keep track of the employment information for their former students. Therefore, for this review, we compiled information on the current status of 108 graduate students who completed a Master's or Ph.D. program between 2002 and 2006. We were able to get information for 107 of the 108 students.

For the 67 students who completed the Ph.D. program between 2002 and 2006, the average time to complete the degree was six years (calculation of the mean, mode and median give the same result).

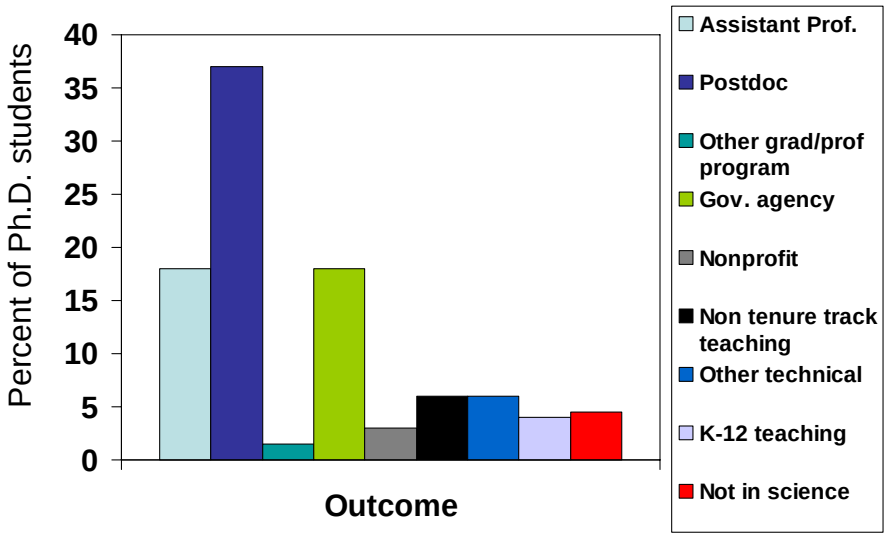


Figure 7. Current employment by category for graduate students who completed the Ph.D. program in biology between 2002 and 2006.

The most frequent outcomes for our recent Ph.D. positions are employment in post-doctoral positions (37%), assistant professorships (18%) or governmental agencies (18%) (Fig. 7). Some also are employed by non-governmental agencies or are in non-tenure track teaching positions. Thus, most of our students are finding exactly the kinds of positions we thought we were training them to occupy. Only three of the 67 are not involved in science in any way.

Typically, our master's students take three years to complete the degree (mean, mode and median are the same). Their fates are more diverse than those of the Ph.D. students (Fig. 8). For the 40 students we tracked, 25% are now in Ph.D. programs and another 20% are working as research technicians. Almost all are involved in science in some way.

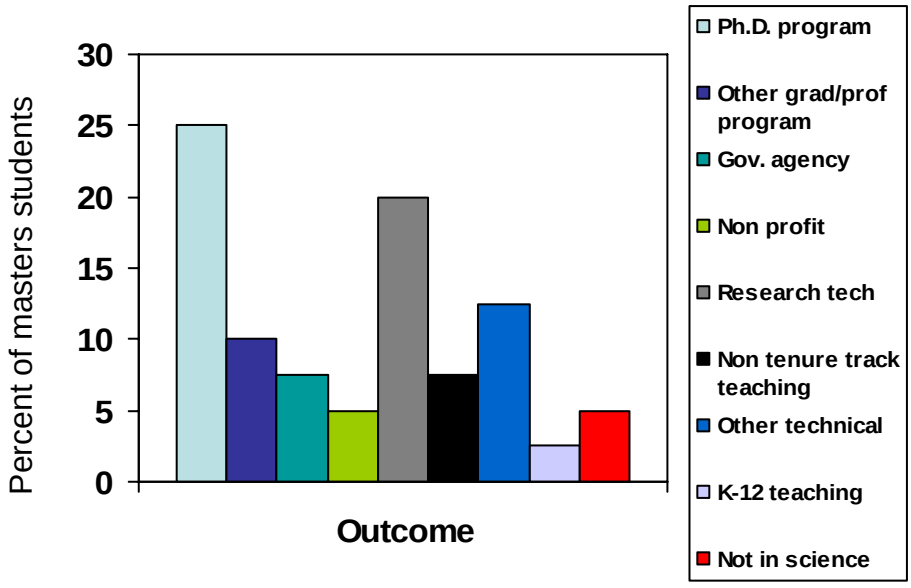


Figure 8. Current positions of master's students who completed their degrees in biology from 2002–2006.

Special Programs for Training Graduate and Undergraduate Students:

Since the last program review, the Biology Department has hosted a number of externally funded programs that aid in training graduate and undergraduate students.

1. *The Biocomplexity Program*, 2000–2000, NSF, $2,500,000, PI's, J.Brown, J.West, B. Milne.

(a) Project Summary: This was a training grant designed to expand programs initiated originally with NSF GRT (Graduate Research Traineeship) support. Our goal was to recruit outstanding graduate students and postdocs with diverse backgrounds and skills and to train them to use collaborative, interdisciplinary approaches to address interesting scientific questions of broad significance. Formal course requirements were minimal: participate in a weekly Biocomplexity Seminar and attend SFI Complex Systems Summer School. Most of the emphasis was on research. Fellowship support allowed freedom and creativity in the choice and design of projects. Collaboration and interaction were highly encouraged, and support was provided to work with investigators at other institutions and to present papers and posters at meetings and workshops. Additionally, students invited and hosted scientists from other institutions within the US and abroad to UNM to present and discuss their work. Students and postdocs were encouraged to develop their own collaborations, and to work in a highly interactive 'research team' mode. We have found this to be a successful way to get students doing broad-based interdisciplinary research, and in the process to train a new generation of scientists comfortable with working across disciplinary boundaries.

(b) Program impacts: The success of the training program can be judged by the accomplishments of the trainees. To date, the students and postdocs have given scores of oral and poster presentations at scientific meetings and published more than 150 papers. The journals include *Science*, *Nature*, *PNAS*, *Proceedings of the Royal Society*, and *BioScience* as well as more specialized ones, such as *American Naturalist*, *Ecology*, *Ecology Letters*, *Functional Ecology*, *Oikos*, *Oecologia*, *Evolutionary Ecology Research*, *Theoretical Population Biology*, *Ecological Archives*, and *Theoretical Physics Archive*. Recent trainees have obtained postdoctoral or faculty positions at major research universities (14, including Harvard, Brown, Princeton, MIT, Arizona (2), Florida, Wisconsin, New Mexico, UC Santa Barbara, UC San Diego, and Utah State (2)), the National Center for Ecological Analysis and Synthesis (5), small colleges (2), Scripps Institution of Oceanography, Monterey Bay Marine Institute, Hutchinson Cancer Institute, and Institute for the Study of Atmosphere and Ocean (U. Washington). Diversity was a major criterion in allocating support: to females (8) and minorities (1 Black, 1 Hispanic, 2 Asian).

(c) It is not a stretch to say that the Biocomplexity grant catalyzed the emergence of UNM as a center for research and training in interdisciplinary approaches to biological complexity. One sign is our ability to leverage funding of additional grants, including a Packard Interdisciplinary Science Grant, an interdisciplinary training grant from the Howard Hughes Medical Institute and the NIH NBIB, and multiple NSF and NIH research grants to senior personnel.

(d) Program Statistics: The program supported one undergraduate, 16 graduate students, and nine post-doctoral fellows

(e) Publications: More than 150 papers and book chapters, including more than 125 authored or co-authored by graduate students, postdocs, or NSF REU-supported undergraduates.

2. *Integrative Graduate Education and Research Traineeship (IGERT) Interdisciplinary Program In Freshwater Sciences*, 2002-2005, funded by NSF.

(a) Project Summary: This program was a collaboration with the University of Alabama designed to train students to address emerging problems in maintaining a supply of fresh water. Students were able to compare freshwater ecosystems across regions using both arid and humid environments. The program included interdisciplinary research, an interdisciplinary core curriculum, externships with state and federal agencies and exchange programs between universities.

(b) Program Impacts: Collaborations continue with the University of Alabama and among departments at the University of New Mexico. It offered interdisciplinary training for both students and postdocs. Coursework in freshwater ecosystems is still offered.

3. *Integrative Graduate Education and Research Traineeship (IGERT) Interdisciplinary Program in Imaging.*

(a) This IGERT program at the University of New Mexico (UNM) was in cross-disciplinary optics research and education (CORE). Five different departments (Physics, Biology, Chemistry, Electrical Engineering, and Chemical Engineering) with six different Ph.D. programs (programs of the former departments and PhD in Optical Science and Engineering) participated. In line with our initially proposed efforts we see two major educational accomplishments: “added value” to our graduate programs in general, and broadening formal optics education to departments and degree programs that use optics in interdisciplinary research.

(b) Added value to existing degree programs: One of the deficiencies of our graduate programs that we identified when submitting the IGERT proposal was inadequate training and education beyond the discipline specific expert knowledge. While this expert knowledge is absolutely necessary, graduates entering the workforce are challenged in many other areas in which they have not received formal training. The lack of leadership and mentoring skills, insufficient ability to talk in front of an interdisciplinary audience, poor technical writing skills, and the lack of an international perspective are reasons why many of our graduates are falling short of the expectations of our leading research, educational and industrial institutions. We addressed these problems by implementing a blend of interconnected formal and informal education and training components into our IGERT program, which turned out to be very successful overall. The following describes these interrelated activities and the observed outcomes.

All IGERT trainees took a technical writing class during the summer, which was taught by a professor from UNM’s English Department. The goal of this course was to expose students to the established rules of technical writing and speaking. Another concrete outcome of the technical writing class was a research proposal. Students had to identify a research problem, typically derived from their own thesis research, which an undergraduate student could perform.

Another program component addressed the development of an international perspective. This was not part of a formal international IGERT component, which did not exist when we applied in 2001. IGERT trainees were expected to participate in two to three internships during their (typically) three years in the program. For two-thirds of the students, one of these internships was a four-week course with practical exercises and research at the University for Applied Science in Jena, Germany.

(c) Program Statistics: One graduate student in the Biology Department was funded by this program.

4. *Initiatives to Maximize Student Diversity (IMSD*), Dr. Margaret Werner-Washburne, Project Director

(a) Project Summary: This program is funded at UNM through the National Institutes of Health (NIH) National Institute of General Medical Sciences. The long-term goal of the UNM–IMSD program is to increase the numbers of competitive, under-represented minority students entering careers in biomedical research by enhancing undergraduate research, facilitating the transition to graduate school for these students, and increasing the number of successful, minority Ph.D. students at UNM and elsewhere.

Currently, the program at UNM funds 18 undergraduates and five graduate students to pursue research in biomedical sciences in 19 departments at UNM in the Colleges of Arts & Sciences and Engineering and the Biomedical Sciences. IMSD has 60 qualified mentors with whom students can work. The program includes a one-credit conference class each semester that includes bioethics, lab practices, career and scientific development, and research presentations. Students attend SACNAS (the Society for the Advancement of Chicanos/Latinos and Native Americans in the Sciences) meetings their first year, another national meeting their second year, and present their research at UNM spring symposia, and an IMSD-sponsored summer symposium. IMSD provides individual help with assembling graduate applications and provides GRE workshops for IMSD and non-IMSD students. IMSD and Minority Access to Research Careers (MARC) work closely together in these activities. UNM–IMSD has been at UNM for 31 years, formerly known as MBRS. In that time, we have provided research opportunities to more than 800 students.

Dr. Margaret Werner-Washburne, who has been nationally recognized for both her research and mentoring, took over the program, which was faltering, in 2003. Funding from UNM allowed the program to continue for one year prior to renewal of the long-term grant. In the past three years since the renewal was funded, 48 undergraduates (87% minority) and 20 graduate students (all minorities) have participated in IMSD. Of the undergraduates who have completed the program (28), 19 have graduated, seven have gone to graduate school, and six will apply for graduate school in the next year. This is an astounding success rate of 68%. We also have been extremely successful with Ph.D. students. We fund the first two years of a Ph.D. program for incoming minority students and have been able to fund the last semester of the Ph.D. program for some students. In the past three years, IMSD has funded 20 graduate students. Of the 15 who have completed the program, six have graduated with Ph.D.s, four will graduate next year, and four have received pre-doctoral fellowships from NSF, NIH, and DOE. Although, because of lack of funding, we have not been able to affect the percentage of minority graduate students in these departments, we have increased the success of these students.

