

Undergraduate Academic Program Review

Name of Program: B.S., B.A. Biological Sciences

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The programs are: Biological Science Bachelors of Science and Arts

I. Program Mission

NCA Criterion One: Mission and Integrity

Mission Statement: Main Campus: The Department of Biological Sciences is dedicated to the advancement and dissemination of biological knowledge. To fulfill this mission the Department supports research and instruction (baccalaureate and graduate level), as mutually reinforcing activities. The Department of Biological Sciences provides access to scholarship and learning, technological development, and cultural enhancement while fostering collegial involvement and responsibility for continuous improvement of education and research.

II. Program Description

NCA Criterion Two: Preparing for the Future

Program Description, Main Campus -

The Department of Biological Sciences curriculum offers a broad, integrated, in-depth approach to the life sciences. The programs require a balanced core of courses selected from several subject areas combined with elective courses from the various life science departments in the university. We offer several different programs to students including a Bachelor of Science and Bachelor of Arts in Biological Sciences, Bachelor of Sciences in Clinical Laboratory Sciences (previously Medical Technology), Bachelor of Science in Environmental Sciences, and Master of Science in Biological Sciences. A dual major with Chemistry is available as well. Students can now choose from three options within our Bachelor of Science in Biological Sciences; an exercise biology option, a preprofessional option, and a bioinformatics option.

Exercise biology consists of three major areas of study: exercise physiology, human motor behavior, and human biomechanics. This program is designed to promote and integrate scientific research, education, and practical applications of all aspects of exercise biology to prepare the undergraduate in fields of physical performance, fitness, health/wellness, and research. Course work and practical experience are designed with the latest American College of Sports Medicine objectives for comprehensive knowledge in the field. Outcomes of study include the opportunity

to take the American College of Sports Medicine (ACSM) and the National Strength and Conditioning Association (NSCA) certification exams.

The preprofessional option combines all the required courses of a professional school, which include one year of biology, two years of chemistry, and one year of physics, while using recommended courses as science electives to fulfill the bachelors program. Recommended courses include two quarter of human physiology, two quarter of biochemistry, a quarter of microbiology, a year of molecular biology, genetics, and cell biology, and a medical/scientific terminology course.

The bioinformatics track prepares students to assist in the application and development of computational tools and approaches used to acquire, store, organize, archive, analyze, and visualize dramatically increasing amounts of publicly available biological data. Students completing the program obtain a major in biological sciences and a minor in computer science as they develop an appreciation for the substantially different vocabulary and problem solving approaches used in both disciplines.

The B. S. curriculum also serves the needs of those students preparing for careers as high school (Adolescent/Young Adult) biology teachers. Under Ohio licensure requirements, preparation for this career includes an undergraduate degree in a subject area (such as Biology) followed by a year in the Education College for a Master's degree. Thus, students can, and probably commonly do, pursue the Biology B.S. curriculum without ever declaring intent for AYA education, and only make that choice or declaration upon graduation and subsequent application to the College of Education.

