

**Department of Biological Sciences**  
**2004-2005 Annual Report**  
**July 31, 2005**

## **INTRODUCTION**

In 2004, the Department of Biological Sciences drafted a new strategic plan for the future of its research and teaching programs. Faculty hiring within the department became fully integrated into the College of Science's cluster hiring process, resulting in excellent candidates in our searches, and success in hiring. Following several years of reduced or flat budgets, new resources were available to reinstate teaching programs that were previously cut or in danger of being lost. The department made progress toward its goals of increasing research, growing its graduate and postdoctoral programs, and meeting a higher demand for undergraduate education in biological sciences. This year, we conducted our second annual research day event, which included invited presentations by star graduate students, poster sessions, and a plenary talk by a former graduate. In attendance at this very successful event were faculty and students from the department, graduate student recruits (most of whom chose to come to Virginia Tech), and representatives from our Alumni Advisory Board, who donated cash awards for the best presentations. The department has initiated new activities to build a multicultural environment, including the establishment of a diversity committee, and new activities including a sociometric workshop for faculty, and an international day lunch. Finally, in an action that symbolizes the complexity of the programs now in our department, the name was changed from Department of Biology to Department of Biological Sciences.

## **A NEW STRATEGIC PLAN FOR RESEARCH, TEACHING AND FACILITIES**

### ***Introduction and goals***

One of the most significant activities in the department this year was the development of a new faculty hiring plan. Faculty worked from late spring through fall semester to completely rethink how the department defines itself and sees itself in the future. The first and most crucial steps in this process were to develop a vision for faculty hiring and for the facilities that the faculty will need. The following goals were used to develop the plan:

- Achieve national prominence in scholarship and teaching
- Strengthen Virginia Tech research in several strategically important areas (e.g., biomedical, nano-biotechnology, environmental)
- Contribute \$30 million to Virginia Tech's annual research revenues from extramural research and training grants by 2010

The third goal is ambitious in light of recent budget reductions within federal agencies that provide research funding. However, if faculty can be hired to build research clusters capable of competing for large, multi-investigator grants, significant increases in research funding are likely.

The plan calls for growth in faculty FTEs from 40 in 2004 to 70 by 2010. Hiring will be focused in three major areas of research with highest potential for us to reach national prominence in scholarship, and in teaching specialists to enhance the quality teaching and develop scholarly programs in the study and application of teaching methods. The plan also proposes new strategies for adding and modifying building space to meet program needs, and a new faculty leadership model to manage research and teaching programs.

### ***Three areas of research emphasis***

- 1) *Cell regulation and signaling* (Figure 1), takes a subcellular view, and aims to uncover the fundamentals of host – pathogen interactions, biochemical controls of cell division, communication between different biochemical pathways and between cells, and the process of development. The focus of this group is largely on the interactions between major classes of biochemicals (DNA – RNA – Proteins – Substrates), which is known as “systems” biology. When combined with research conducted within single classes of biochemicals (Figure 1), the fundamental discoveries made by this group will be useful for controlling infectious disease and cancer.
- 2) *Integrated Behavioral and Organismal Biology* (or IBOB) researchers will use physiology, population biology and ecology to study vertebrates (mammals, birds, reptiles, etc.) and organisms that interact with vertebrates (Figure 2). This group will investigate behavior, evolution and disease epidemics, to solve problems in conservation and public health.
- 3) *Ecosystem processes at the aquatic/terrestrial interface*. This group will consider how terrestrial and aquatic ecosystems are linked (Figure 3). Nutrient cycling, aquatic-terrestrial interchanges, and the influences of human social and economic systems on natural ecosystems will be investigated to solve problems with water quality, public health, and global climate change.