Over the past three years of this grant, we have identified specific challenges with respect to creative, scientific thinking and have developed courses that we believe can increase the preparation of all of our students for graduate school. The goals of this program are consistent with these needs: to continue to improve the IMSD graduate and undergraduate programs at UNM by significantly increasing the number of UNM undergraduates who enter Ph.D. programs and under-represented minority Ph.D. candidates at UNM. Toward these goals, we propose the following specific aims:

(1) To increase numbers of undergraduates who understand and are prepared for research careers. For IMSD-sponsored students, this will include: (a) participation of all IMSD-funded students in a one-credit conference course that involves preparation of a research proposal each year, a bioethics component, research presentations, and other career and scientific development activities; (b) participation in summer and academic-year research symposiums at UNM; and (c) participation in workshops dealing with graduate school applications and the Graduate Record Exam (GRE) as well as taking the GRE. To double applications to IMSD, we will develop workshops and materials for students, faculty, staff, and university advisors to educate them about career options and research opportunities in the sciences. To prepare a larger number of UNM undergraduates for graduate school, we will support the development of one-semester Discovery and Innovation courses in Chemical Engineering and broadening of this course in the Biology Department. The effectiveness of all of these activities will be determined by evaluation. Through these efforts, we will increase the number of students entering graduate school immediately upon graduation to 60%. (The current class of IMSD seniors will reach this goal.)

(2) To broaden the opportunities for minority students at UNM in areas of research funded by NIH. This will be done by increasing the research opportunities in areas such as Physics, Mathematics, Computer Sciences, etc., through (a) increasing the number of mentors in these areas and (b) increasing outreach to students in these areas. To increase awareness of opportunities outside UNM, we will establish exchanges with T32 and summer programs at the University of Washington that will be available to all UNM students. We will continue our Model Organism Database workshops and support the development of at least one cross-listed Discovery and Innovation courses, e.g., Computational Biology: Discovery and Innovation, to increase students' awareness of interdisciplinary research.

(3) To significantly increase the success of under-represented minority graduate students at UNM, IMSD will continue to support the success of minority graduate students by: (a) supporting and mentoring five new, current graduate students; (b) increasing the number of minority graduate students through education of admissions committees and cooperative recruiting and informational activities with the Office of Graduate Studies (OGS), the organization Peer Mentoring for Graduate Students of Color, Deans, and Department Chairs; (c) providing career seminars and workshops for current graduate students; and (d) decreasing the time to graduation for enrolled graduate students by providing support, as available, for students for whom one semester of support, including access to help from IMSD staff and faculty, will help them finish their dissertations and graduate. As a result of these efforts, 90% of the IMSD Ph.D. students will complete their terminal degree in biomedical fields.

5. *Program in Interdisciplinary Biological & Biomedical Science (PIBBS),* 2005–2008.

The newly created Program in Interdisciplinary Biological & Biomedical Science (PIBBS) is a collaboration between the departments of Biology, Computer Science, Physics, Math and Statistics at UNM, Los Alamos National Laboratory LANL), and the Santa Fe Institute(SFI). PIBBS is funded by the Howard Hughes Medical Institute (HHMI) and the National Institute of Biomedical Imaging and Bioengineering (NIBIB) at the National Institutes of Health (NIH). The close linkages with SFI and LANL allow us to offer educational and research opportunities not available in most traditional curricula. The impetus for this program is the increasing recognition that research on fundamental problems in biology and biomedical science will benefit from the input of new ideas, methodologies, and investigative strategies from the physical sciences, engineering, and mathematics. Yet, few scientists are trained or possess the necessary skills to conduct effective interdisciplinary work.

The primary goal of PIBBS is to develop new training opportunities for Ph.D. students that will provide them with the skills and knowledge needed to conduct leading edge interdisciplinary research. Building on successful initiatives ongoing at UNM over the past few years that highlight the importance of small intensively focused research teams, we will work towards: (a) developing a common baseline of mathematical, computational and biological knowledge and skills necessary for successful interdisciplinary collaborations, (b) exposing students to the disparate ways in which various scientific disciplines tackle and solve scientific problems; (c) exposing students to the language, culture, technology, literature and different perspectives/approaches used by various disciplines; and (d) learning the communication, scientific and social skills necessary to work effectively in small interdisciplinary research teams.

Currently, PIBBS is developing three additional courses for graduate training.

• CiT: Course in Teacher Training. The primary goal of this course is train graduate student teachers in developing and teaching interdisciplinary science courses. The course is supervised by a PIBBS faculty member. The course is developed and team taught by students who are supported by PIBBS. This first class, Human Ecology was developed and is being taught by Jordan Okie (Biology), a 2nd-year HHMI interface scholar at UNM, PIBBS; William Burnside (Biology); and Oscar Burgar (Anthropology). Both Bill and Oskar were supported by Dr. Brown's biocomplexity grant and have been pursuing academic research that is interdisciplinary in nature. The class has 17 students enrolled in it.

• Ethics 101. Being developed, possibly in collaboration with Professor Joe Cook.

• Survival 101. A "how to succeed in graduate school' course still being developed.

Opportunities for Students and Program Overview**:** Our initial funding will provide fellowship support for six Ph.D. students per year, beginning Fall Semester 2006. It is expected that these fellows will be admitted and enrolled as doctoral students in good standing in one of the participating departments (Biology, Computer Science, Mathematics and Statistics, Physics and Astronomy, or some other appropriate department). As members of the PIBBS, they will be expected to participate in all program activities. Specific requirements include:

- Students will enroll in a Fall Topics in Integrative Biological & Biomedical Science (TIBBS) Course and Spring PIBBS Seminar each year for their first two years; attendance is encouraged, but not mandatory after this time.

- Students will attend/participate in summer school/internships during their first two years in program. Specifically students will attend programs that offer skills, techniques or perspectives not represented at UNM or affiliated institutions.

Number of fellows supported to date: 9

HHMI Interfaces Scholars at the University of New Mexico, PIBBS:

2006–2007: six fellows; 2007–2008: 8 fellows.

Program Impacts: (1) Biology Department—This program offered collaboration with other researchers and organizations to look at how scaling relationships offer clues to underlying mechanisms that powerfully contain biodiversity. (2) Students—the primary goal of PIBBS is to develop new training opportunities for Ph.D. students that will provide them with the skills and knowledge needed to conduct leading edge interdisciplinary research. Building on successful initiatives ongoing at UNM over the past few years that highlight the importance of small, intensive focused research teams, we will work toward: (a) developing a common baseline of mathematical, computational and biological knowledge and skills necessary for successful interdisciplinary collaborations, (b) exposing students to the disparate ways in which various scientific disciplines tackle and solve scientific problems; (c) exposing students to the language, culture, technology, literature and different perspectives/approaches used by various disciplines; and (d) learning the communication, scientific and social skills necessary to work effectively in small interdisciplinary research teams. Course participation: 87 students taught between Fall 2006–Fall 2007.

6. *Minority Access to Research Careers (MARC) Program*, Mary Anne Nelson, PI

The current NIH-funded UNM MARC U-STAR Program, "Undergraduate Biomedical Research Training," is funded from June 1, 2006—May 31, 2011. Mary Anne Nelson is the PI and Program Director. The program receives approximately $320,000 in direct costs and $25,000 for indirect costs (8% F&A) per year. Each year, five new MARC scholars are admitted to the two-year program, so that, at any given time, there are 10 MARC scholars. The 10 MARC students are juniors and seniors who conduct laboratory research with a faculty mentor in some area of biomedical sciences. About half of the MARC scholars work with professors on Main Campus, and half in various departments at the UNM Medical School.

In the first summer, students do research full-time in their UNM laboratory, and at the end of summer, they present talks in the student research symposium supported by Initiatives to Maximize Student Diversity (IMSD) and MARC. During the academic year, students continue their research 15 hours per week and participate in regular MARC meetings. MARC students also take a 3-credit Research Ethics course and a one-credit GRE Preparation course, both of which are fully supported by the MARC Program; a limited number of other UNM students are admitted to these classes. In the fall, all MARC scholars attend a national meeting such as the SACNAS (Society for the Advancement of Chicanos and Native Americans in the Sciences) Conference, and in the spring, they present a poster or talk at the annual Department of Biology Research Day or similar venue.

During their second summer, MARC scholars work for 12 weeks in a laboratory at another university or research institute. In fall they return to their UNM laboratory and conduct research for 15 hours per week. In year two, MARC students take the GRE and apply to graduate schools. They complete their projects and write up their results. Most second-year students also present their research at a national scientific meeting in their area of specialty, and many publish their results in peer-reviewed journals. Most MARC scholars, after graduation, have gone on to graduate school in the biomedical sciences.

7. *Research Experiences for Undergraduates (REU) Program* at the Sevilleta Long Term Ecological Research (LTER) site, funded by the National Science Foundation, $246,705, Scott Collins, PI.

   (a) Program Summary: Three years of support for an interdisciplinary REU Site Program at the Sevilleta LTER. Our goals are to (1) recruit 30 undergraduates from across the nation, targeting under-represented students at partner institutions and the ESA SEEDS program. Our REU students will (2) be immersed for 10 weeks in research under the guidance of faculty in the Departments of Biology and Earth and Planetary Sciences; (3) gain hands-on training through conducting their own research; (4) attend weekly seminars and informal workshops in the responsible conduct of research and professional development; (5) participate in field trips throughout the region, and (6) maintain a collaborative relationship with their mentor after the field season to complete the research and publish results.

   (b) Intellectual Merit of the Program: Two fundamental experiences characterize our REU Site Program—interdisciplinarity and the research setting. Our program includes faculty in ecology, the geosciences, and meteorology. Students, as well as participating faculty, post-docs, and graduate students, will have numerous opportunities to share ideas and explore issues within and across these disciplines. This will enhance the excitement of the setting for all participants as results are shared both informally and during symposia and workshops. The LTER is a perfect location: it invites close interactions among students and faculty, and graduate student peer mentors, during field data collection and laboratory research. This setting and learning with "hands on" activities will promote greater interest in and understanding of the research process. Comprehension of hypothesis testing, data analysis and interpretation all increase as students become engaged in scientific study. Their confidence and self-identity as scientists will grow under the guidance of faculty advisors, especially because with the advisor's assistance, each student will design and implement their research study, and gain additional experience in reporting scientific results and making real contributions to research.

8. *UNM URM Undergraduate Nurturing Opportunities (UNO)* National Science Foundation, URM-5 years (9/2007-9/2012), $1.01M total Joe Cook, PI

(a) Program summary:**UNO.** Our **goal** in this 5-year program is to recruit and prepare for graduate study and research careers at least 20 undergraduate students (4 cohorts of 5 students (10 students per year when cohorts overlap). All students will have 1-3 years of preparation and concentrated research with faculty mentors based in the Museum of Southwestern Biology, Sevilleta Long Term Ecological Research (LTER), Biology Department and University Honors Program. We will **recruit** sophomores, targeting underrepresented students who qualify and are interested in biology from UNM, Diné

(Navajo) College, Central New Mexico Community College (CNM), Southwestern Indian Polytechnic Institute (SIPI) and other institutions in the Southwest. We will use **multi-level mentoring approach** by involving students at various academic stages, so UNO participants can more easily identify and choose successful paths to graduate school. In addition to *Faculty Mentors***,** the program will include a rotating *Graduate Mentor,* a *Peer Mentor* from the Honor's Program, and each student will be assigned a *Graduate Mentor* to help them navigate coursework and research demands. UNO will immerse undergraduate biology majors in an integrated set of long-term environmental research projects throughout the Rio Grande Valley and mountain regions of the Southwest. Program mentors are scientists in related fields of ecology and evolutionary biology, whose work is organized in terms of the mission and designated activities of the MSB and LTER. The integrated research conducted through MSB and LTER includes a large number of interdisciplinary studies, ranging from regional climatological patterns and large-scale landscape studies, to ecosystem processes and nutrient cycles, to community and population dynamics of animals, plants, and microbes, to investigations in systematics, molecular ecology, conservation genetics and morphological evolution of a variety of species.

(b) Program impacts: UNO will *directly* **increase diversity** and the level of participation by underrepresented students in advanced graduate training and research careers. The project will *indirectly* influence more students from underrepresented groups to seek graduate level training. It has already strengthened UNM partnerships with SIPI and CNM for future recruitment and programs. UNO is a program that **integrates research and education** through the seminars and participants' laboratory and field experiences.

Institutional Contributions

The Biology Department teaches both a non-majors course (Biol. 110 lecture plus Biol 112 lab) that fulfills a core science requirement for any student and a series of courses for students planning on entering nursing, medical technology or pharmacy programs, among others. The courses for the health sciences students include Introductory Biology for Health Sciences (Biol. 123 and 124L), Microbiology for Health Sciences (Biol. 239L), and two semesters of Human Anatomy and Physiology (Biol. 237 plus Biol. 247L and Biol. 238 plus 248L).

These courses use substantial resources—instructors, teaching assistants, lab and lecture space, and supplies—and represent a high proportion of the department's teaching effort; demand for these courses often seems to be insatiable. For example, Biology 123 now enrolls about 500 students every semester and classes are always full. The increasing demand for some of these courses is illustrated in Fig. 9.