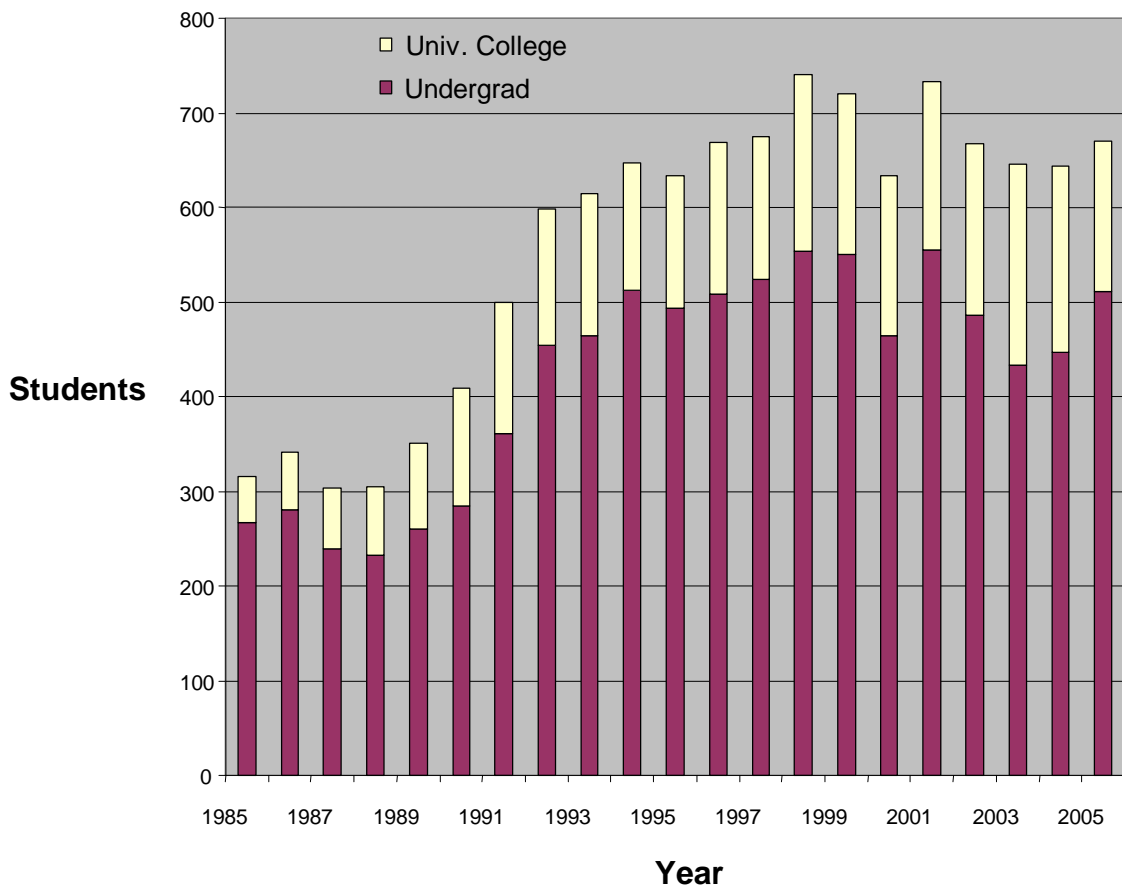
The department still maintains the Bachelor of Sciences in Medical Technology and Environmental Sciences however the Medical Technology has changed names to Clinical Laboratory Science. We now host a preparatory program in Allied Health areas to meet students' requirements to apply to those allied health programs. We have created a minor program, incorporating a flexible choice of courses from among our offerings, for those students in other departments who wish to focus some of their studies to the field of biology. For students who wish to teach biology or chemistry in Ohio public high schools, they can now pursue the B.A. or B.S. degree in biological sciences, and then upon completion enter the Professional Educators Program Master of Education degree through Wright State's College of Education and Human Services.

In 2000, the Microbiology & Immunology Department was disbanded and the faculty and offerings distributed among the life science departments of the College of Science and Mathematics. Biological Sciences gained one faculty member and the selected undergraduate courses from the M&I department. The pre-service course for the College of Nursing, M&I220 Microbiology of the Human Environment, brings approximately 300 pre-nursing student through our department every year. Moreover, we have defined a curricular option focusing on microbiology and immunology that incorporates the M&I courses now in Biological Sciences and other departments.

Number of students served, majored, and minored –

As mentioned previously, the biology department serves not only its own students but students across the university. In the academic year 1995/1996, we served approximately 1500 students through our general education courses, anatomy and physiology, and genetics for health professionals. In 2005/2006, we served close to 2,000 students with the same courses plus the addition of M&I 220, (Microbiology of the Human Environment, for pre-Nursing students) and “Concepts in Biology” courses, BIO 345 & 346 (for education majors studying to be early childhood and middle school teachers).

Student Enrollments (Figure 1)



Student enrollment has nearly doubled from their numbers 20 years ago (Fig. 1). Moreover, after a dip from the peak, the number of declared majors in Biological Sciences has been increasing again in recent years. For two reasons, we anticipate that this latter trend will continue. First,

University College tells us that the number of students expressing interest in life sciences is growing. Second, and perhaps more importantly for projecting into future years, job prospects in life sciences are strong. In a recent Money magazine listing, more than a quarter of the top 50 best jobs, ranked on salary and job prospects, were in life sciences. Likewise, the Bureau of Labor Statistics (BLS) projects that medical-related jobs will constitute seven of the top ten fastest-growing job areas in the sciences. For college students deciding which professional path to pursue, or anyone considering a change of career, labor market trends provide valuable insight into earnings potential and future demand. In the coming years, job seekers in the health-care and information technology fields should be best positioned. "As the population gets older, there is a higher demand for all types of health care services, so more workers are needed," says Debra Stock, vice president of the American Hospital Association in Chicago. "The other thing fueling demand in the industry is the fact that many current health care workers are getting older themselves and starting to retire. You put those two trends together and it means huge opportunity in terms of employment."