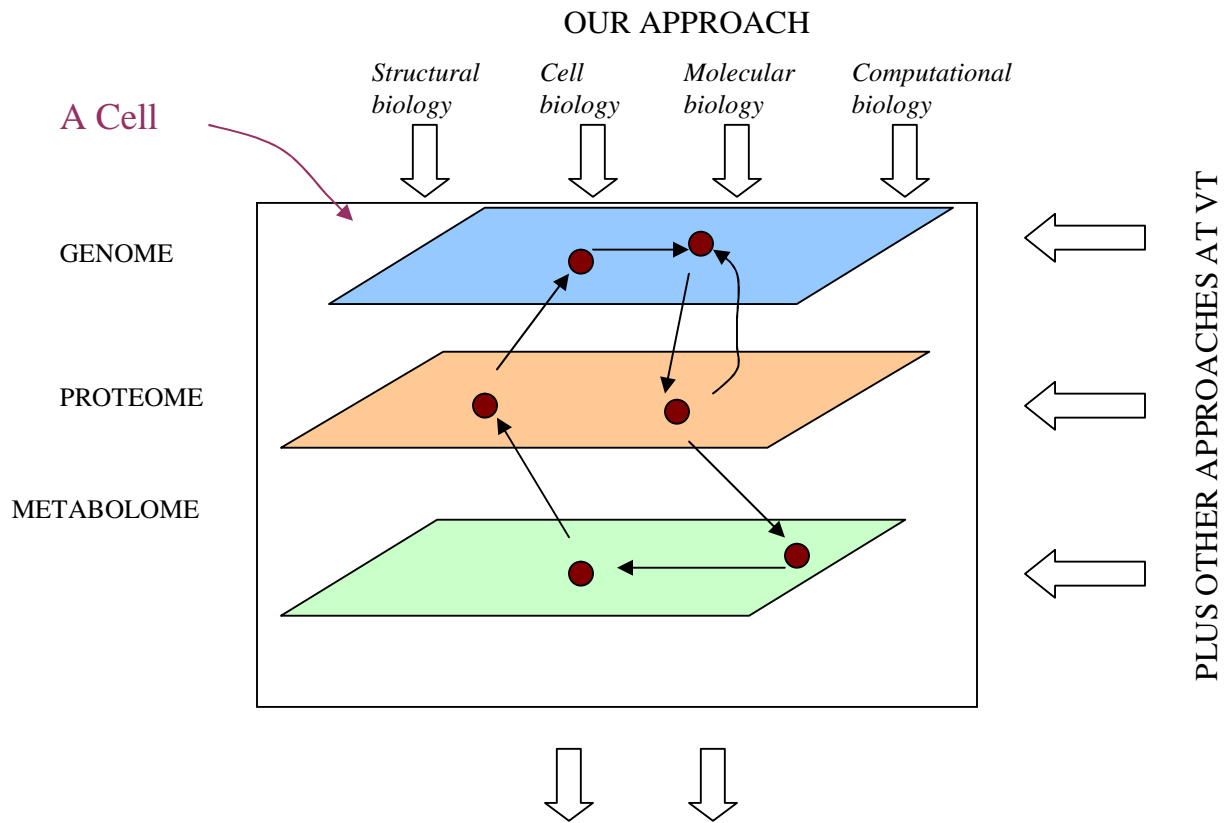
### ***New teaching program***

At present, all faculty members in the department, except non-tenure track instructors, are expected to both teach and conduct research. However, with growing numbers of undergraduate majors, and opportunities for funding in educational programs, a new teaching thrust area is proposed. New hires will include instructors to handle some of the routine lower division courses, and new tenure track faculty who will specialize on the scholarship of teaching and learning in biological sciences.

### ***Faculty hiring schedule***

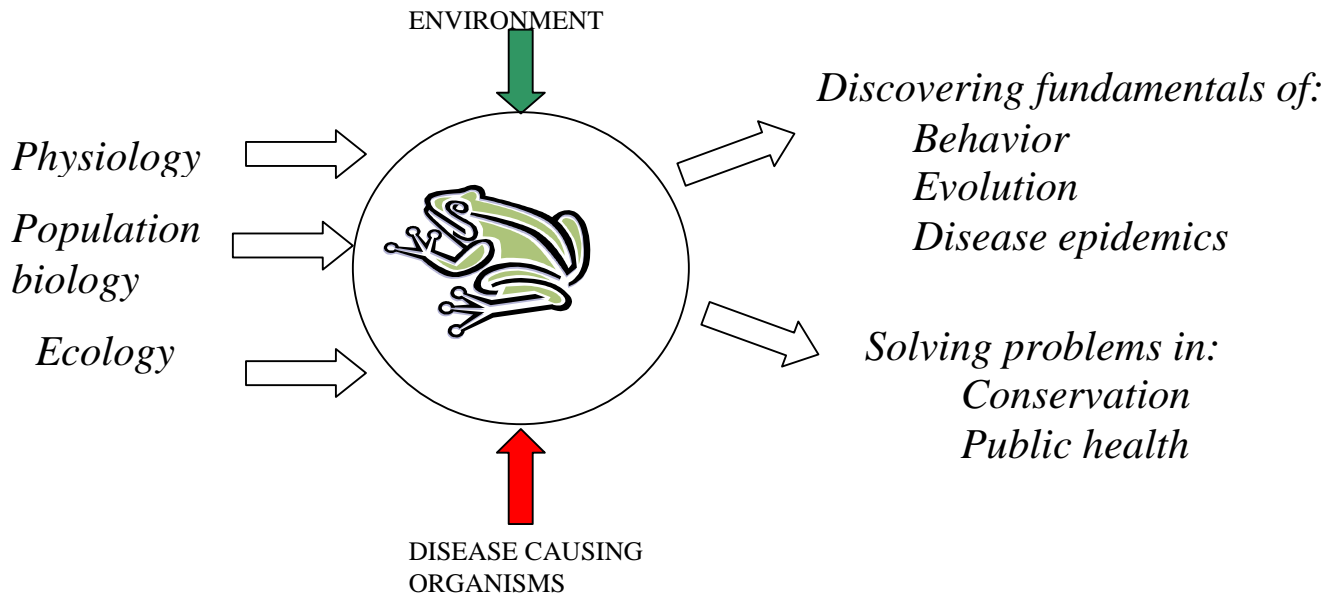
The department currently has eleven faculty over 60 years of age, which means that about two will retire per year over the next five years. To reach the goal of 70 faculty by 2010, a net growth of 30 FTEs, or six per year, is needed. Thus, a total of eight hires per year (2 to replace retirements and 6 additional), would be needed. Hiring at this rate is very difficult due to the complexities and costs of each hire. So, reaching 70 by 2010 is a stretch goal. However, it is clear that major hiring will occur, and this affords an opportunity to rapidly grow in the four target areas (three in research plus one in teaching). A schedule of proposed faculty changes is listed in Table 1.