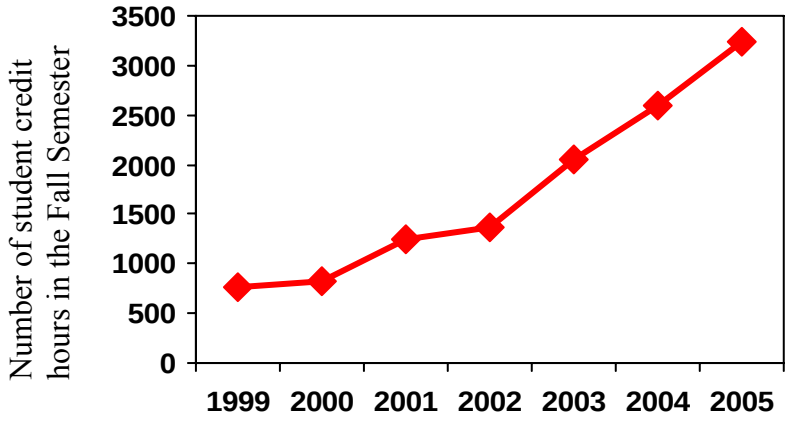


Figure 9. Number of student credit hours in Biol. 110, 123 and 239 in each fall semester, 1999–2006.

At the time of our last review, enrollment in these non-majors courses was considerably lower for three reasons. First, we were not as clear about the roles of these courses versus our majors series. Many students who simply needed a laboratory science course enrolled in our first major's course rather than the non-majors course; often these students performed poorly. Through a combination of work with University College advisors, better advertising, and required prerequisites for the majors series, students are better placed into the appropriate courses. Second, we now have a staff of full-time lecturers devoted to these courses. Formerly, many of these classes were taught by part-time instructors. This change has allowed more consistency in the courses and the opportunity for faculty to invest in course development. Third, the demand for pre-nursing and pre-pharmacy courses has increased as the size of the nursing and pharmacy programs have increased at UNM.

Assessment of the Non-Majors Curriculum: One of the full-time lecturers for the non-majors curriculum, Christina Fridrick, developed an assessment program for Biol.110 and 123. She has produced assessment instruments for Biol. 110, 112L, 123 and 124L. These instruments were first tested in Spring 2007 (See Appendix J). The plan is to continue with these assessments each semester; however, some funding for grading is needed.

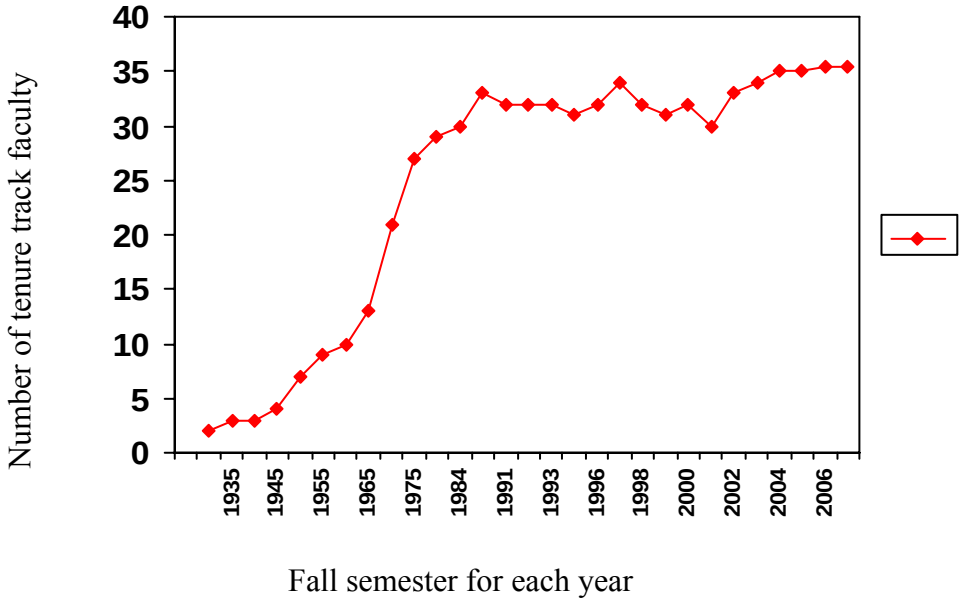
Although Ms. Fridrick is currently on maternity leave, most of the rest of the lecturers are engaged in ongoing development of the non-majors assessment program this spring. They have been holding meetings to refine the assessment instruments and will apply the revised instruments during Spring, 2008.

FACULTY

Brief CV's for all faculty are in Appendix A.

Faculty Demographics: As of January 2007, our faculty includes three Distinguished Professors, 18 Professors (UNM's President and Dean also hold Professorships in Biology, but have no assignments in the department), five Associate Professors (plus one who is on long-term leave), and 8.5 Assistant Professors.

Figure 10. Number of tenure-track faculty by year. Faculty on long-term leave or on full-time administrative assignment outside the department are not included.



During the period from 1993 to 2007, when numbers of undergraduate majors more than doubled, numbers of tenure-track faculty were virtually unchanged (Fig. 10). There has been considerable turnover in the faculty and almost half of the faculty currently in the department were not present for the last program review.

Although the number of tenure-track faculty has not changed, the number of full-time lecturers has increased from two at the time of the last review to 8.5 at present. These lectures teach all of the non-majors courses, 25–50% of the sections of Biol. 201 and 202, and some upper-division coursework.

Table 1. The Frequency and Percentage of Male and Female Faculty by Rank in January 2007.

Rank	Number of Female Faculty	Number of Male Faculty	% Female Faculty
Distinguished Professor	0	3	0
Professor	4	14	22%
Associate Professor	1	5	20%
Assistant Professor	4.5	5	44%
All tenure track	8.5	27	24%
Lecturers	5	3.5	59%

For the period from 1996–2006, the percentage of women on the faculty stayed below 20% (Fig. 2). Recent hires have changed this pattern so that 44% of our assistant professors are women, while 24% of the tenure-track faculty are women. The majority of the lecturers are women.

Table 2. The Number and Percentage of Minority Faculty by Rank.

Rank	Number of Minority Faculty	Number of Non-Minority Faculty	% Minority Faculty
Distinguished Professor	0	3	0
Professor	1	17	5.5 %
Associate Professor	1	5	20%
Assistant Professor	2	8.5	21.5%
All tenure track	4	33.5	10.9%
Lecturers	0	8.5	0%

The number of minority faculty in the department has always been low (Fig. 3). In recent years, one minority faculty member retired and two minority faculty members were hired, both as special hires. This year is the first time that the percent minority faculty has gone above 10%. This is in sharp contrast to the percentage of minority undergraduate students (Fig. 3).

The faculty also includes approximately 60 adjunct faculty (whose primary work is not on campus) and 30 research faculty (who work on campus and are usually paid from grant funds). Typically, adjunct and research faculty are nominated by one or more tenure-track faculty, their CVs are reviewed, and the tenure-track faculty vote on their appointment. Names of research and adjunct faculty and the policy for research faculty promotion are in Appendix K.

Faculty Areas of Expertise: As shown in the attached CVs, faculty expertise spans most of the range of modern biology. Although it is increasingly difficult to categorize the faculty along conventional lines, approximately 21 of the faculty are in the general realm of ecology and evolution if physiological ecologists and molecular evolutionary biologists are included, another nine are in the cell/molecular realm including immunologists and microbiologists, and another six are curators. Many faculty do research that spans more than one of these areas.

Teaching Assignment Patterns: The standard teaching load for tenure-track faculty is one lecture course each semester and one additional assignment. The additional assignment is often a small readings course or lab group. Occasionally, this teaching load is modified by allowing a doubling-up in one semester to free the other semester for field work, reducing to accommodate large administrative assignments, or reducing to buy out from grants. The latter is actually quite rare with only 2–4 faculty per year buying time. Lecturers teach two, usually large classes per semester. Occasionally, lecturers take on an additional assignment and receive additional compensation.

Although the teaching load is meant to be the same, the experience can be quite different for faculty in the two broad areas in the department. These differences arise from the discrepancy in undergraduate interests and faculty interests, differences in faculty numbers, and differences in opportunities to buy time with grants (NSF almost never funds release time, while NIH is willing to do so). At the lower-division level, Biol. 201 (Cell Biology) and Biol. 202 (Genetics) have been taught about half the time by tenure-track faculty and half the time by lecturers. Biol. 203 (Ecology and Evolution) and Biol. 204 (Plant and Animal Form and Function) have been taught entirely by tenure-track faculty. At the upper-division level, virtually all ecology, evolution, organismal and behavior classes are taught by tenure-track faculty. Most classes are small, ranging from 10–30 students. Occasional classes have as many as 50 students. For upper-division classes in cell and molecular biology, there is enormous undergraduate interest as these are the courses that apply most directly to the health professions. Many of our students find these topics particularly interesting. Some classes are quite large (up to 100 students per section) and each semester several upper-division classes in this area are taught by non-tenure-track faculty. (These are excellent lecturers with appropriate Ph.D. level training.) Thus, both the teaching and learning environments are different across the major areas of the department.

Publications: Faculty in Biology are expected to publish regularly. Although there is some variation, since 1996, the general trend is an increase in number of publications per year (Fig. 11). This is interesting in that the faculty size has changed little. Each year, these publications include several in very prestigious journals such as *Science* and *Nature*. Complete lists of annual publications can be found in the department's annual reports, which are available in the Biology Department. Each year, most of the tenure-track faculty publish in peer reviewed journals. For the last five years, on average, 83% of the tenure-track faculty have published in any year. Typically, faculty who do not publish in one year publish in the next.

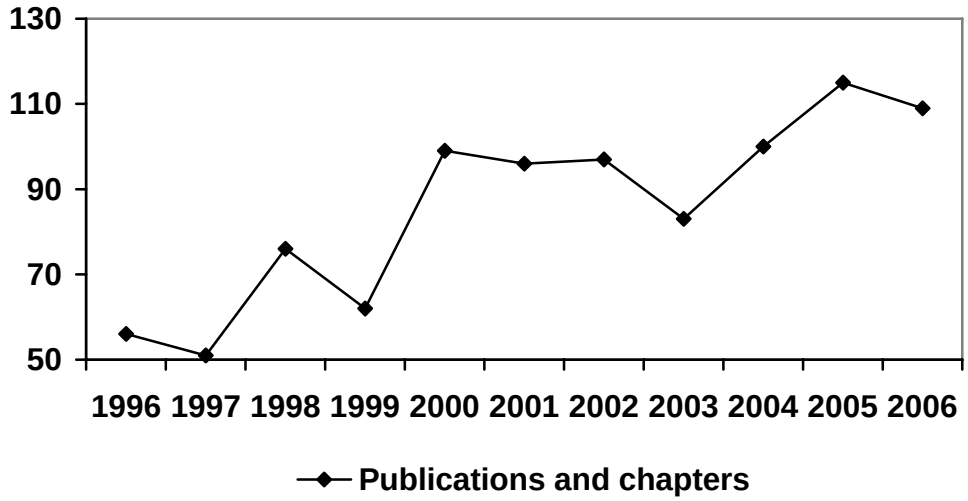


Figure 11. Numbers of peer reviewed publications and book chapters published by Biology faculty in each calendar year.

Every year, our faculty earn honors and awards. Some of the most impressive in the last five years include: Jim Brown's election to the National Academy of Science; Eric Charnov's continuing award as a MacArthur Fellow; and Maggie Werner-Washburne's Presidential Award for Excellence in Science Math and Engineering Mentoring. During this five-year period, Cliff Dahm was the University Research Lecturer, Sam Loker became a Regent's Professor, and three faculty were Regent's Lecturers. Also, Maggie Werner-Washburne was elected an AAAS Fellow, Ulfar Bergthorsson won the Stebbins Medal for the best paper in plant systematics or evolution, and Tom Turner had an NSF CAREER award. Furthermore, Bruce Milne was awarded the Distinguished Landscape Ecologist Award from IALE, and four faculty won major teaching awards on campus.

Review of Faculty: In addition to the university-level procedures for tenure and promotion review, Biology faculty are reviewed each year. Faculty members are required to submit annually a data report (Appendix L). These data are reviewed by the Salary Committee and the Chair. Typically, annual salary adjustments include a cost-of-living adjustment and a small merit raise.

Untenured faculty are assigned two mentors from among the tenured faculty. The mentors are expected to discuss the expectations for tenure and promotion, observe teaching at least once per semester, answer questions about departmental issues, and present the untenured faculty member's record at a meeting of the tenured faculty each spring.

Governance: The faculty are led by a chair and two associate chairs. Most faculty business is discussed at faculty meetings held every one to four weeks. While there is a regular time for faculty meetings, meetings are not held unless there is business to discuss. Faculty meetings are always held to discuss tenure and promotion decisions and faculty hires. Votes on all major decisions are conducted by paper ballot with a 24-hour voting period, which allows voting by faculty whose family and other responsibilities prevent them from staying until the end of long meetings, and preserves the anonymity and independence of junior faculty.

Faculty Hires: Planning for faculty hires involves three components. First, the department holds a retreat every few years to discuss the long-term needs in the department. The last of these retreats was held in 2004. Second, for many years, the department has had the practice of trying to build in the area of cell and molecular biology, while retaining our recognized strength in ecology, evolution, and behavior. Third, when faculty leave the university through retirement or otherwise, we consider the holes created in the department's teaching and research programs.