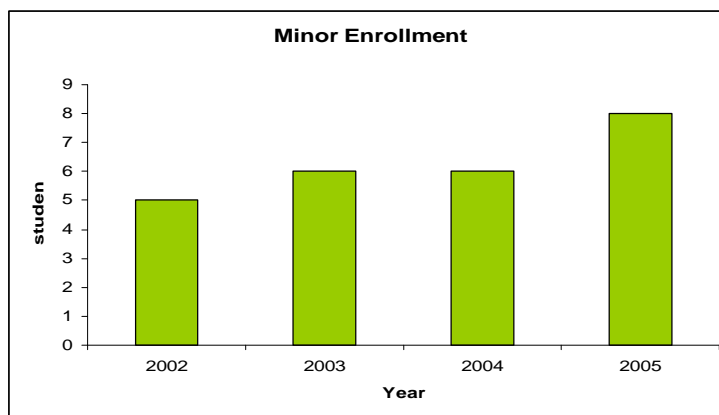
Network systems and data communications analysts, the second-fastest growing occupation on the BLS list, will increase 55% in employment between 2004 and 2014. This area includes bioinformatics, a new option within our Bachelors of Sciences. Occupations that appear just below the top 10 include: network and computer systems administrators; database administrators; physical therapists; forensic science technicians; veterinary technologists and technicians; and diagnostic medical sonographers. Education for five of these six fields may begin in our science programs.

Momentum also is strong for environmental engineers; teachers (preschool and postsecondary); cardiovascular technologists and technicians; hydrologists; computer systems analysts; hazardous materials removal workers; biomedical engineers; employment specialists; and paralegals. The BLS projects these occupations will grow roughly 30 percent during the 10-year period.

Based on the number of entering student who are identifying an anticipated major in biology and the job trends identified by the BLS, we expect our enrollments to continue to rise.

Enrollments in our minor program are relatively small (fig. 2).

**Departmental
minor enrollments
(Fig. 2)**



However, they have continued to slowly increase since the program's inception. Because our efforts to communicate information about our programs are improving, including newsletters, email distribution lists, and web site, we anticipate the program will continue to grow.

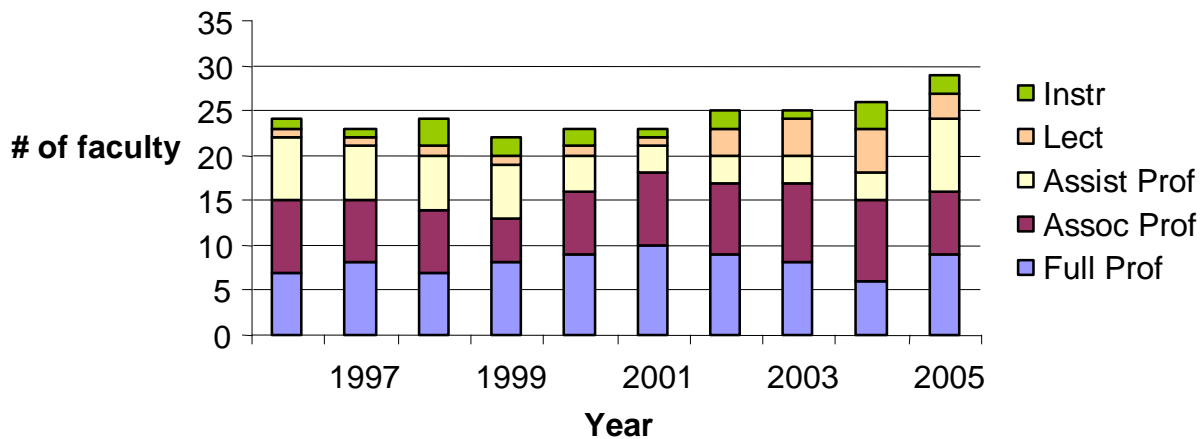
Student Gender/Diversity –

Information regarding student gender, ethnicity, race, and full vs part time status, is listed in appendix A.

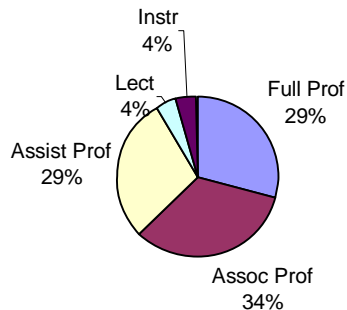
Departmental Faculty –

As shown in Figures 3, 4, & 5, numbers of tenure-track faculty and their proportion relative to Instructors and Lecturers vary year to year as the department hires new faculty.