**Figure 1. Model of the cell regulation and signaling emphasis area**

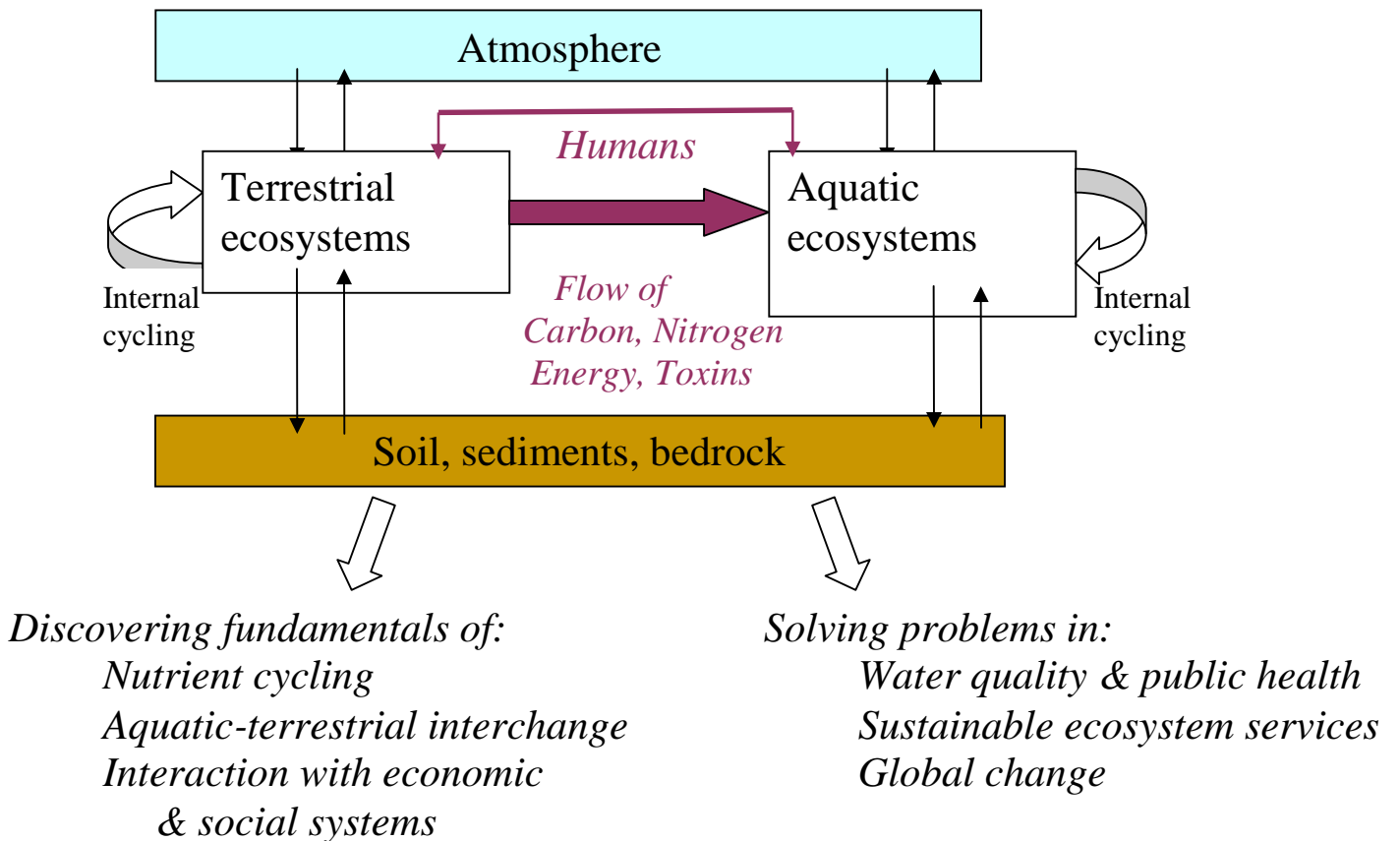


*Developing a systems level view of:  
Host – pathogen interactions  
Cell cycle regulation  
Intra- and inter-cellular signaling  
Microbial differentiation*

**Figure 2. Model for integrative behavioral and organismal biology emphasis area**



**Figure 3. Model for ecosystem processes at the aquatic/terrestrial interface emphasis area**



**Table 1. Changes in faculty expertise needed to meet targets in strategic hiring plan.**

<b>Faculty Group</b>	<b>Current (2004)</b>	<b>Target (2010)</b>	<b>Notes</b>
(1) Cell regulation and signaling	TOTAL = 16 5 microbiologists 4 cell biologists 8 computational plus other molecular*	TOTAL = 38 12 microbiologists 12 cell biologists 14 computational plus other molecular*	(a) focused to support biomedical & biotech research (b) Existing cluster hiring = IBPHS and Nano
(2) Integrative behavioral and organismal biology	8 vertebrate biologists	13 vertebrate biologists	(a) focused to support public health and conservation research (b) new cluster being proposed
(3) Ecosystem processes at the aquatic/terrestrial interface	6 ecologists	12 ecologists including microbiologists &/or mycologists & plant scientists	(a) focused to support sustainable systems & global change research (b) new cluster being proposed
Other existing faculty	8 in sub-disciplines not strongly related to thrust areas 1-3	0	(a) with retirements, we will redirect hires into our four thrust areas
Instructors and dedicated teaching scholars	4 FTE	7 FTE	When possible, use senior faculty retirements to support instructor hires
<b>TOTAL</b>	<b>40</b>	<b>70</b>	

\* other molecular = virology, immunology, yeast and plant systems

***Plans for new space***

For many years, the department has been limited by a lack of quantity and quality of research and teaching space. A new building (Life Sciences I) now being planned and slated for opening in spring 2007, will provide space for as many as 14 faculty, many of which are likely to be from the Department of Biological Sciences. Ultimately, another new life science building will be needed to co-locate all of the department's research programs. Until then, a proposed schedule that uses building space in the Corporate Research Center (CRC) has been proposed (Table 3). The university is currently working on methods to create and pay for additional space in the CRC.

**Table 3. Proposed distribution of faculty across buildings**

<b>Building</b>	<b>2004-2006</b>	<b>2006-2008</b>	<b>2008-2010*</b>	<b>2011+</b>
CRC – Old Building	7	0	0	New Life Sciences II and other New Buildings
CRC – New Building 1	--	20-25	20-25	
CRC – New Building 2	--	20-24	20-24	
Fralin Biotechnology Center	2	2	2	
Life Sciences I	--	10-14	10-14	
Life Sciences II	--	--	--	
<u>Derring Hall</u>	36*	7*	7*	
<b>Total Faculty</b>	~43	57 - 70	70	70

\*NOTE: Throughout planning horizon, 4-7 teaching faculty and instructors remain in Derring Hall or move to new teaching space on core campus

### *Strategy for leadership and staff development*

In each of the four areas of concentration, faculty leaders will be identified to:

- Organize and coordinate cluster hiring through departments, colleges and university
- Seek opportunities and coordinate efforts to obtain training grants, center grants, and large team grants
- Work with funding agencies (public and private) to position VT for large grants

Since these are major efforts, the department plans to support the leaders by providing time and financial resources.

Additional staffing will be needed to accommodate the increased demands for personnel and financial management, and for the increases we will see in numbers of graduate students, numbers of buildings occupied, and increased sophistication in the teaching program. In 2004, the departmental staff began discussions (which are ongoing) to plan for these changes.