In practice, following the recommendations that result from the faculty retreats is hampered by several factors. First, faculty separations from the university are not always predictable. Since the last program review, we have experienced more turnover in faculty than at any previous time in the department's history. Of the 32 faculty present in Spring, 1996, 16 have retired, one died, and one left for another job. In addition, between the two reviews, five other faculty joined and then left the department. Of the current faculty, 20.5 were not present during the last review. (The 0.5 FTE represents a faculty member with a joint appointment.) Second, since faculty lines do not automatically stay in the department, replacement of faculty takes time and, in some cases, we are still waiting to replace areas of expertise vacated several years ago. Often, by the time a line comes available, additional retirements or separations have occurred and hiring priorities are muddied. Third, the department has avoided reductions in size only because of special hiring opportunities. Two faculty were hired through the NIH-funded CETI program (Center for Evolutionary and Theoretical Immunology, see below), three were special spousal hires, and two were special hires where soft money research positions were converted to tenure-track lines. These are valuable hires of quality faculty and our numbers would be severely limited without them; however, these hires are the result of special opportunities rather than the outcome of a department-wide planning processes. Nonetheless, as a consequence of the department taking the initiative to make special hires and using grant funds to leverage, expedite and support hires and to create new programs, we have avoided the significant losses in faculty size that have plagued other UNM science departments, many of which have been ravaged by retirements and recruitment by other campuses. Aggressive and successful efforts have been made to retain some of our faculty who have been offered jobs elsewhere. As noted above, many of the new hires have been women.

Despite the issues listed above, three major shifts in faculty expertise have occurred. First, two faculty with expertise in behavioral ecology and community ecology, who were also museum curators, were replaced with faculty whose expertise is more directly in systematics and phylogeny. This, accompanied by another hire in 2002 of a phylogeneticist, has increased expertise in systematics and phylogenetics.

Second, funding of the CETI (Center for Evolutionary and Theoretical Immunology) program allowed the department to develop in a new direction, one that fits the department well as it draws on expertise from both evolutionary and cell/molecular biology. Hiring of two new Biology faculty for this program, along with existing expertise in the department (including research faculty) and CETI-supported hires in other departments and at the Los Alamos National Labs, has allowed for significant growth of a program in evolutionary and theoretical immunology and parasitology/infectious disease. The immunologically related hires associated with CETI have permitted the development of a critical mass of investigators that has achieved visibility and a growing level of prominence on national and international scales. Included in the future plans for CETI, if and when the renewal proposal is funded, are additional leveraged hires,

one to replace a departed comparative immunologist and two additional hires to benefit both CETI and to contribute to the department's general needs.

Third, an unplanned shift is occurring. The department has had an international reputation in behavioral ecology and had always been able to attract excellent graduate students in that area. However, already one well-known faculty member from that area has retired and others are nearing retirement age. We have no young faculty in this area. Without some action, this expertise will be lost to the department. A few years ago, faculty in behavioral ecology asked the department to consider making junior hires of behavioral ecologists, before the existing, well-known faculty retired. The thought was that we had the best opportunity to attract excellent young faculty while our reputation in behavior ecology was still intact. However, after a thorough discussion, the faculty voted to use the faculty lines for another urgent departmental need—to fully staff the MSB curators. Currently, there are no plans to hire in behavioral ecology, but the possibility of making such hires is by no means foreclosed. Senior faculty in this area should continue to pursue this path. Whether expertise in new areas in the department can achieve the reputation held by the behavioral ecologists is not known.

Roles for Retiring Faculty: Usually, retired faculty are granted emeritus status after a request to the department. They may have office space in Marron Hall, very near the main biology building, and mailboxes in the department's Main Office. Retired faculty do not retain lab space, but often continue writing and doing research by sharing space with other faculty. Retired faculty are occasionally hired to teach courses, as needed. Retired faculty serve on graduate committees, but may not be the sole chair of these committees.

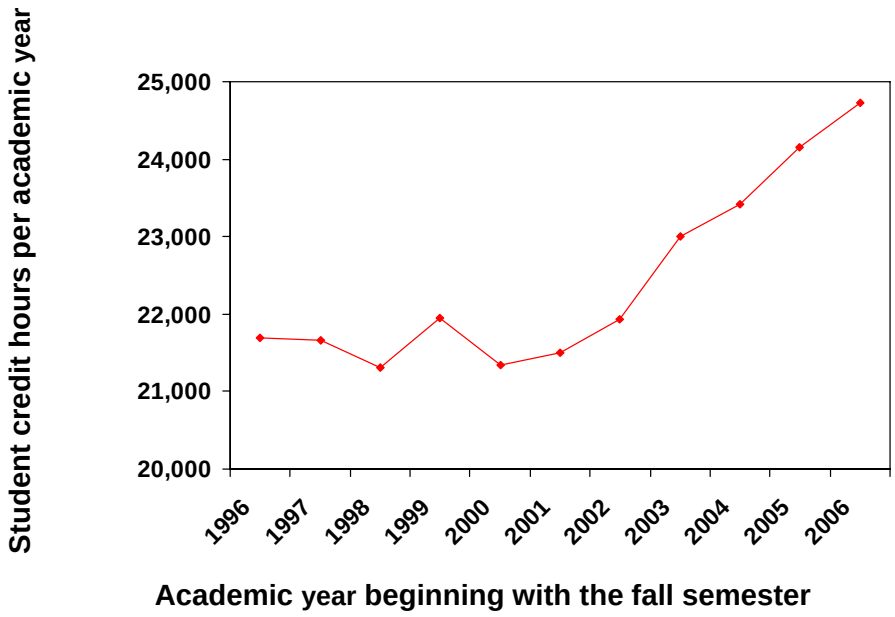
Faculty Involvement in Interdisciplinary or Cross-Unit Academic Programs: Faculty have been involved in a number of large, interdisciplinary training programs. These include the Biocomplexity and IGERT programs described above. Current programs include the PIBBS, IMSD, and MARC programs. In addition, Bruce Milne founded the Sustainability Studies program at UNM which is by definition interdisciplinary. Helen Wearing was recently hired to assist with UNM's BA/MD program and has a 50:50 appointment with Biology and Mathematics and Statistics.

Faculty Workload Analysis: The number of student credit hours taught per year has increased steadily since the last program review (Fig. 12). Overall, we are teaching 14% more student credit hours now than in 1996–1997.

Of those student credit hours, a declining number are taught to our majors (Fig. 13), due to the increasing number of students in our non-majors courses. The College of Arts and Sciences has supported teaching extra sections of those courses to improve student access to courses that are part of the university core curriculum and to increase access to courses that are prerequisites for health sciences programs, especially nursing

The situation is different in upper- and lower-division courses. Most of the student credit hours in upper-division courses are taught to our majors (Fig. 14).

Figure 12. Student credit hours in biology per academic years. Academic years are indicated by the beginning of the Fall semester. That is, 1996 is the 1996–1997 academic year.



As the number of lecturers in the department has increased, the proportion of student credit hours taught by the tenure-track faculty has decreased (Fig. 15). This is largely because the lecturers teach primarily in the large, non-majors courses. For example, in Fall 2003, tenure-track faculty taught 34% of the lower-division student credit hours (SCH), 67% of the upper-division SCH and 90% of the graduate SCH. In Fall 2004, tenure-track faculty taught 3% of the lower-division SCH, 69% of the upper-division SCH, and 93% of the graduate (SCH).

Figure 13. Percent of student credit hours taught to majors in biology from 1999–2005. Figures are for academic years, i.e., 1999 represents the 1999–2000 academic year.

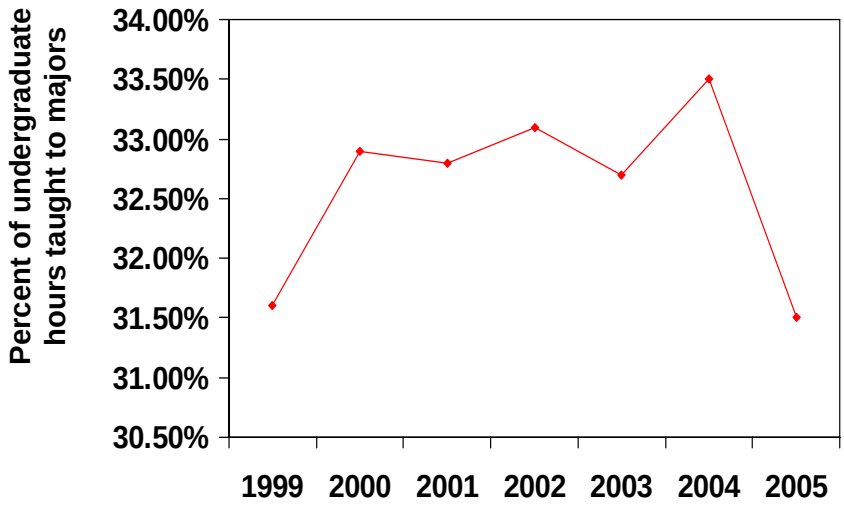


Figure 14. Percent of credit hours in biology taught to our majors. 100- and 200-level courses are lower-division, while 300- and 400-level courses are upper-division.

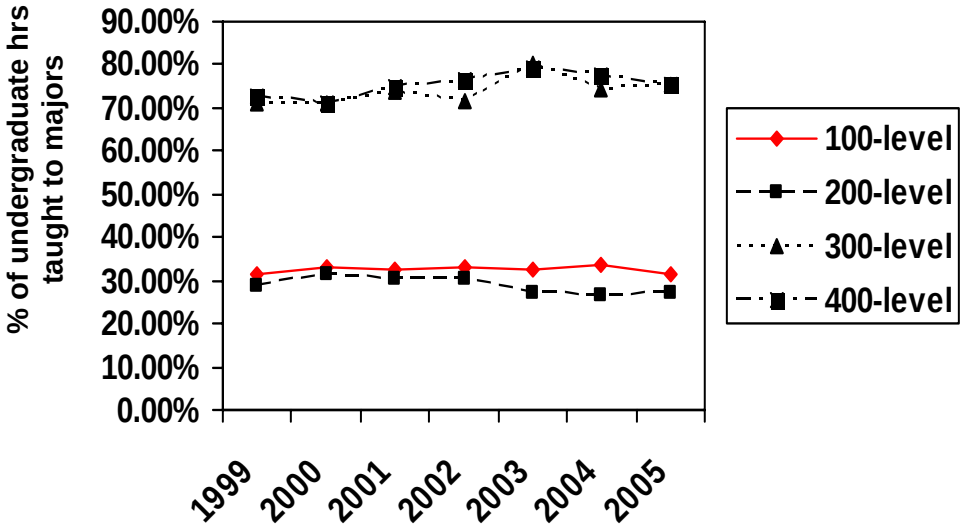
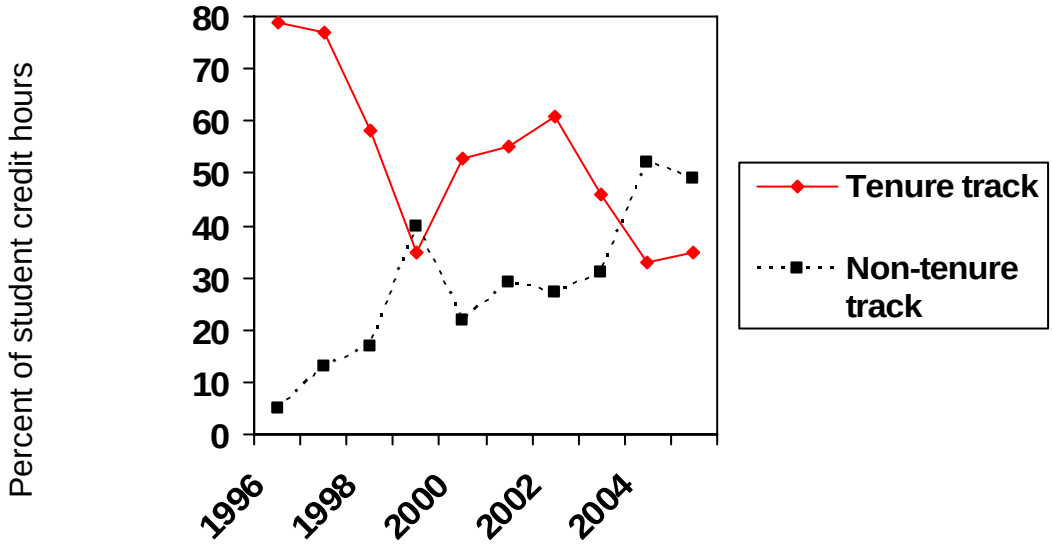


Figure 15. Percent of student credit hours taught by tenure-track and non-tenure-track faculty. 1999 is an unusual year because several visiting assistant professors were hired to deal with retirements and sabbatical leaves.