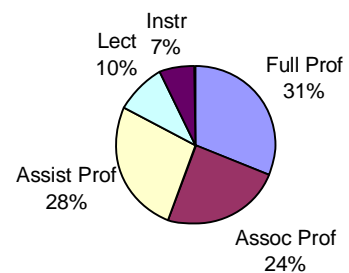
Total Number of Faculty (Figure 3)



Proportions of Faculty 1996 (Fig. 4)



Proportions of Faculty 2005 (Fig. 5)

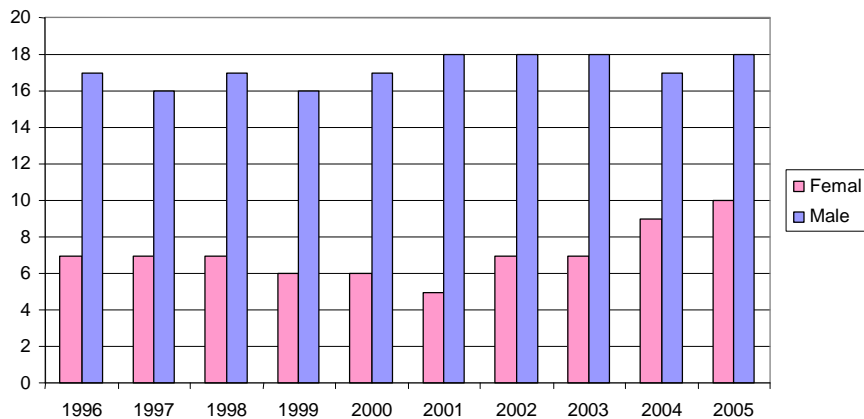


It appears from figure 3 that we have experienced a recent small rise in the number of faculty. However, this really represents almost entirely a filling of a series of positions that were vacated because of a combination of retirements, promotions, and occasional departures, and indeed the number of faculty is little increased now compared with 20 years ago. At the same time, the demand for instruction has grown markedly. As noted above (fig. 1), undergraduate enrollment has increased substantially in that time frame. So too has the diversity of our offerings, as we have added an exercise biology program (growing in popularity) and programs in bioinformatics and in microbiology and immunology. In addition, we now participate in an increasing number of graduate programs beyond the long-standing Biology MS and Biomedical Science PhD programs, including the Microbiology and Immunology M.S. program, which rests in large part in the Biological Sciences department, and, prominently the Environmental Sciences PhD program. Thus, the demand for undergraduate and graduate instruction has continually increased. Graduate instruction probably suffers the most from this; the demands to staff our undergraduate curriculum severely limit the number of graduate offerings we can accommodate. A related problem is that attracting strong graduate students to these M.S. and PhD programs requires having strong foci of research faculty in various areas related to the graduate program, adequate both to provide a strong base for training and to garner adequate resources (funds, equipment). This is exceedingly difficult with the number of faculty available relative to the number of programs in which we participate.

Diversity –

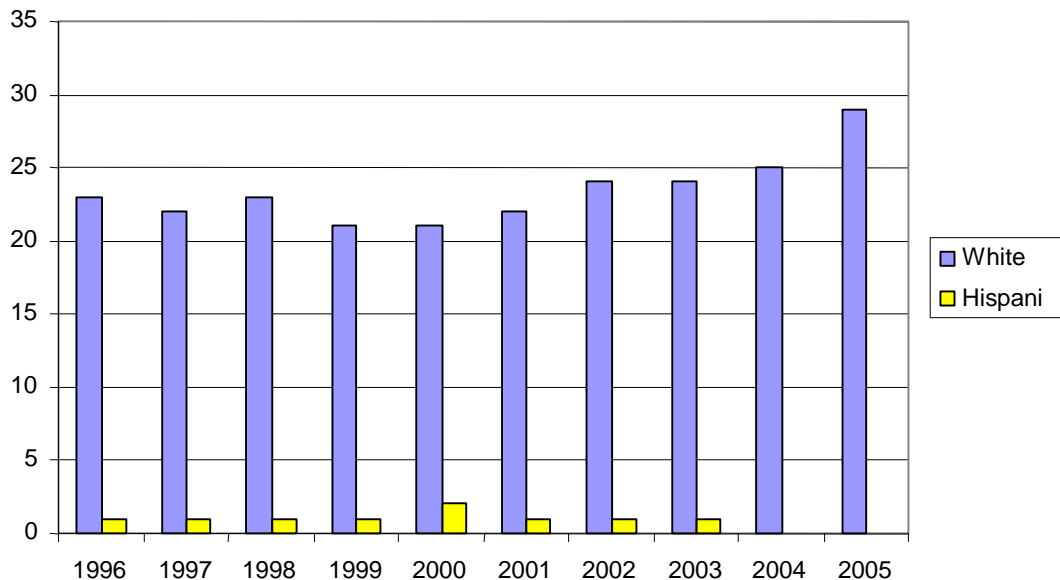
The Biology Department has had unusual success for a science department in hiring female faculty in recent years, and indeed five of the last six tenure track faculties hired have been women (Fig 6). In 1996 just 4 of the female faculty were tenure-track, by 2005 that increased to 7 (and to 8 at the start of 2006). Thus, the representation of women among tenure track faculty in the department now significantly exceeds their proportional representation in the applicant pool.

**Faculty Gender, all faculty (Tenure-track, Lecturers, and Instructors)
(Figure 6)**



In contrast, we do not have an ethnically or racially diverse faculty, and efforts to hire an African American faculty member have proven difficult and to date unsuccessful (Fig 7).