## **FACULTY AND STAFF CHANGES**

One new tenure track, full time teaching and research faculty member joined the department in spring 2005: Dr. Dorothea Tholl. She is a plant molecular biologist, and will have a laboratory space in Fralin Biotech Center. A very aggressive college and university cluster hiring plan is underway, and so far, the department has received commitments from: Dr. Liwu Li (immunology), Dr. Dana Hawley (disease ecology), Dr. Daniela Cimini (cell biology) and Dr. Carla Finkielstein (cell biology). Searches are in still in progress or contracts are pending for additional positions in structural biology, disease ecology, infectious disease and computational cell biology. Leaving us in 2004-05 were assistant research professor Dr. Ed Wojcik (for a position at Louisiana State University), assistant professor Dr. Cynthia Gibas (for a position at University of North Carolina at Charlotte), assistant professor Lynn Adler (for a position at University of Massachusetts), and Dr. Charles Rutherford, who retired, but will remain active in research with us for at least one more year. Three administrative and three technical staff left during 2004-05, and have been replaced (or will soon be replaced). Three additional research technicians were hired as part of sponsored research programs. The staff have been meeting to discuss how staffing needs will change as the department increases in size and in the number of buildings the department occupies. Some initial restructuring and additions are planned for the first part of AY 2005-06.

## **SIGNIFICANT ACHIEVEMENTS IN THE DEPARTMENT OF BIOLOGICAL SCIENCES DURING THE PAST YEAR**

Over the 2004-2005 academic year, the Department of Biological Sciences made progress toward its goals of enhancing scholarship, increasing emphasis on graduate student and postdoc training, maintaining excellence in undergraduate programs, growing stronger relationships with alumni, and increasing the quantity and quality of facilities. There were also some significant developments in outreach and international programs.

### **Research and Scholarship**

Overall, research productivity in 2004 remained at about the levels for 2003. The numbers of books, peer reviewed book chapters, and peer reviewed journal articles in print or in press declined slightly from 2002 (142) to 2004 (132), the number of presentations over the same period has remained relatively steady at between 103 and 110, but the number of invited presentations dropped considerably (Table 4). The declines probably reflect the impacts of budget cuts in fiscal years 2002 and 2003, increased pressures on faculty to teach greater numbers of students, and a very slow pace of faculty hiring prior to 2004. With increasing operating budgets and a vigorous hiring plan, increases in publications and presentations are very likely to occur, although a lag period of at least one year is expected since research projects are invariably multi-year endeavors.

**Table 4. Summary of research outputs for the departmental faculty (~37 FTE research and teaching faculty) for calendar years 2002 – 2004.**

<b>Indicator of research/scholarship activity</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>Projected 2005</b>
Books, book chapters, and journal articles in print or press (calendar year basis)	142	133	132	
Presentations at professional meetings and conferences (calendar year)	104	110	103	
Invited seminars (calendar year)	54	44	26	
Total research grants dollars in force regardless of PI versus co-PI status and regardless of location of funds (fiscal year)	\$19,000,000	\$26,000,000	\$36,500,000	
Research expenditures (actual dollars spent during fiscal year)	\$2,219,357	\$2,871,899	\$2,607,532	\$3,069,350
Research revenues (dollars received by department including indirect revenues)			\$3,033,662	\$3,689,000

Note: these numbers do not include any double counting in cases where more than one Biological Sciences faculty member is an author or Co-PI the data are only counted once

Extramural research funding was also steady in fiscal 2004 versus previous years, but there are indicators of increases on the way. One of the best measures of funding, “research expenditures”, declined slightly from fiscal year 2003 to 2004 (Table 4). However, grants in force (GIF) are on a steep incline upwards. GIF include funds that are not directly held by or spent by Virginia Tech (e.g., they may reside at the home institution of one of our faculty’s research collaborators), but they nonetheless support research that our faculty are conducting, and can ultimately lead to enhanced levels of publication. Another upward trend is evident if we project research expenditures and revenues to the end of fiscal year 2005 (which ends June 30). Both expenditures and research revenues (which include incoming overhead as well as direct funds) appear to be increasing by 10% or more. Since some of the new faculty hires in our department will be bringing in existing grants, we expect the numbers in 2006 to increase once again.

Other significant contributions and highlights of other accomplishments include:

- ~11 faculty were invited to present their research at other institutions
- Dr. Iuliana Lazar, who has a joint appointment between Virginia Bioinformatics Institute (VBI) and Biological Sciences received a prestigious NSF CAREER award that provides 5 years of funding to promising young scientists.
- Dr. Christopher Lawrence, who also holds a joint VBI – Biological Science Appointment, received a \$804,000 award from USDA to study the genome sequence of the model necrotrophic fungus *Alternaria brassicicola*. Dr. Lawrence also holds a prestigious NSF Plant Genome Young Investigator Award.
- Dr. Duncan Porter, who serves as the director of the Darwin Correspondence project in Cambridge England, published volume 14 of the book series that is annotating all of the extant letters written by and received by Charles Darwin. The full reference is: Burkhardt, F., **D. M. Porter**, S. A. Dean, S. Evans, S. Innes, A. Sclater, A. M. Pearn, & P. White (eds.). 2004. *The Correspondence of Charles Darwin. Volume 14: 1866*. Cambridge: Cambridge University Press. xl + 655 pp. Volume 15 is now in press.
- Dr. Lisa Belden, and her postdoctoral research associate Dr. Mike Rubbo, are co-authors on a significant paper that made the cover of the American Scientist. The full citation is: Kiesecker, J.M., **L.K. Belden**, K. Shea and **M. J. Rubbo**. 2004. Amphibian decline and emerging disease. *American Scientist* 92: 138-147.
- Dr. Khidir Hilu received a collaborative \$3,000,000 tree of life grant from NSF to study the origins and phylogenetic relationships among flowering plants.
- Dr. Zhaomin Yang received a \$1,170,507 grant from NIH to study the processes that regulate gliding in colonies of bacteria.
- Dr. John Phillips and his former postdoc Dr. Thorsten Ritz published a paper in the prestigious journal **Nature** on magnetoreception in birds. The full citation is: Ritz, T., P. Thalau, J.B. Phillips, R. Wiltschko & W. Wiltschko **2004**. Avian Magnetic Compass: Resonance Effects Indicate a Radical Pair Mechanism. **Nature** 429: 177-180.
- Dr. Asem Esen and co-PI Dr. David Bevan of the Department of Biochemistry, received a \$711,000 grant from NSF to study interactions of plant defensive compounds and disease-causing organisms in corn.