Support for Faculty Development: Faculty support starts at the hiring stage. For the last five faculty who came into the department as full-time assistant professors, starting salaries averaged $56,500 and setup packages averaged $287,000. Currently, these setup packages are funded 35% from the Office of the Vice President for Research, 42.2% from the College of Arts and Sciences, and 22.8% from the Biology Department. The Biology Department's portion comes from overhead funds that are returned to the department. Currently, there is a large deficit in the Research Office and we are concerned about their continued ability to provide setup funds.

Typically, beginning faculty are given a teaching release by the department for the first semester, and then most get a research semester from the College of Arts and Sciences between the mid-probationary review and the tenure review. New faculty are assigned two mentors from the tenured faculty.

The department provides additional support for faculty from its overhead accounts. These funds are used for faculty travel to meetings, publication costs, and research support for faculty who are between grants or are starting new projects.

Faculty Retention Efforts: The department makes substantial efforts to retain faculty who are under consideration for faculty positions at other universities. The policy of the College of Arts and Sciences in this matter has varied among Deans. Sometimes we are able to make counter offers when a faculty member is offered an interview, sometimes after an interview and in other cases, not until a job has been offered. In the last 4.5 years, Retention efforts have been made for six faculty. These efforts include pre-emptive salary adjustments (two cases), spousal hires as a means of retaining one of our faculty (two cases that have resulted in hiring of two female tenure-track faculty members), competitive counter-offers that have resulted in retention (one case), and one on-going case involving hoped-for retention of a faculty member who accepted another position elsewhere, but who has remained on leave of absence at UNM in the meantime. In addition to a higher salary or the offer of a spousal position where relevant, our efforts in this area also include making provisions for staff assistance, working out special time-sharing arrangements with other academic units or institutions, and provisions of more material resources. Unfortunately, there are seldom funds from the college to deal with the potential inequities created for faculty who are less mobile due to family or other reasons. The annual salary increment given to the department is not sufficient to take care of these kinds of situations.

SPECIAL PROGRAMS WITHIN THE DEPARTMENT

Museum of Southwestern Biology (MSB)

The MSB produced a separate self-study document, Appendix N, that details its goals and status. The Museum's activities are briefly summarized below.

The MSB is is headed by a Director, who reports to the Dean of the College of Arts and Sciences. It maintains a very close relationship to Biology because the curators are tenure track Biology faculty. Its role is distinct from, but highly complimentary to, the normal teaching, scholarship and outreach missions of the Department. The MSB acts as a repository for representative specimens and data that document biological diversity. MSB curators and staff are charged with maintaining and enhancing collections to increase and disseminate knowledge of

our natural history and environment. The MSB does not have a formal public exhibition program. Rather, the MSB is dedicated to advancing knowledge in, and service to, the scientific fields of organismal biology, ecology, systematic biology, public health, and natural history. MSB applies its resources and expertise to the service of the Department, UNM, the state of New Mexico, and to the wider regional, national, and international scientific communities.

Faculty–curators, museum associates, and staff usually have full-time appointments in the Department of Biology and are expected to meet departmental expectations of performance in scholarship, teaching and service. These activities are reported in the broader Biology Department Self Study. In practice, research and teaching are highly integrated into the curatorial mission. The MSB report (Appendix N) provides metrics intended to describe and assess performance in the following areas: (i) collections growth and development, (ii) scholarly activity of MSB staff and associates, and (iii) student curatorial mentorship and training. The performance of each the MSB's nine Divisions is compared to peer institutions in the United States through narrative descriptions of collection growth, use, and enhancement. Based on self assessment, the MSB is on par with nationally and internationally known research university collections including Arizona State University, Yale University, and the Illinois Natural History Survey at the University of Illinois Urbana-Champaign.

The planning process of the MSB is done by an advisory executive committee (composed of the director and curators) and annual retreats for the entire MSB staff. Through this process, the museum has identified three major goals. First, it will enhance use and visibility of the collections through development of world-wide web accessible, integrated databases. Second, it will develop formal curatorial training and mentorship programs for undergraduate and graduate students. Finally, it will enhance opportunities for integrated, specimen-based research across UNM. Challenges to fully implementing database goals include lack of information technology staffing and physical space

Center for Evolutionary and Theoretical Immunology (CETI)

One of the prominent research programs with its administrative home in the Biology Department is the Center for Evolutionary and Theoretical Immunology (CETI), which is supported primarily by the National Institutes of Health (NIH) National Center for Research Resources (NCRR) Centers for Biomedical Research Excellence (COBRE) program. CETI also is incorporated as a Level One center within the College of Arts and Sciences. CETI is devoted to the study of the origins and diversification of immune systems across the spectrum of organismal life; it also is dedicated to revealing the underlying principles that govern how immune systems work. The program has its major emphasis within the Biology Department, but also has as formal participating faculty in the College of Engineering's Department of Computer Science, and theoreticians at the Los Alamos National Laboratory. In addition to providing mentoring for junior investigators seeking to attain their own independence and research funding, CETI also has provided more than $300,000 to upgrade core research facilities in the Biology Department, including the purchase of two new automated sequencers, several new research quality microscopes, and incubators and environmental chambers; it also has provided significant support to establishing a mass spectroscopy center devoted to proteomics study in the Department of Chemistry and Chemical Biology. CETI has provided $450,000 in renovation funds to completely overhaul one of the wings of our building as improved research space to support CETI activities, and has supported the visits of numerous prominent investigators to Biology and

UNM. In addition to its core NCRR funding, CETI also is supported by research grants awarded to its individual participants, both junior and senior participants alike.

This program is funded by a COBRE grant from NIH. The COBRE grant is a $10.4M, five-year award that has provided support for 10 tenure-track and/or senior investigators, 11 research-track faculty and/or postdocs, nine graduate students, 12 undergraduate students and eight research staff. The grant award has the possibility for renewal at the end of the original five-year funding period, which will end in June, 2008.

Long Term Ecological Research (LTER) program

The Sevillelta LTER program is a long-term, comprehensive, integrated, interdisciplinary research program addressing key hypotheses on pattern and process in aridland ecosystems. Our focal sites are the 100,000 ha Sevilleta National Wildlife Refuge, located about 80 km south of Albuquerque and the Middle Rio Grande bosque between Cochiti Dam and Elephant Butte Reservoir. Since its inception in 1988, the Sevilleta LTER program has conducted research at multiple ecological levels and a variety of spatial and temporal scales. The Sevilleta is organized into five thematic areas with designated group leaders: climate and abiotic drivers (Cliff Dahm), water fluxes (Will Pockman), soils and biogeochemistry (Bob Sinsabaugh), producer dynamics (Estaban Muldavin), and consumer dynamics (Blair Wolf).

The Sevilleta LTER is involved in education and outreach through a School Yard LTER program (BEMP), an NSF-funded GK-12 program, a summer REU program, an ESA SEEDS chapter, and everyday classroom teaching by our researchers.

The Sevilleta LTER program supports our graduate program in several ways. First, students use the site for their research projects. Second, the LTER provides summer fellowships of up $3,500 and supported seven students last summer. Finally, students working at the Sevilleta can use the resources of the Sevilleta field station.

LTER Network Office

The LTER Network Office is funded as a Cooperative Agreement with the National Science Foundation (Robert Waide, PI). The first cooperative agreement was for six years in 1997 at $7,289,433. We were successful in renewal of the Cooperative Agreement in 2003 for $8,161,893. We are in the process of writing our third renewal proposal this spring for continued funding in 2009.

Summary: The LTER Network Office was created by the National Science Foundation in 1983 to support and coordinate network and site activities of the U.S. Long Term Ecological Research (LTER) Network (in support of the overall LTER vision, mission, goals and objectives). It moved to the University of New Mexico from the University of Washington through a competitive grant process in 1996. With more than two dozen sites participating in the Network within the United States, rapidly advancing technology, and growing collaborations with other national observatory networks, federal agencies, and countries, the complexity of facilitating collaborations among sites and maintaining supporting infrastructure has created great challenges and an even greater need for a strong and dedicated Network Office.

The mission of the LTER Network Office is to provide a central point of contact and collective expertise to support the objectives of the LTER Network by:

- providing an efficient computational and communication infrastructure;
- developing and deploying state-of-the-art techniques in information management ;
- maintaining a strong public outreach program;
- coordinating interactions with other scientific networks, agencies, and entities;
- providing administrative support;
- contributing to an efficient and effective environment in which site, cross-site, and synthetic research and education can be conducted.

Impacts of the Program on the Department: The LTER Network Office supports or partially supports one tenure-track faculty member and four research faculty. The research faculty, while broadly experienced, are all internationally known leaders in the area of ecological informatics and have been successful at attracting significant additional funds to further knowledge in areas ranging from sensor networks and remote sensing to computing infrastructure and software development. The LTER Network Office operations are supported by four office staff, three computer support staff, two information systems specialists (one supported by USGS NBII), and a public information officer. The LTER Network Office usually funds one to two students per year to assist with core services provided to the LTER Network scientists.

The LTER Network Office maintains a controlled-environment server room in the basement of the Center for Environmental Research, Information & Art (CERIA) Room 123. Currently, this room is shared by various divisions of the Museum of Southwestern Biology and Sevilleta LTER Project. In addition, we have designed, outfitted, and currently maintain an innovative information technology training laboratory in Room 335 of CERIA. This facility is used regularly for intensive training courses, seminars, and workshops involving scientists, students, and information management specialists from around the world. UNM students and faculty are eligible to apply for many of these courses and workshops.

FACILITIES AND RESOURCE BASES

Support Staff: The department staff includes 89 members, 26 of which are paid in part or full by I & G funds. Every year in the annual report, the chair says that the support staff perform minor miracles on a daily basis to keep the department afloat. This is because the department becomes larger (in terms of programs, not faculty) and more complex every year and because the demands of the university accounting system and auditing become more difficult every year. In 1996, the department had 23 state-funded staff positions (the number of FTE lines was less). In 2002–2003, there were 21.14 FTE's, and in 2006–2007, there 22.88 FTE's. State support for staff lines is in no way adequate. The department supplements this by paying all or part of some staff salaries from overhead and foundation accounts. Some essential functions, such as managing the research greenhouse and growing plants for our courses, are not supported by state lines at all (Appendix B).

Space: Space for our research and teaching missions has always been in short supply. However, there have been several major changes since the last program review.

At the time of the last review, the department had just received permission to renovate and use much of the space in a nearby building that formerly had been the campus bookstore. Garnering funds for and completing the renovations took nearly a decade from the time the space was first promised. After a number of problems, new space became available in 2004–2005. This space was occupied by the collections and staff of the Museum of Southwestern Biology. This included the curators, so six faculty moved from offices in the main Biology building (Castetter Hall) to the newly renovated building (Center for Environmental Research, Information & Art [CERIA]). The staff of the LTER Program and the LTER Network Office also moved into CERIA. There is no faculty lab space in this building.

Moving the museum collections opened up considerable space in the basement of Castetter Hall, but funds to renovate this space for new uses were not immediately available. However, $7M became available from a student-funded bond issue to renovate 20,000 sq. ft. in the newer wing of the basement for teaching. In mid-October, 2007 this space opened with five new teaching labs, three new lecture rooms, offices for seven lecturers, an advising suite, student study areas, and a student commons area. This represents the most significant renovation of Castetter Hall since it was constructed.

Since the last review there also have been funds received for renovating some faculty labs, with the funding coming from the university, the student-funded bond issue and the CETI Program. University funding for research lab renovation has been particularly hard to come by in the last decade as the university has invested in upgrading core infrastructure. An example of this problem faces us at present. With the opening of the new teaching labs in the basement, four rooms in the old wing of Castetter Hall are available now for other uses. We had thought to renovate these into new faculty labs, but funding is not available and is unlikely to become available in the near future.

We plan to provide up to 35,000 sq. ft. of new faculty office, conference and research lab space in a phased addition to Castetter Hall. Funds ($ 5 M) for Phase I, a two-story 15,000 sq. ft. addition, are in place and construction will begin in March, 2008. We have also secured another $2.78M from the legislature and $2.25M from another UNM bond issue. We have secured a place on the state's general obligation bond for $5M, to be voted on this fall. All of these funds will be applied to Phase II, which will include a new research greenhouse and a three-story addition.

We are still in need of substantial renovation funds for our current building. We just submitted a request for support for several minor capital improvement projects (defined as less than $1M per project). If funded, this would allow renovation of two faculty labs and enable us to recover more of the vacated space in the old wing of the building for use. We need all the support we can get for these requests. While some very nice renovation has occurred, other parts of the building have little or no renovation since the 1950s and 1960s. The recent renovation of the basement has shown us what could be possible.

Over time, the department has been frustrated by changes in administration that alternately emphasized new construction or renovation. We have been plagued by delays in obtaining funds and by increased construction costs that result from these delays. Nonetheless, our current construction and plans could put us in better shape than we have been in for decades.