**Faculty Race
(Figure 7)**



Although we have interviewed several non-White faculty in the past 10 years, and made offers of jobs to some of those, we have been unsuccessful in increasing the ethnic/racial diversity of the faculty.

Budget –

The operating budget for the Department has remained largely unchanged for approximately 15+ years. However, the cost of scientific supplies, including those needed to teach our classes, has risen substantially during that time, indeed much faster than the cost of living generally or than the rise in tuition over that same time frame. Thus, in 2001/02, we decided that we could no longer afford to operate on that flat budget, and we implemented the only remedy available to us, a laboratory fee of \$15/credit hour for all of our laboratory-based classes. That fee is about as low as we could make it, but it has added importantly to our ability to fulfill our mission. The revenues have helped us to upgrade, repair, and diversify our laboratories, including addition of more modern instrumentation and techniques, and they have allowed us to re-institute elements of professional development that are critical to our abilities to keep current, such as a vigorous seminar program and some conference travel support. We have not increased the laboratory fee since it was instituted five years ago. Thus, we continue to evaluate the revenues from those fees relative to the actual costs of running our programs.

Average Class Size –

The department offered 19 courses to undergraduate students in 1996 and 11 courses to graduate students. In 2005, we were able to offer 29 courses to undergraduates and 17 to graduates. The table below lists the class averages by 100, 200, 300, 400, and graduate levels. The average class size in the freshman courses has averaged 400 students in the past ten year. This is primarily due to the maximum capacity of the lecture halls and the number of laboratory sections we can safely

offer. Our freshman labs begin at 8:30 AM and don't end until 6:00 PM with some evenings running until 9:30 PM. We limit the number of students per section to 28 for safety and educational reasons (though they commonly over-fill to 30). Courses at the 200 level have increased in enrollment and class size. Many of these are laboratory classes, and so enrollment is limited by enrollment restrictions on lab sections and by availability of GTAs to staff those laboratories.

Class Avg. (Table 1)

Level	1996	2005
100	394	404
200	55	96
300	30	32
400	23	13
graduate	6	6

In general, we would like to advocate smaller class sizes. Laboratories should be limited to 20 - 24 for effective teaching by the GTAs, especially as we work to implement more investigative laboratories. In lectures, we have several faculty working to implement team-based learning, which appears to be both popular and effective; however, this is a real challenge with the large classes we teach. Many of our classes should have more substantial writing assignments, but faculty may be dissuaded by the large classes.

Facilities and equipment/Instrumentation –

The Biological Sciences building, completed in 1975, contains approximately 100,000 square feet and houses facilities of the biological and health sciences departments. The building is showing signs of age, both in basic structure (e.g. leaks from the roof) and in utilities (absence of emergency power, erratic climate control). The forthcoming renovation is most welcome. The Department is well equipped with research instrumentation. Some instruments are under the responsibility of individual users, while others are shared by the department. The department maintains classrooms and research laboratories for over 150 upper-division and graduate students. Excellent auxiliary facilities include specialized instrument rooms, cold rooms, constant temperature rooms, animal rooms, a greenhouse, radioisotope laboratories, and an electron microscopy center, including complete darkroom capability.

Major items of available research equipment include liquid scintillation counters; amino acid analyzer; infrared, visible, and ultraviolet spectrophotometers, spectrofluorometer; DNA and protein chip technology; flow cytometer; confocal microscope; greenhouse and experimental garden; field and aquatic sampling gear; preparative ultracentrifuges; nuclear magnetic resonance spectrometer; mass spectrometer; a wide range of instruments for light microscopy; transmission and scanning electron microscopes; preparative and analytical chromatography instruments; specialized cell and tissue culture facilities, and facilities for recombinant DNA research; and computer services (both individual and centralized).

A biological preserve plus additional wooded areas on campus totaling about 200 acre provide opportunities for field-oriented research and teaching experiences. Nearby natural areas include an extensive wetlands and a wide variety of aquatic habitats.

The department has excellent working relationships with other department on campus with the scientific complex of Wright-Patterson Air Force Base, and with several facilities that are affiliated with the Wright State University School of Medicine.

Beginning summer of 2006, the College of Science & Mathematics will be starting a major renovation (Table 2.). Construction of the new biology building is scheduled to begin in summer of 2006, and renovation of the existing building in spring of 2008.

Projected Timeline for Renovation (Table 2).