## Graduate Education and Postdoc Training

Total grad student enrollment in biology has remained between 70 and 80 for the past 10 years. However, active full time students with GTA or GRA support have been averaging between 60 and 70 per year, or about 2 per full time teaching and research faculty member. Departmental goals are to increase the number of graduate students, the multicultural component within the grad student body, shift the ratio of PhD to MS students and increase the number of postdocs. In addition, the department would like to increase the number of graduate course offerings. New faculty hires occurring now and planned for the future will make it possible to meet these goals.

This year, graduate enrollment for PhDs remained flat compared to last year (between 37 and 38 each year) (Table 5). However, there was a substantial net growth in Master of Science Students (from 31 last year to 40 this year. Some of the Master of Science students are likely to convert to a PhD program, and this likelihood, plus recent trends in recruitment, indicate that we will continue to grow the number of PhD students. Ultimately, we would like to have nearly 2 PhD students per faculty. Coupling this goal with at least modest growth in the faculty FTEs from the current level of ~40 to at least 50 by 2010, we anticipate that the number of PhD's will grow from the mid 30s today to approaching 100 by 2010.

Postdoc numbers have edged up slightly over the past three years from 8 to 10 (Table 5). We anticipate that new faculty hires are likely to increase this number substantially over the next two years.

**Table 5. Summary of graduate student enrollment, types of graduate support, graduate stipend payroll, and number of postdocs for fiscal years 2003 – 2005.**

	2002-03	2003-04	2004-05
PhD students enrolled <sup>1</sup>	33	38	37
MS students enrolled <sup>1</sup>	34	31	40
PhD/MS ratio <sup>1</sup>	0.97	1.23	0.93
Funded GRAs <sup>1,2</sup>	26.0	27.5	27.0
Funded GTAs <sup>1,2</sup>	44.0	38.5	46.7
GRA/GTA ratio <sup>1,2</sup>	0.59	0.71	0.58
GTA stipend payroll	\$511,894	\$516,707	\$583,192
GRA stipend payroll	\$416,658	\$553,817	\$571,061
Full time postdocs <sup>1</sup>	8	9	10

Significant activities in graduate education this year to improve (or reflect) the quality of our graduate program include:

- The second biology research day was held on Saturday, March 19, 2005 in Torgersen Hall. The event was co-organized by graduate students Dayna Wilhelm and Kerri Huffman, and by faculty members Ann Stevens, Maury Valett, Erik Nilsen and Iulia Lazar. The event included 8 invited talks by current graduate students, 24 posters by current graduate students, and an invited plenary talk delivered by Dr. Jen Tank (a former PhD student of the department's). An abstract book was published, and over 100 people

attended the meeting, including four people from our Biological Sciences Alumni Advisory Board. Also in attendance were ~8 graduate student prospects.

- The Department continues to be a campus leader in two major university seminar series: the Molecular and Cell Biology and Biotechnology series (MCBB), and the Ecology Evolution and Behavior (EEB) series. In both series, Biological Sciences faculty and graduate students are leaders in planning the schedules, and are very active in inviting speakers and attending the seminars.
- Graduate student Michelle Barthet was awarded the best student paper in Biology at the meeting of the Virginia Academy of Science, held in Richmond in spring 2004.
- Graduate student Brian Olsen received a Smithsonian Institution Predoctoral Fellowship Award, which consists of a \$20,000 stipend. He will be using DNA microsatellites to examine how the mating systems of two sub-species of the Swamp Sparrow have diverged.
- Graduate student Glen Stevens won first place for student presentations in the Behavior and Ecology and Quantitative Ecology session at the Entomological Society of America Annual Meeting, held in Salt Lake City, November 14-17.
- Graduate student Amanda Lentz received notification that she will be awarded a prestigious NSF Doctoral Dissertation Improvement Grant.
- Six graduate students were supported by fellowships, which covered most or all of their stipends.
- Three graduate students were supported by the Multicultural Academic Opportunity Program (MAOP), a partnership designed to build diversity within the Department, College and University.

In our most recent 5-year review of our graduate education programs, the most critical issues identified by students and alumni as areas that need improvement were: 1) support for health care, and 2) a desire to broaden graduate education beyond its heavy focus on research. The university and the graduate school have made significant progress in providing additional support for graduate student health care costs. To address the second issue, the Department of Biological Sciences, in partnership with the Graduate School, initiated a pilot project for “preparing the future professoriate”, in which a number of our graduate students could obtain teacher pedagogical training (by taking the course GRAD 5114 -- Pedagogical Practices in Contemporary Contexts, offered by Dr. Shelli Fowler), and then teach a lecture course under the mentorship of a faculty member. The department agreed to provide students and their major professors an additional month of summer GRA support to offset the major commitments that this pilot program would take. Table 6 shows the identity of the students who volunteered for this pilot project, the courses they taught and the faculty mentors. Student perception of teaching evaluations for the courses taught in this program were similar to those seen among faculty at large, and so we believe the program was a success. However, scheduling the courses and using GTAs in lecture instead of laboratory created some pressures on the department. Therefore, we intend to repeat this program but will move all of the lectures to summer courses, which will alleviate funding and scheduling issues for the department.

**Table 6. Data on the preparing the future professoriate pilot program.**

<b>Graduate student</b>	<b>Major advisor</b>	<b>Course taught, Spring 05</b>
Dayna Wilhelm	Jill Sible	BIOL 2104 Cell and Molecular Biology; mentored by Dr. Joe Cowles
Brian Olsen	Jeff Walters	BIOL 4404 Ornithology; mentored by Jeff Walters
Ayesha Carter	Jill Sible	BIOL 2104 Cell and Molecular Biology; mentored by Dr. Jill Sible
Scott Parker	Robin Andrews	BIOL 3404 Introduction to animal physiology; mentored by Drs. Anne McNabb and Ignacio Moore
Matt Neatrou & Glen Stevens	Bob Jones	BIOL 2804 Ecology; mentored by Dr. Bob Jones
Michelle Barthet	Khidir Hilu	BIOL 1106 Principles of Biology; mentored by Mike Rosenzweig

The number of postdoctoral research associates in the department is growing. In spring semesters, the number of postdocs has increased from 8 in 2003 to 9 in 2004 and 10 in 2005. We anticipate that this trend will continue over the next several years.