Special Facilities

Molecular Biology Facility (MBF): The MBF provides (1) access to the tools and techniques of molecular biology for faculty and students who do not have suitably equipped labs, (2) common equipment for all molecular biology work, and (3) support and equipment to classes. Available equipment includes DNA sequencers, ultra- and high speed-centrifuges, gel documentation systems, and DNA analysis software. In 2006–2007, more than 49,000 sequences were run on the facility's genetic analyzers. Twenty-six tenure-track faculty, 34 graduate students, and 45 undergraduates used the facility. Students from five classes used the MBF and 18 peer-reviewed manuscripts acknowledge the facility.

Sevilleta LTER Field Station: The field station is operated by the Biology Department in collaboration with the U.S. Fish and Wildlife Service. It supports research in biology, ecology, geology, and anthropology. The primary mission of the field station is to provide housing and research space for programs centered at the Sevilleta Wildlife Refuge. It also acts as a facility for meetings and small conferences. The facilities include housing for up to 48 people, general laboratories, specimen processing and storage facilities, reference collection, a computer center, a library and a large conference room. This facility has enormous potential for advancing our education and research missions, but has never been adequately financed by UNM. Provision of a recurring financial commitment of about $100K per year from either UNM or the state would allow this beautiful facility to achieve its full potential.

Library Resources

The University Libraries (UL) is a member of the Association of Research Libraries, and is composed of four separate facilities on the University of New Mexico's Main Campus in Albuquerque: Zimmerman Library (education, social sciences, and humanities); Centennial Science and Engineering Library (CSEL); Parish Memorial Library (business and economics); and the Fine Arts and Design Library.

The four branches of the UL hold more than two million print volumes in their collections. Currently, the UL has more than 8,000 subscriptions to print journals and nearly 17,000 subscriptions to electronic journals in all disciplines. There are numerous special collections in the UL, including the Map and Geographic Information Center (MAGIC) at Centennial Library. The MAGIC collections include approximately 221,000 maps and cartographic images.

The UL provides 24/7 remote electronic access to more than 300 electronic databases, electronic journals, electronic reference sources and other books, and the library catalog (LIBROS) of print holdings. There are several electronic sources that specifically support research in biology at all levels. The JSTOR archive contains journal collections focusing on: general science; ecology and evolution; botany; developmental and cell science; health sciences; and zoology. BioOne provides electronic access to 84 journals in the biological sciences, including many smaller society publications. A more complete electronic coverage of journals is needed for UNM to keep pace with its peers. The UL collaborated with the American Ornithologists Union, the Cooper Ornithological Society, the Association of Field Ornithologists, the Wilson Ornithological Society to produce SORA, a searchable archive of more than 120 years of international ornithological literature. The UL provides access to more than a dozen major databases covering various aspects of the world's biological literature,

including BIOSIS, Web of Science, Zoological Record, and several environmental databases through Cambridge Scientific Abstracts.

The staff at CSEL provides library instruction to students in the sciences and engineering. In 2007, more than 50% of these sessions were conducted for students in undergraduate biology classes, both majors and non-majors. Library staff had contact with 72 unique classes or lab sections in these instruction sessions, interacting with approximately 1,440 students. More than half of these sessions were taught by the biology librarian.

We are grateful to have a biology librarian who provides additional assistance to the department by selecting books for the library's collections and handling biology reference questions directly for any students, faculty, and staff in the department. Additional reference support is provided by all CSEL librarians via the reference desk, which is staffed in person, by phone, and by e-mail over 50 hours per week.

Financial Resources

The department has four main sources of funding, state funding (the I & G budget) that is allocated to the department by the College of Arts and Sciences, course fees that are collected from students, overhead funds generated by grants, and gifts that are managed by the Biological Society of New Mexico (BSNM) and the UNM Foundation. The faculty, staff and students in the department also hold grants funded by a variety of agencies. These funds, of course, are for research projects, not for the general operation of the department. This section provides an overview of our financial situation. Details can be found in a report provided by our accounting staff (Appendix M).

I & G Budget: The state-funded budget includes two parts—Salaries and Materials & Supplies. Starting in fiscal year 2004–2005, a 1% tax was imposed on all transactions in the I &G budget. This tax funds implementation and operation of a new data base system—Banner. The listing below of the total I & G budget is shown after the Banner tax was imposed, since the effect is to reduce the funds we receive. Generally speaking, while the department's I & G budget has increased overall, the increase is entirely in salaries (Fig. 16). The Materials and Supplies budget has decreased in the last five years (Fig. 17). Funds in the Salary budget can be spent only on salaries. Funds from unfilled positions are reclaimed by the College of Arts and Sciences.

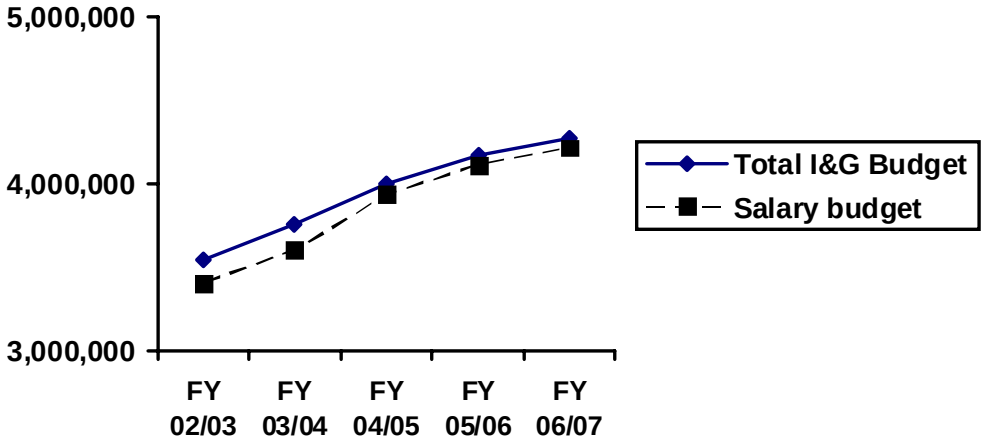


Figure 16. Total I & G budget for the past five fiscal years. Budget amounts are after the Banner tax has been removed.

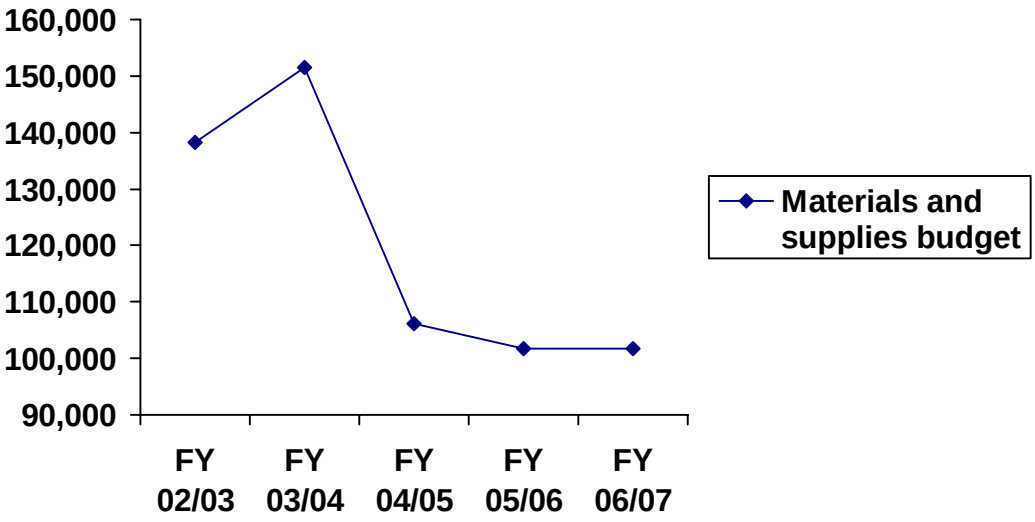


Figure 17. Materials and Supplies budget provided by state funds in the last five fiscal years. Available amounts in the last three fiscal years are actually less than shown due to a 1% Banner tax.

The Materials and Supplies budget is even more limited than it appears here as a number of fixed or rising costs are paid from this account. Fixed costs include the operating budget for the Museum of Southwestern Biology ($48,800), a budget for the Animal Research Facility ($12,600) and the lease for departmental copiers ($36,500). Additionally, there are two other large costs: telecommunications ($62,400 in FY 2006/07) and tuition for special T.A.s ($32,500 in FY 2006/07). The large telecommunications bill arises because the university has not increased for many years our budget for telephone lines. As the department increased in size and complexity, additional telephone lines were needed and the department pays for them from the I & G budget. The T.A. tuition cost is generated when the department agrees to add sections to courses to meet university enrollment needs. When many students want to enroll in a closed course, the university tries to open up additional sections so that students can progress through the curriculum. When additional biology lab sections are needed, the department is offered T.A. stipend support, but not T.A. tuition support. We are unwilling to create a second class of T.A.s who do not receive tuition support, so we pay their tuition from the I & G budget. Thus, our acquiescence to the universities goals costs us about $30,000 per year.

Because of these nearly fixed costs that are necessary to operate the department, our Materials and Supplies budget is spent before we start thinking about funding for classes. In 2006–2007, when our fixed costs, as listed above, were $192,000, our Materials and Supplies budget was only $100,643 (after the Banner tax was applied). The College of Arts and Sciences recognizes this problem and has supplied additional operating funds to the department in four of the last five years (Supplemental allocations to the Materials and Supplies budget were $67K in FY 2002/03, $76K in FY 2004/05, $132K in FY 2005/06, and $116K in 2006/07). Note that these funds declined in the last year and that these are not guaranteed funds for the department. In FY 2006/07, after fixed costs were paid, the department had $22,683 for teaching courses, which equaled $2.26 per student or $0.97 per student credit hour. That was actually a relatively good year, as the average for the last five years was $0.47 per student or $0.20 per student credit hour.

Course Fees: Because the state budget for teaching materials had become completely inadequate, the department began charging fees for all courses. Some course fees for the more expensive labs had always been a part of the budget; however, because all courses had costs that could not be covered by the state budget, the department applied for and gained approval to charge the following course fees: $5 per lecture class, $10 per discussion class, $30 for all lab classes (that do not have special, higher fees), and $75 for all field trip and anatomy and physiology classes.

Charging course fees has turned around the department's teaching budget. These fees generated $136,000 in FY 2006/07. These funds are monitored carefully and are spent only on teaching, which allows us to purchase supplies for classes and to engage in a program of upgrading teaching equipment. For example, in the past year, the department purchased 20 new microscopes for upper-division courses; these replaced microscopes from the 1940s. We still face challenges in providing lab supplies, which increase in cost, but we are in a better circumstance than we were a decade ago.

Overhead Funds: A portion of the overhead generated from grant accounts (13.2% of the total overhead generated on a typical grant) is returned to the department from the Office of Research. These funds are used for start-up costs, research support, faculty development, graduate student support, etc.

In FY 2006/07, the department's overhead allocation was $416,273.00. The money was used as listed below.

General Category Expenditures:		
Faculty Travel Support	$10,000	
Catastrophic Leave	$2,500	
Start-up Packages	$107,745	
Cost Shares	$120,000	Commitments made to support some grants
Shipping Charges	$1,000	
Faculty Meetings	$1,000	
Faculty Moves	$10,000	
Biology Renovations	$35,000	
F&A Splits	$26,800	
GRAC	$5,500	A graduate-student-administered research fund
Green Card/Visas	$10,000	
Graduate Computer Pod	$2,500	
Proposals	$500	
SAC Deals	$6,000	Supplemental administrative compensation
Salary Support	$69,000	

Foundation Accounts: The department, through its own development efforts, has accumulated some accounts managed by the UNM Foundation. These support scholarships for undergraduate and graduate students, the Museum of Southwestern Biology, research, and discretionary activities. Table 3 summarizes the current UNM Foundation accounts. To the extent possible, we have, in recent years not used the annual spending account of the major departmental endowment, as a way to continue to grow the endowment principal.

Table 3. Summary of Biology Department Accounts in the UNM Foundation.

Type of Accounts	Number of Accounts	Purpose	Funds Available to Spend	Endowment Amount
Non-endowed Biology Foundation Accounts:				
	9	Museum of Southwestern Biology	$35,964.00	
	1	N.M. Natural Heritage Program	$218,383.00	
	1	Plant Ecology Scholarship	$5,887.88	
	1	Chair's Discretionary Fund	$2,936.00	
Endowed Biology Accounts:				
	8	Scholarships for graduate and undergraduate students	$51,127.15	$875,064.09
	3	Museum of Southwestern Biology	$875,064.09	$108,659.79
	3	Departmental research support and chair's discretion	$43,894.04	$503.128.37
Biology Trust Fund Account	1	Scholarship		$11,695.00

Grant Funding: In 1996, the department had $4,927,390 in grant expenditures. In FY 2006/07, the department had $13,358,472 in grant expenditures on 219 grant indices (based on UNM's accounting system, the number of grant indices is a measure of the number of active grants. This is a slight overestimation as a few grants have more than one index). Thus, although the faculty has stayed at about the same size, grant activity has increased considerably. Average inflation during the period would have increased grant activity only to $6,331,203.40.