PROJECTED SCIENCE LAB RENOVATION PROJECT SCHEDULES																											
Project	2005			2006				2007				2008				2009				2010				2011			
	Spr	Sum	Fall	Wint	Spr	Sum	Fall	Wint	Spr	Sum	Fall	Wint	Spr	Sum	Fall	Wint	Spr	Sum	Fall	Wint	Spr	Sum	Fall	Wint	Spr	Sum	Fall
Brehm Lab Reno	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Oelman Hall Reno																											
New Bio. III Bldg.	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Bio. II Reno																											
Bio. I Reno																											
Design/Bid	■																										
Move	■																										
Construction	■																										

Table 3 provides the current square footage and that projected after renovation.

**Space Summary
(Table 3)**

TYPE	EXISTING (square foot)	NEW (square foot)
TEACHING General & Dedicated	35,326	43,203
FACULTY/ RESEARCH	82,706	101,409
STUDENT 'LOUNGE'	1,222	7,974
TOTAL	119,254	152,586

III. Program Effectiveness

NCA Criterion 3 Student Learning

NCA Criterion 4 Application of Knowledge

Program Assessment -

Our program consists of:

- ✍ University requirements of general education,
- ✍ One year of general biology,
- ✍ One year of molecular/cell/genetics plus one quarter each of ecology and organismal physiology,
- ✍ One quarter senior capstone course,
- ✍ Forty quarter hours of life science electives,
- ✍ Two years of chemistry, including general and organic,
- ✍ One year of physics.

Our department administers an exit questionnaire completed by seniors prior to graduation which include questions regarding their experiences during their academic career and what knowledge they feel they have taken away with them. Students clearly were pleased with the quality of education afforded them; greater than 80% of the students agreed or strongly agreed that they

came away from the core curriculum with a good understanding of that subject matter. Moreover, 95% agreed/strongly agreed that there was a high quality of teaching in these courses, 87% were satisfied with the depth and breadth of the information/skills learned, and 98% agree/strongly agreed that the faculty was fair in evaluating their performance.

Students obtain a diverse biological background within our departmental courses and are able to successfully advance their knowledge through a variety of upper level life science electives. Seventy-five percent of our students agreed/strongly agreed that a sufficient number of courses were offered within their specific area of interest. Students have the opportunity to enroll in independent research courses throughout the year. The availability of opportunities for mentored independent research is one of the strengths of our program, and for those students who took advantage of these courses; it has served as a valuable experience with increased opportunities in graduate work, acceptance into professional schools, and beginning a career.

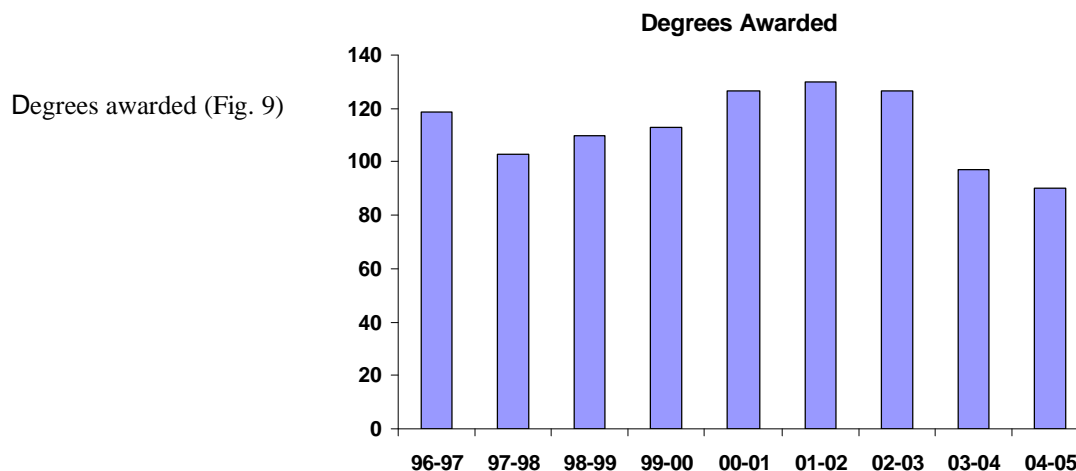
The data received from graduating students illustrates that the primary area of biological interest is preprofessional (33%), followed by environmental/ecology (24%) and cell/molecular (21%). Future career choices for graduating students were 36% professional school, 37% graduate school, 20% employment in the biological field, and 7% in an unrelated field. We are now collecting, via exit and alumni questionnaires implemented as part of an enhanced assessment program, data on the success of students in achieving those career objectives; those data are too few to analyze at this point.

Alumni surveys -

The departmental alumni survey is in its infancy. The relatively few surveys we have collected from our alumni reveals that many of our graduating students are employed; however, only about half of them who entered jobs directly from their undergraduate degrees have jobs related to their area of study and few of them were satisfied with their starting salaries. These data reinforces the importance of obtaining a graduate or professional degree within the areas of science. The baccalaureate degree provides a solid foundation in biology that can be used towards graduate or professional programs in research and allied health-related fields.