### **Undergraduate Education**

Both the quantity and quality of teaching conducted by biology faculty remain high. In calendar year 2004, there were approximately 130 individual sections of biology lecture and senior lab courses (the exact number depends on nuances of how course sections are counted). These plus the freshman and sophomore lab courses and independent study courses generated 37,461 weighted student credit hours (i.e., the product of course credits and number of students, summed across all courses taught). This is almost a 20% increase over the number of hours in 2003. Biology faculty accounted for 22,144 (60%) of this teaching, which amounts to approximately 340 weighted student credit hours per year for each of the department's 39 full time equivalent faculty members. Approximately 40 biology graduate student teaching assistants accounted for 9042 hours (25%, mainly lab courses; ~226 hours per grad student) and our graduate students from the future professoriate program plus faculty from outside the department for 6275 hours (15%). It is departmental policy to obtain student evaluations for each course using the student perception of teaching (SPOT) method. In the fall 2004 and spring 2005 semesters, 93% of rated biology lecture courses (total of 82 rated) received an overall SPOT score of 3.0 or better (from a maximum of 4.0); the mean SPOT weighted by number of students in each course was ~3.45, which lies between "good" and "excellent". Laboratories offered by our department, taught by our graduate students and evaluated by undergraduate students (total of 147 sections evaluated) had a mean overall SPOT of 3.51.

Undergraduate research is a key opportunity for student development. In 2004 calendar year, the Biological Sciences faculty provided substantive research experiences (as a course with credit, or as paid labor) for 104 students.

This year has seen another impressive performance by biology majors. At spring 2005 commencement, 78 seniors (out of 256 graduates) from the Department of Biology graduated with distinction, which includes a GPA of 3.40-3.59 (27 students), 3.60-3.79 (33 students) or 3.80 plus (18 students). The class of 2004 included 6 Commonwealth Scholars, 4 Honors Scholars, 8 Health Studies Scholars and one Honors Baccalaureate. One biology major won a Barry M. Goldwater scholarship. Other indicators of excellence in teaching and learning include:

- Dr. Ann Stevens (awarded in 2003-04) and Dr. Brent Opell received College of Science Certificates for Excellence in Teaching.
- Drs. Muriel Lederman, Rebecca Scheckler and Jill Sible have initiated an NSF funded study on the integration of social studies into biological science teaching.
- Graduate student Natasha Wiles, who completed her PhD degree in spring 2005, received a special Commendation from the Graduate School for exceptional teaching.
- Undergraduate students Nicole Mammerella, a biology major who graduated in 2003, was selected as a National Science Foundation Graduate Scholarship, which appears to be the first such award given to a Virginia Tech Biology Major. Nicole is currently pursuing a PhD at Harvard.
- Dr. Bill Claus was voted the most influential professor by the class of 2005. He received a PHD in bacteriology from Iowa State in 1964, served in the army medical corps, and then held an appointment at Penn State University before joining our department in 1973. He quickly became one of the department's best teachers, and a leader in our microbiology teaching program. Dr. Claus retired in fall 2002 but continued to teach until last year. He has a reputation for attention to detail and fairness. He is an innovator in use of modern information technologies, inquiry based approaches, and student-run review sessions. His courses emphasized team work, which is a major challenge for classes with over 100 students, which he typically taught. Dr. Claus has been an inspiration to several generations of students from the beginning of his teaching career through the class of 2005.
- Three faculty were recognized for exemplary teaching at the 2005 commencement: Drs. Art Buikema, Jill Sible and Rich Walker. Dr. Buikema is Alumni Distinguished Professor of Biology. He has a PhD from the University of Kansas, and joined our faculty in 1971. He has taught over 25 types of courses including lab and lecture, independent studies and honors, biology and social sciences, freshman through senior level, on-campus and overseas. The quality of his courses has been consistently ranked among the best at Virginia Tech. Art is incredibly creative, a pioneer of new teaching methods, and leader in planning for the future of bioscience education at Virginia Tech. Dr. Jill Sible earned her PhD from Tufts University in 1995 and joined our faculty in 1998. This marks the fourth time that she is being recognized by the students and faculty in our department for excellence in teaching. Jill teaches cell and molecular biology, and a variety of innovative graduate level courses. She is currently spearheading an NSF funded project to incorporate social studies into biology teaching, with a goal of encouraging women to develop careers in science. She has won praise year-in and year-out as a superb graduate advisor and mentor. Dr. Rich Walker earned his PhD from the

University of North Carolina Chapel Hill in 1989 and joined our department in 1994, and from day one has been the department's leader in teaching cell biology. He serves on many graduate advisory committees, carries a heavy load of undergraduate advising, and has been a leader for guiding our department's curriculum. Although Rich's courses are rigorous, he has deep concern and respect for students, and is one of our most approachable professors, making it easy for students to learn.

- Undergraduate student Aaron Kaluszka in four years earned four bachelors degrees in Biology, Computer Sciences, Computer Engineering and Electrical Engineering. While taking as many as 32 hours of course work per semester, he earned a cumulative GPA of 3.91, and received a Goldwater Scholarship.
- The 2005 Outstanding Biology Senior Award was presented to Rebecca Starr, who demonstrated excellence in academics, research, leadership and extracurricular activities. She held leadership positions in Alpha Chi Omega, Book Aid, and Mortar Board and was a very active participant in several other organizations. Her service activities included mission trips, Red Cross volunteering, and Adopt-a-School volunteering, among others. She is receiving an Honors Degree in Health Studies and will be attending medical school at the Edward Via Virginia College of Osteopathic Medicine this fall.
- Katharine Penney was selected as the outstanding researcher of the class of 2005. She began her research activities in 2002, working for two years in Dr. Carol Cramer's plant molecular biology lab. Since then she worked on plant animal interactions with Dr. Lynn Adler and most recently on molecular microbiology with Dr. Ann Stevens. In Dr. Stevens' lab, Katherine displayed an unusual ability to learn and understand laboratory techniques. She is a co-author on an upcoming presentation at the American Society for Microbiology Meeting titled "Comparative Analysis of the quorum sensing regulators LuxR and EsaR". Katharine plans to attend Pharmacy School at UNC-Chapel Hill in the fall.