Although grant activity has increase in the last decade, it has fallen off a bit in the last two years (Fig. 18). The peak in FY 2004/05 represents the initiation of the large NIH grant that funds the CETI program.

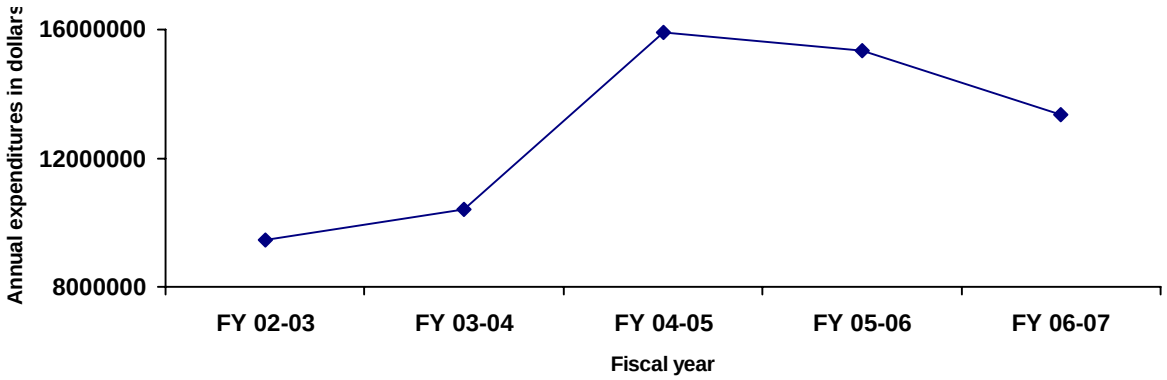
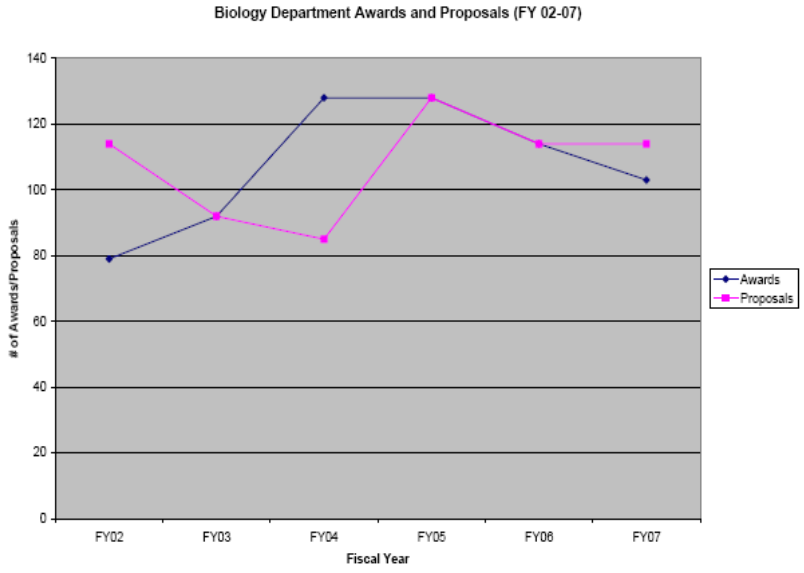


Figure 18. Annual expenditures of grant dollars from Fiscal Year 2002/03 to Fiscal Year 2006/07.

We worry somewhat about the decline in grant dollars for the last two years. This may represent normal funding cycles for some large programmatic grants, the increasing difficulty of obtaining federal funds, or reductions in submissions of proposals by our faculty. The last would generate the most concern. We also are concerned about the changing climate for funding from federal agencies. A comparison of number of proposals and awards over the last five years (Fig. 19), shows a dip in submission in FY 2004, but a subsequent increase in proposals. Thus, faculty effort in seeking awards is not the most likely explanation for the decline in grant dollars. We would like to work with the college and university development staff to improve our connections with and funding from private foundations.

Figure 19. The number of proposals and awards for the Biology Department from FY 2002–FY 2007.



On average, the department has funding per year from 55 different agencies. These range in amount from a few hundred dollars to millions of dollars. Typically, the largest amount of funding comes from the National Science Foundation (NSF). This is primarily because of the large grants to the LTER and LTER Network Office, but there are also numerous single investigator grants. Funding from NIH also is substantial and increasing over time, in part due to

the large COBRE grant that funds the Center for Evolutionary and Theoretical Immunology (CETI). Details of funding sources are presented in the financial report (Appendix M).

While most of the grant dollars come from awards to tenure-track faculty, substantial grant activity also comes from the work of other department members, especially the research faculty. In FY 2006/07, 36% of the grant dollars came from awards to members of the department who were not tenure-track faculty. On average, 26 tenure-track faculty hold grants each year.

Current and Projected Costs: The bulk of our annual I & G budget is for salaries and the salary funds cannot be moved to other budget categories. We expect salaries to continue to increase and worry about the slow rate at which the state budget increases. Salaries need to rise to be competitive with our peers and to retain our faculty. A recent concern has been an increase in the UNM administrative budget, resulting in fewer funds trickling down to the faculty level. The department would benefit from both an increase in the number of staff lines and an increase in the rate of pay for staff. Essential duties are still supported by overhead funds. The number of guaranteed T.A. lines has shown essentially no increase in the last five years. Additional T.A.s are supported each year by special allocations, but these allocations do not cover all of the costs of T.A. support, e.g., tuition is not paid. Thus, these special allocations are problematic for two reasons. First, they create a financial burden for the department, because the department pays the TA tuition. Second, because they are not guaranteed, so we cannot plan around them and cannot increase the size of our graduate program. The time has also come for a substantial (at least 20%) increase in TA stipends to remain competitive.

We also expect materials and supplies costs to continue to rise, likely at higher than the rate of inflation. In recent years, this budget actually has declined, and we use course fees to cover the shortfall.

Grant revenues are difficult to predict. Given the current funding climate and the state of the federal budget, in the near future it is more likely that these funds will decrease rather than increase. This creates two problems for the department. First, faculty are likely to experience gaps in funding and ask for support from the departmental overhead funds. Second, fewer grant dollars means a smaller overhead budget. Yet we expect the demands on the overhead budget to be even greater, as travel costs for faculty, gaps in funding, and requirements for start-up funds all increase.

We are very concerned about our overhead budget. This budget has kept the department afloat during many lean times at UNM. However, this budget is allocated from the Office of the Vice President for Research (OVPR). In the last year, a multimillion dollar shortfall in the OVPR budget has been discovered and reported. Trying to cover that deficit is likely to affect all units that rely on overhead funds.

The debt that has been reported in the Office of the Vice President for Research and Economic Development (OVPRED) imperils the research activities of the Biology Department in several ways:

1. It is likely to lead to a permanent, institution-wide redistribution of overhead funds (currently 56% OVPRED, 26.4% college, 13.2% department, and 4.4% PI) to something less favorable to the colleges, departments and individual PIs. This is disastrous, because, at the departmental level, we depend on our overhead funds to support travel to professional meetings or for

collecting trips, to enable purchase of equipment items or supplies needed by faculty in transitional funding situations, or to provide supplemental support for the research activities of graduate students. Overhead funds are among our most discretionary funds, and insofar as they are devoted to research activities, and given that we have created the overhead streams in the first place by virtue of getting grants funded, these are very important to us.

2. A reduction in the level of funds returned to the units that generate them in the first place is a huge negative incentive for PIs. Even though the PI share received now is small, it is something, and can be used by the PI to initiate totally new projects or to make scientific trips that would not be possible otherwise. If there is no return or a diminished return, we feel it will eventually cause the number of proposals submitted to decline.
3. There is a considerable concern that if the OVPRED office retains more research overhead funds to service a debt, this will impact significantly their ability to provide start-up funds related to future hires (currently, they contribute 35%). Will this amount to a de facto hiring freeze in the sciences where large start-up packages are the norm?
4. Many of our large, multi-investigator projects rely heavily on cost-shares to help pay for the support personnel needed to administer the program in question. In some cases, virtually 100% of the overhead generated has been returned to the projects via cost shares. If cost shares suddenly are eliminated because of debt problems, then the efficient operation of some of our most valued programs becomes increasingly imperiled.
5. More philosophically, if overhead funds generated from research are not plowed directly back into research, but instead are siphoned off by other UNM financial units, then this sends a very strong negative message to the faculty that research is not sufficiently valued, or that the research infrastructure (compliance, proposal handling, accounting) is not being sufficiently supported. All of these things create difficulties for submission or support of research endeavors, create negative incentives for continuing to submit proposals, and cast doubt on the potential of UNM to excel in research.

The Relationship Between the Budget and the Department's Mission and Goals: The department has little control over the I & G budget, yet this budget is necessary to perform our primary missions of research, teaching and service. Annual increases in salary, as provided by the state, are small enough that only small merit awards can be given. Larger increases in salary come from counteroffers to those faculty who can seek jobs elsewhere and from adjustments based on administrative responsibilities. This is typical of the entire university. Our needs for additional staff lines are very difficult to address and extra T.A. lines are not allocated in a way that allows us to plan for new graduate students.

The department does control its course fee budget. Course fees were created to address directly the need for teaching equipment and supplies. The course fees budget is used entirely for those purposes.

The overhead budget is used most directly to support our goals related to the research mission. Here, where the department does have control, funds are allocated directly to faculty research needs.

The Plan for Dealing with Increases or Decreases in Resources over the Next Five Years: During initial planning for this review, we were asked to consider the impact of a 5% increase or decrease in the budget. Decreases in the I & G budget would be disastrous for the department. Of

this year's $4.2 million budget, only $100,000 was allocated to materials and supplies. That money is allocated entirely to fixed costs. So, unless we plan to stop using telephones or photo-copiers, we cannot really cut that part of the budget. Thus, with a 5% cut, $210,000 would have to come from salaries. If it were a temporary cut, we could slow down hiring, but that would affect the number of courses we teach. If it were a permanent cut, we would have to cut faculty or staff lines. Since the numbers of personnel already are minimal for a department of this size, any cut would have a direct effect on the number of courses we could teach. This would jeopardize the university's goals to increase student graduation rates.

Because we are covering course supplies by assessing course fees, a $210,000 increase in the budget would most likely be spent on salaries. Given that state-funded staff lines are nearly the most limited resource in the university, we would likely add at least one staff line. Given our low ratio of faculty to majors, we also would likely add a faculty line.

COMPARISONS TO OTHER PROGRAMS

National Rankings: There are no routine comparisons of programs in biology, and given the breadth of the field, comparisons are rather difficult. We are still best known for our program in ecology and evolution, but do not have a department with that name. It is seldom possible to separate out just a part of a program for a review.

National Research Council (NRC): The last NRC doctoral training ranking was published in 1995. Because of an administrative problem, data were submitted for only a few programs from UNM, and we are not entirely certain what was submitted about our department. Nonetheless, our program in ecology, evolution and behavior was ranked 47 out of 130 (The University of Utah was 25 and The University of Arizona was 20). Size of the faculty played a large role in that ranking, and we have fewer faculty in ecology and evolution than do departments dedicated to that area. The best single univariate predictor was Science Citation Counts per faculty member. The next set of NRC rankings are underway. Our department chose to be ranked in ecology and evolution. This resulted in the entire faculty being surveyed for this area, although not everyone works in ecology and evolution. In the last decade, there have been some highly cited papers produced by our faculty, we added another distinguished ecologist, and Jim Brown was elected to the National Academy. These will likely improve our ranking, but we won't know for about six months. While there is a good chance that we will improve this time, we will decline in ranking in this area in the next time period unless we make some significant changes. Our three distinguished professors in ecology and evolution are all likely to retire before the next round of NRC rankings and we have no current plans to replace them with senior hires.

U.S. News and World Report publishes an annual ranking of graduate programs, although programs in biology are ranked only by opinions of those in the field. We do not fare well in a general ranking of biology departments, ending up in 2007 in a tie for 105th. This is no surprise, however, given the size of our department. UNM's peer institutions with higher rankings all have more biology faculty, often found in two or three departments. *U.S. News and World Report* also gives a listing of top programs in ecology and evolution; we are not among the 13 they list, and a longer list is not published. Of the 13 published, eight are very well-known private universities

and the other five are very large public universities with far more faculty and resources than UNM. It is hard to know what to make of this list.

Within UNM Comparisons: Biology is unique among the sciences at UNM in its large number of majors coupled with a strong enrollment in service courses. Since the service courses are now handled very well by lecturers, we want to comment especially on the number of majors. The ratio of undergraduate majors to tenure-track faculty is far higher in the Biology Department than in any of the other science departments at UNM (Table 4). Having increased our number of lecturers does not solve the problem the high majors : tenure-track faculty ratio creates. Our majors are the students who need small, upper-division courses, access to research experiences in our labs, and mentoring from individual faculty. Obviously, our ability to do this is impaired by the high numbers of majors. No faculty member can have 38 students in his or her lab.

Table 4. The numbers of tenure-track faculty and majors in science departments at UNM.