Degrees Awarded –

The number of B.S. degrees awarded has decreased slightly over the last couple of years (Fig. 9).



This decrease follows the decreased number of declared majors in 2003/2004. We anticipate that the trend will shortly begin to reverse, again following the increasing number of declared majors in recent years (Fig. 1). These shifts might in part reflect changes in different areas of study. For instance, we have seen a dramatic increase in our Exercise Biology enrollment over the last two years.

Integration of technology into curriculum and instruction –

Coursework in Biological Sciences incorporates technology in the classroom in a variety of ways. Virtually all classes use electronic media of some sort for transmitting course materials. Electronic reserves through the library, WebCT, and Banner all provide means of giving students access to syllabi, electronic presentations, assignments, readings, grades, chat rooms, and more. This has simply become the norm for most classes, and has been assisted by the increasing access to computers and wireless access on campus and of classrooms across campus that are equipped for multimedia.

In laboratories, students use a diversity of instrumentation. Centrifuges, spectrophotometers, fluorescence microscopes, PCR instrumentation, physiological transducers, and others are a part of the investigative laboratories associated with many of our classes.

Students more and more come to us familiar with a variety of software programs, particularly for word processing, spreadsheet, and presentation. Nevertheless, we continue to offer instruction and guidance in these media when they are needed, such as for analyzing data and formulating graphs in laboratories.

The Biology Department has offered a limited number of courses on-line. In particular, our Medical Terminology class has been very popular in this format. Occasionally a seminar has also been offered on-line. Nevertheless, faculty continue to believe that face-to-face instruction remains the most effective.

Description of how program ensures that it is always current –

For some of our programs (e.g. Environmental Health and Clinical Laboratory Science), periodic review by accrediting agencies provides external assurance of currency. Additionally, a departmental seminar program brings in experts from across the country, typically nearly every week of the academic year, to speak on their research; most faculty attend these seminars, which provide insights into current research in diverse areas of biology.

To a large extent, we rely on faculty to remain current in their fields. All departmental faculty regularly attend meetings of professional societies related to their teaching and research; the department provides funding for one or two such meetings per year per person. Moreover, productivity in research (funding and publishing) is the most important criterion for promotion,

and all faculty are actively engaged in their areas of specialization; quite a number are national or international leaders in their fields.

Research funding by departmental faculty has averaged about \$1 million per year. In the most recent year (2005-06), new grants have already been awarded from the National Science Foundation (3 grants totaling nearly \$1 million), from the National Institutes of Health (a five year award totaling nearly \$2 million), and from the Ohio Department of Education for \$200,000. Sources of that support in recent years include the National Institutes of Health, National Science Foundation, Environmental Protection Agency, Department of Agriculture, Ohio Plant Biotechnology Consortium, and many others. The results of that research are communicated via numerous conference presentations and publications in journals and books. For example, in each of 2004 and 2005, faculty authored 58 refereed publications and book chapters. Thus, the faculty in Biological Sciences are active in research on the national and international level, and our students benefit by receiving the most current perspectives on the field.

Comparative advantage -

Advantages offered by our programs include the ready access to research faculty for undergraduate students, including opportunities to work in research laboratories alongside faculty, post-doctoral students, and graduate students; the breadth of our programs; and the close physical proximity and collaborative association with the medical school faculty.

NCA Criterion Five: Engagement and Service

Community and Professional Engagement –

Departmental expertise is extended to the community in diverse forums. We participate in community events (e.g. Tech Fest, Science Fair, Take our Sons and Daughters to Work Day), consult on various initiatives (from wetlands conservation to allergies), and speak to community groups. Several of our curricula (Exercise Biology, Environmental Health, and Clinical Laboratory Sciences) require internships, and student interns often continue working with the same employers upon graduation.

In 2004 and 2005, departmental faculty and students presented 128 conference presentations and invited talks. We hosted one national symposium each year on “The Science of DNA Profiling” which was attended by nationally recognized scientific experts and attorneys as well as 110 attendees and media. Each year the faculty were involved in numerous outreach programs consisting of guiding science fair students, career nights at surrounding high schools, and numerous workshops.

Departmental faculty hold positions of prominence in national and international scientific organizations, including societal officers, journal editors, advisory board members, and grant review panelists. In each of 2004 and 2005, faculty sat on 5 editorial boards of professional journals, and were members of 9 granting agencies, including National Institutes of Health,

National Science Foundation, Environmental Protection Agency, and American Heart Association.

Program Needs/Areas of Improvement -

The Department of Biological Sciences offers a strong educational and research environment. Nevertheless, we recognize several areas worthy of improvement. As the modern economy continues to depend increasingly on a college-educated population, particularly in the sciences, it is likely that the main campus will also grow. Additional courses will need to be offered to meet this growing concern and thus additional faculty members may need to be hired to eliminate the dependence on adjunct faculty.