During the 2003-04 academic years, data were gathered to assess the status, quality, and key trends concerning the Bachelor of Science degree program in biology during the previous five academic years (1999-00 through 2003-04). Here we comment on how the 2004-05 year compared to trends we have identified for the previous five years:

- Enrollment remained high though the sample period peaking in 2004 with 1335 majors. The numbers graduating exceeded 250 for the first time in 2005. Nearly 18% of these graduates did not begin as Biology Majors (compared to 20% in years past), but transferred into the major generally as sophomores. Approximately 27% of entering freshman biology majors from 2003-04 changed majors prior to the end of the sophomore year in 2004-05 (down from 33% in previous years).
- The quality of entering freshmen in the biology major remains higher than that of the College of Science and the University as a whole as measured by high school GPA and SAT scores. The number of students named to the Deans list every semester is proportionately higher for Biology and any other group in the Sciences. Nomination to and acceptance into honor societies (Phi Sigma, etc) from Biology is proportionately higher than any other section of the College of Science.

- Academic advising has received continued high praise and awards for excellence. Undergraduate research opportunities provided by more than half of the faculty members assures the importance of this aspect of undergraduate education.
- The results from the graduating senior survey remain very positive for the department. Many areas of excellence were identified including advising, attitude of faculty toward students, course quality, and faculty excellence.
- Most undergraduate students in Biology (Approx 50%) are looking to go to professional or graduate schools. Biology majors are very successful competing for National, College, and University competitive scholarships. The competitiveness and success of our undergraduates in professional schools is outstanding and professional and graduate programs welcome their applications.

### **Summary**

The current undergraduate program in biology has high quality and is an academic success from many perspectives. By all measures of performance (exams, honors, scholarships) biology majors are doing extremely well and more than half are going beyond the BS into professional training or graduate work. Students who interact with their advisors regularly report the quality of advising as exceptional and this is a result of having all academic advising located in one central location.

### **Reflections on the Five Year Review Recommendations**

Areas of concern for the department were identified these included:

- **Career advising.** This is an area criticized by current and former students and the department has taken steps to increase the quality of career advising by strongly encouraging students to take advantage of existing college and university career evaluation and advising resources. The future needs in this area with continued growth can only be met by the addition of a position in the department whose sole job would be in this area and to coordinate these efforts among the various sources.
- **Course overlap.** The department curriculum committee has evaluated the sophomore level core courses; reviewed and evaluated the learning objectives, course requirements, and how they relate to the original course descriptions. That review made minor suggestion on some section revisions but found the core course to be appropriate, timely and central to the upper division curriculum for which they serve as prerequisites.
- **Oral and Visual communication skills.** Identified as an area for which improvements should be undertaken relative to written communications. The university new mandate to modify the writing intensive requirement such that all three objectives are satisfied provided the stimulus to evaluate our curriculum for this requirement. The departmental curriculum evaluated all course offerings for writing, visual and oral components. The Biology freshman year has written, visual, and oral components in the laboratory section and will serve as the base for the upper division lab classes to include these aspects. Out of the existing upper division courses the requirements to meet the ViEWS mandate were

achieved with some minor modification of content. The Department plan developed by the curriculum committee passed approval after one round of modification.

- **Decrease the student to faculty ratio.** An evaluation of peer schools (n=21) both land grant and non land grant, indicated that the faculty to student ratio in the Virginia Tech Department of Biology, which is 35:1, is well above the average (mean=19:1), and it is well above that for the Virginia Tech campus as a whole (16:1). In the immediate future, the ratio is not likely to change much, but with current and pending hiring efforts, this ratio could begin to decline within the next several years toward 25:1. The quality of our program is tied to this decline. If, however, the number of Biology majors continues to increase, it will take major investments in new faculty to reach the 25:1 ratio, and to maintain or improve the quality of instruction.

### **Outreach and Service**

One of the most substantial outreach programs in the department is led by Dr. Mike Rosezweig, and is done in collaboration with the Department of Geosciences. The Science Outreach program (SOuP) focuses on K-12 teacher training, and value added to sponsored research proposals (<http://www.socm.vt.edu/>). In 2004-05, SOuP obtained \$45,000 in extramural funding from two NSF and one internal Virginia Tech grants, and had outreach contacts with a total of 1656 college students and faculty, K-12 teachers, K-12 classes, and the public (mainly youth).

The department also houses a herbarium with the largest holdings in the state of Virginia. Dr. Duncan Porter acts as curator, and we have one full time staff person, Tom Weiboldt, dedicated to herbarium maintenance and botanical outreach. In collaboration with our information technology staff, Tom put together a new atlas of the vascular plants of Virginia, which is available to the public at: [http://www.biol.vt.edu/digital\\_atlas/](http://www.biol.vt.edu/digital_atlas/). Between June 2004 and May 2005, the herbarium added 2028 plant specimens to its collection, had 21 officially recorded visits (which is probably less than half of actual visits), and about 10 requests per month for information in addition to requests for identification of 352 plants.

Department faculty are engaged in numerous activities beyond Virginia Tech, and they serve the university and profession in many ways. These activities increase the image of the university and enhance its influence regionally and internationally. Examples of activities and awards recognizing special service include:

- The Department of Biological Sciences has established an Outstanding Service Award. The first such award was presented to Dr. Anne McNabb at the spring 2005 commencement. Dr. McNabb received her PhD from UCLA in 1968, and joined our department in 1969. In addition to major contributions to our research and teaching missions, and award winning efforts in student mentoring and multicultural activities, Dr. McNabb has served on the editorial boards of seven different peer-reviewed academic journals, as an organizer of many research conferences, a leader in two major professional societies, and a panel reviewer for the US EPA and National Science Foundation. Within Virginia Tech she has served on the search committees for deans and provosts, and has participated in, or has led, innumerable committees. From 1996 to 98 she led a major university strategic self study. She is now the chair our department's and our college's inaugural diversity committees. For her strong record of graduate student

mentorship, Anne was recently appointed as an Associate Dean in the Virginia Tech Graduate School.