Department	Tenure-Track Faculty, Fall 2007	Majors * from Jan. 2008 Hyperion Report	Ratio of Majors to Faculty
Biology	35.5	1348	38
Chemistry	16	289	18
Earth and Planetary Sciences (includes Environmental Sciences majors)	21	183	8.7
Physics and Astronomy	28	130	4.6

In addition to attracting many more majors than the other science departments, the Biology Department also has been successful in attracting minority and female students to the sciences (Figs. 20 and 21).

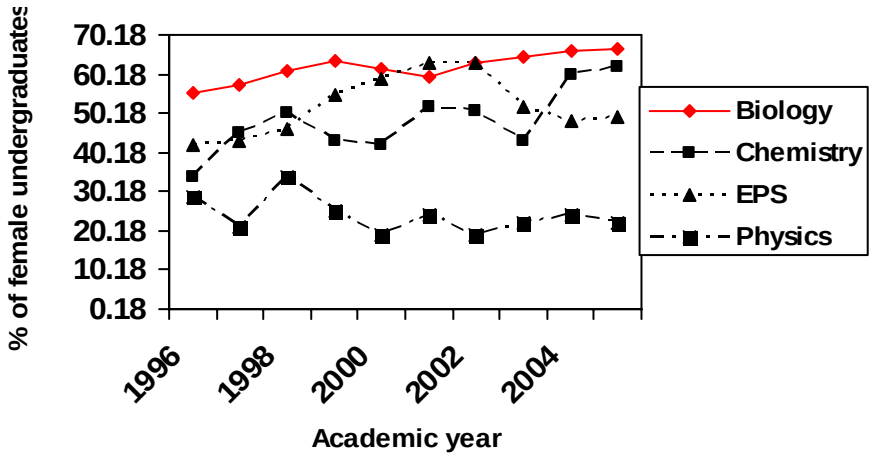


Figure 20. Percent of females among Biology under-graduates, 1996–2005.

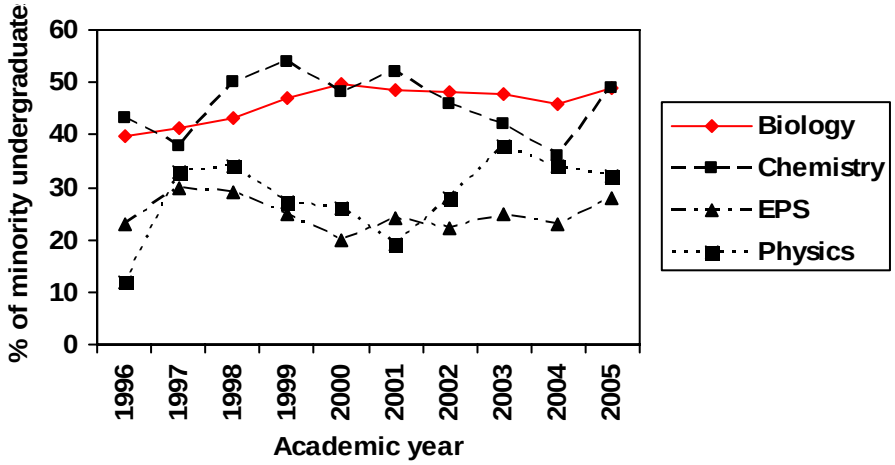


Figure 21. Percentage of minority students among Biology undergraduates 1996–2005.

In addition to the high proportion of minority students among our undergraduates, the number of minority students also is impressive. In 2005, we had 406 minority students among our majors. At the same time, the combined number of minority majors was only 103 in Chemistry, Earth and Planetary Sciences and Physics.

Student Credit Hours and Instructional Costs, UNM Departments and Peer Institutions: UNM spends less per student credit hour on biology instruction than is spent at our peer institutions or at Carnegie Research Universities. This is not a problem unique to the Biology Department as many departments in the College of Arts and Sciences face a similar shortfall. Among the sciences, UNM spends more per student credit hour on Earth and Plantetary Sciences instruction than is typical at our peers and nationally, but it spends less than other universities on all of the other sciences. Only two other departments at UNM have more than the national average of instructional spending: Anthropology and Political Science.

Table 5. Comparison of Instructional Expenditures per Student Credit Hour among Science Departments for Fiscal Year 2004/05. Source: 2005 Delaware Study of Instructional Costs and Productivity

Department	National for Carnegie Research Universities	UNM Peer Institutions	UNM
Biology	$203	$219	$194
Chemistry	$221	$265	$157
Geological & Earth Sciences	$225	$207	$262
Physics	$234	$291	$208

Table 6. Comparison of Student Credit Hour Production per FTE Faculty Member among Science Departments for Fiscal Year 2004/05. Faculty Include Tenure-track Faculty, Non-tenure-track Faculty, and Teaching Assistants. Source: 2005 Delaware Study of Instructional Costs and Productivity

Department	National for Carnegie Research Universities	UNM Peer Institutions	UNM
Biology	246	223	233
Chemistry	241	232	260
Geological & Earth Sciences	202	187	229

The Biology Department teaches more student credit hours per faculty FTE than our peer institutions, but this is also the case for other science departments at UNM (Table 6). We are able to do this because we have hired lecturers to teach the large sections associated with our non-majors courses. These lecturers have higher teaching loads than tenure-track faculty.

We are particularly interested in the ratio of majors to faculty members at our peer institutions. The data we have gathered suggest that our ratio of majors to faculty is high, even for a biology department (Table 7). This affects our ability to provide small, upper-division courses for majors and to provide significant research experiences to more than a small fraction of our majors.

Table 7. The number of Biology Faculty, Majors and the Ratio of Majors : Faculty at some of UNM's peer institutions.

University	Number of Tenure-track Biology Faculty	Number of Biology Majors	Ratio of Biology Majors to Faculty
UNM	35.5	1,348	38
University of Iowa	36	717	20
University of Utah	43	800	18.6
University of Missouri	42	1,050	25
University of Oklahoma–Zoology	35	1,000	28.6

The ratio of biology majors to faculty would be lower if we included lecturers in the counts. We have not done this for two reasons. First, we do not have comparable data for the other institutions cited. Second, and more important, for most of the lecturers, the primary role is in the non-majors curriculum. Of the 8.5 lecturers currently in the department, five never teach majors courses, one teaches primarily majors courses, and 2.5 teach half of the time in majors courses. So, the number of lecturer FTE's that could be assigned to the major's curriculum is 2.25. Adding that number to our tenure-track faculty produces a faculty : majors ratio of 36.2, still well above that of other institutions. Also, the lecturers, while helping to teach courses, cannot provide space in research labs for our students.

Salaries: Average faculty salaries at UNM remain below those of our peer institutions. A 2006 study done by the New Mexico Secretary of Higher Education indicated the following gaps in total compensation for UNM faculty: –$18,000 for professors, –$7,000 for associate professors, and –$6,000 for assistant professors. Thus, as has been the case for many years, the longer a faculty member stays at UNM, the greater the compensation gap becomes.

Average faculty salaries in the Biology Department actually decreased in the last year (Fig. 22), because of the retirement of more highly paid faculty and their replacement by new faculty at lower salaries.

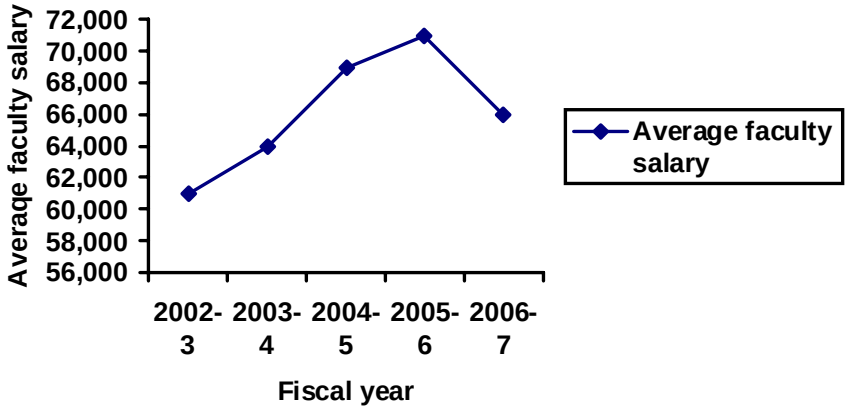


Figure 22. Average faculty salary in the Biology Department for the last five years.

In 2006–2007, the average faculty salary was $65,944. As a comparison from one of our peer institutions, in the same year, the average faculty salary in the Molecular, Cellular and Developmental Biology Department at Colorado University–Boulder was $87,128, and it was $88,308 in Ecology and Evolutionary Biology at the same institution. In all three departments, lecturer salaries were included in the averages.

RECENT PLANNING EFFORTS IN BIOLOGY

The most recent faculty retreat, held on March 5-6, 2004 at the Sevilleta LTER Field Station, was attended by 28 faculty members. The retreat focused primarily on planning for faculty hires and started with the following questions:

1. Do we want to grow?
2. Do we want to develop new areas?
3. Do we want to instead emphasize solidifying our existing areas?
4. Do we want to focus hires and develop a smaller number of concentration areas or do we want to remain broader? (See Appendix O for more details.)

Discussion ranged from budgetary issues, the need to consider special hiring opportunities that leverage large funding programs, the need to hire faculty that builds on our strengths and bridges between programs, the need to improve faculty diversity, and to consider the interests of our junior faculty.

A list of desired hires, in no particular order, included: animal evolution and behavior ecology; genetics of collective behavior; traditional “ologies”; an evolutionary developmental

biologist; a functional morphologist; cell biology; ecological genomics; stress physiology; plant developmental biology; and insect biology.

Since then, we have actually hired: two faculty members for the CETI Program; an ornithologist and an entomologist who are also museum curators; three ecologists and one evolutionary biologist who were special hires; and a mathematical biologist hired through the new B.A./M.D. Program. Currently, a cell biology faculty search is in progress. The lack of correspondence between the list generated at the retreat and the actual hires comes from the lack of new lines for hiring and the need to take advantage of special hiring opportunities to maintain faculty numbers.

In Fall 2004, the department was asked to plan around the themes of Success, Excellence and Distinction for an initiative in the College of Arts and Sciences (See Appendix O for complete reports). The first two themes related primarily to our educational mission.

The Plan for Success focused around our core curriculum. Goals to have automatic prerequisite checking and to have a permanent, full-time line for our staff advisor have been met. A proposal to require our students to take the Biology GRE for outcomes assessment (The Major Field Achievement Test is a more affordable alternative.) was not funded, and we are still searching for ways to assess the majors' curriculum.

The Plan for Excellence considered our needs for new teaching space (which is now available), for a new staff member to help guide students to field and laboratory experiences, for more modern equipment for teaching labs, for the desire to offer more small courses at the 300- and 400-level, and for more advising staff. We were able to raise the advisor line to full time and are purchasing some new equipment from our course-fees account. No university resources have been available to further these plans.

The Plan for Distinction discussed our faculty productivity and considered comparisons to other institutions. One goal was for the ecology, evolution and behavior program to reach the top 25 in the next NRC ranking, due this summer, and to retain that ranking in 2015. The data are submitted for the next ranking, but we will not know the results for several months. We lack specific plans to retain our rank. Concerns for the future centered around renovating current space and gaining new space and improving faculty salaries. There also were concerns about the declining graduate applications While we are making progress in obtaining new space, we need support from the university to address our concerns about salary.

CONCLUSIONS

The Department of Biology at UNM remains strong, contributing in major ways to the educational, research and service missions of the university. As in all previous reviews, our strength comes from the efforts of our faculty to work within the considerable constraints of low funding levels from the state and enormous demand for our courses. We are proud of our strengths, but have important concerns.

We are proud to have completely revised the core sequence for our majors in response to assessment of the program and of learning objectives. We are concerned about the coordination of the upper-division curriculum and about development of a new assessment plan.

We are proud of the strong non-majors courses built by our new cadre of lecturers. We are concerned about providing a career ladder for these valuable faculty.

We are proud of our graduate students and of their success in careers after leaving UNM. We are concerned about declining graduate admissions and will be actively implementing plans to increase recruitment effort and success.

We are proud of the accomplishments of our faculty, but are worried that numbers of tenure-track faculty have not increased significantly in more than a decade. Should we be able to increase faculty size, we need to think carefully about the organizational structure of the department.

We are proud of our strong reputation in ecology and evolution and our growing expertise in other areas. We are worried about maintaining the reputation we have, while also developing in other areas.

We are proud of our continued success in securing grant funding. The direct funds allow us to accomplish our research goals and those overhead funds that are returned to the department allow us to support faculty and staff. We are worried about the national climate for research funding and the potential for reallocation of overhead funds within the university.

We involve many undergraduates in research, but could do more if both the number of faculty and the amount of research space were increased.

We are delighted that space was renovated for the Museum of Southwestern Biology in the CERIA building and that our basement was renovated extensively to provide new teaching space. We are now commencing construction of an addition to our building that will add faculty research space. We still need to find funding for further renovation and maintenance of our existing space.