We continue to face issues relating to the educational preparedness of our undergraduates. It will be a challenge both to provide teaching and curriculum that interfaces with the diverse and often under-prepared students who come to us while still allowing them to progress to the level where they are competitive for excellent post-graduate opportunities. This issue likely requires a multi-pronged solution. We would like to help our students become better prepared for our courses, and this might involve enhanced communications with secondary schools, better informing them of the needs for succeeding at college-level science, as well as the possibility of strengthening the requirements for entering our classes and our major. For students in the classes, we would like to offer enhanced supplemental instruction (we are exploring, for example, the implementation of a prerequisite math placement level prior to entering our introductory course sequence). We need to maintain and enhance our communications and coordination not only with secondary schools, but also with local community colleges, particularly Sinclair CC, and with University College advisors on campus. Likewise, our students benefit from internships that provide practical work experience, and we can enhance our partnerships with scientists in industry and government.

The support for research also demands improvement and vigilance. This includes both physical infrastructure—improved building, continuous updating of equipment—and the enhancement of our graduate student population, in numbers, geographic representation, and educational preparedness. The graduate students provide both colleagues and teachers for our undergraduates, and so the strength of the graduate program also has important influences on the undergraduate program.

In support of these various initiatives, it is important that we improve our contact and interactions with alumni. The Department has many alumni who have advanced to positions of prominence in the Dayton area and beyond. These alumni can provide expertise, advice, inspiration, and potentially financial or in-kind support for our students and our programs.

Proposed Improvement Action Plan and Resource implications -

The Department will continue to improve communications between its faculty, staff and students by distributing a departmental newsletter and maintaining a website that provides information for

current and future students as well as continuous updates of faculty and student achievements, including grants and scholarships. Meetings with students and the Department Chair will be offered on a regular basis to provide a forum for discussing courses, scheduling and other events within the Department. Communications between faculty at the Lake Campus and those at the Dayton Campus will be improved by working with the Lake Campus Administration and Department Chair of Biology at the Dayton Campus to create a better means of collaboration and communication. This could be accomplished by having faculty from the Lake Campus appointed to active committees with the Department of Biology; having faculty from the Lake Campus attend professional development sessions held by the department; and working with department advisors and student groups at the Dayton Campus to assure the students transition and continued development in their major.

The Department is working at recruiting students within the Biology degree to complete independent research as part of their life science electives requirement. Faculty members are encouraged to advertise projects for undergraduate students to apply for in their labs. In addition, advisors and faculty members also work with students in finding internships or co-ops outside of the University.

The Department will work towards developing an Alumni Speaker series where alumni from the Department are invited to speak to the students about their careers. This will better educate our students about the variety of career opportunities available as well as build a stronger connection between the Department and the alumni.

As we look forward to continuing expansion of our programs, we recognize that there are bound to be resource implications. For example, we anticipate increased enrollment not only among our majors, but also in our service courses (including General Education Bio 105, 106, and 107, Nursing Microbiology, and Science Education Bio 345 and 346; the latter two programs have been expanding rapidly, and Gen Ed is likely to expand along with the University's objective of increasing overall enrollment by 10%). All of these classes are laboratory based, and so their expansion requires both supplies and teaching assistants that come from the same pool of resources as our other curricular offerings.

Accomplishing our objectives would be greatly assisted by augmentations to our personnel. These needs fall into several categories. As described above, our involvement with an increasing number of graduate programs, and also the large number of undergraduate majors and large class sizes, argue for additional *faculty* lines. This would allow us to establish research focus groups, enhance research funding and graduate support, teach smaller classes, and rely on fewer adjuncts and instructors. Note, too, that an enhanced research environment and graduate program has direct benefits for the undergraduates, whose opportunities for training are directly proportional to the activity in those other areas. Perhaps the other most important personnel need is for additional teaching assistantships. Currently we hire several adjuncts each quarter to assist with our laboratory classes. In addition, graduate programs compete against each other for student support. Additional *teaching assistantships* would benefit both the quality of our teaching and the quality of our graduate programs. The graduate students could be involved in part with the supplemental instruction described above as a component of our initiatives for improving success

of our students. Additional *staff* positions could also be beneficial, assisting with initiatives like alumni outreach, graduate recruiting, and technical support for research and teaching laboratories.

As all of these changes are implemented, we will continue to gather information on effectiveness through our assessment program. To do so requires gathering of a variety of data, including, for example, results achieved on standardized tests like GRE, MCAT, VCAT, DAT, etc, as well as successes of students in gaining admittance to graduate and professional programs and other post-graduation activities. Gathering these data (the time to collect and analyze them, and potentially costs to acquire certain test scores) may also entail some resource implications.