- Dr. Joe Falkinham is a member of the Steering Committee on *Mycobacterium avium* in the Environment, Joint World Health Organization (WHO) and Environmental Protection Agency (EPA) Task Force, the objective of this committee is to advise WHO and EPA on risk of *M. avium* disease; He is also a member of the Standard Methods Joint Task Force for 9260 Pathogenic Bacteria, which is part of the American Public Health Association and American Water Works Association, objectives of this task force are to revise the current edition of Standard Methods for the Examination of Water and Wastewater.
- Dr. Brenda Winkel serves on the Arabidopsis Biological Resource Center Advisory Committee, North American Arabidopsis Steering Committee, and Gordon Research Conferences Council.
- Dr. Robin Andrews served as president elect of the Society for the Study of Amphibians and Reptiles and will serve as president in 2005-2006.
- Dr. Brent Opell is a member of the board of directors for the American Arachnological Society.
- Dr. Jeff Walters, Bailey Professor of Biology, serves as Member of the Committee on Restoration of the Greater Everglades Ecosystem (CROGEE), member of the US Fish and Wildlife Service (USFWS) recovery team for red-cockaded woodpecker, member USFWS of the Guam Micronesian KingFishers Recovery Committee, member of the NC Sandhills Conservation Partnership Steering Committee, president of the Sandhills Ecological Institute, chair of the American Ornithologists' Union, Co-Chair of the Subcommittee on Red-cockaded Woodpeckers of the American Ornithologists' Union, and Chair of the American Ornithologists' Union Peer Review Panel to evaluate USDA Forest Service report on a meta-analysis of the demography of the California Spotted Owl.
- Dr. Maury Valett is a member of the Executive and International Committees for the North American Benthological Society (NABS) and is participating in the NABS mentor enhancement program.
- Graduate student Lori Blanc received the Virginia Tech Graduate Student Service Award for her very enthusiastic, efficient and extensive contributions to her profession and to the local community.
- Dr. Jack Cranford is a member of a Statewide Mammal Committee of VA State Department of Game and Fisheries; he is also advisor to the Board of Directors of the Wintergreen Conservation Foundation, Wintergreen, Virginia.
- Dr. Art Buikema served as a preliminary judge for the USA Today 2004 All-USA College Academic Team January 5-7, 2004, and then as a finalist judge April 15, 2004.
- A number of our faculty are editors or on the editorial board of professional journals:
  - Tom Jenssen - Editor-in-Chief *Herpetologica*
  - John Tyson - Co-chief Editor, *J Theoretical Biology*, and on editorial boards of *Chaos* and *J Nonlinear Science*
  - Khidir Hilu - *Kurtziana (South American)*
  - Jeff Walters – *Ecology* and *Ornithological Science*
  - Jack Webster - *Freshwater Biology*
  - Bob Jones – *J Forestry Research* and *J Ecology*
  - Brent Opell - *J Arachnology*

- Fred Benfield - *J North Amer Benthological Society* and *Southeastern Naturalist*
- Joe Falkinham – *Applied and Environmental Microbiology*
- Anne McNabb - *J Experimental Zoology, Poultry & Avian Biology Reviews*
- Erik Nilsen - *J Plant Research, J American Rhododendron Society*
- Jack Cranford – *Southeastern Naturalist*

### **International Activities and Internationalizing Our Curriculum**

We continue to have a relatively small international scope to our teaching programs. Plants and Civilization (BIOL 2204) continues as an Area 7 course within the university core curriculum, and Plant Taxonomy (BIOL 3204) is of international scope. As in 2004, we are offering two courses this summer that include international travel. Dr. Art Buikema is taking students to South Africa to compare North American and South African ecology, and Dr. Khidir Hilu is conducting a course on plant systematics in the European Alps. Dr. Ignacio Moore is in the planning phases for a study abroad trip to Ecuador, and Dr. Robert Jones has submitted a proposal to NSF to begin developing study abroad programs linked to research in Belize.

- Joe Falkinham and his colleagues, Dr. Nick Oberlies at Research Triangle Institute (RTI) in North Carolina and Professor Feras Alali of the Jordan University of Science and Technology (JUST), Irbid, Jordan are continuing their studies to isolate and identify novel antibiotics for treatment of infectious disease and chemotherapeutic agents for treatment of cancer and central nervous system diseases. The source material for the new antibiotics and chemotherapeutic agents will be native plants and soil bacteria in Jordan.
- Dr. Khidir Hilu hosted two international scholars in his lab, Dr. Diaga Diouf, a Fulbright Scholar from Universite Cheikh Anta Diop, Senegal, and Dr. Dietmar Quandt from the University of Bonn.
- Many of our faculty have collaborative research with international scholars, e.g., in the past year, Dr. Asim Esen had substantive interactions with graduate students and visiting scholars from Thailand, Sweden, Germany, France, and Denmark; Dr. Khidir Hilu has collaboration with scientists in Germany, England, Mexico and Belgium; Dr. John Philips has ongoing collaborations with scientists in Spain, the Czech Republic, and Norway. Dr. John Tyson has an active program in cell-cycle research with colleagues in the Budapest University of Technology and Economics. As director of the Darwin Correspondence Project, Dr. Duncan Porter has significant collaborative research with colleagues at Cambridge University, UK.

### **Alumni and Development Activities**

The alumni advisory board met in Blacksburg in fall 2004 and spring 2005. The spring meeting was held in conjunction with the Biological Sciences Research Day. This year, the board has established and is now building a funding basis for a new excellence fund for the department. The board is also working with the department to improve its newsletter, webpages, and development activities. For the third year in a row, an alumnus (Dr. Carole Pratt) was the featured speaker at spring commencement. Our emeritus faculty group (the OWLS) remains active, meeting several times per semester to discuss science, keeping up to date on developments in the department, and helping the department maintain a sense of community. Drs. Ernie Stout and Bruce Parker continue to be the leaders of this group. Several OWLS taught or assisted the department in Alumni and development activities, including Dr. Robert

Benoit (teaching general microbiology and medical ethics), Dr. Noel Krieg (teaching prokaryote diversity), and Dr. Bruce Parker (assisting in managing our scholarship funds).