

**2005-06 ANNUAL REPORT
DEPARTMENT OF BIOLOGICAL SCIENCES**

PART 1: EXECUTIVE SUMMARY

The undergraduate learning program in biological sciences impacts a large number of students and succeeds in providing high-quality learning environment where students excel. By many measures of performance (exams, honors, scholarships, participation in the University Honors program) biology majors are doing extremely well. Students who interact with their advisors regularly report the quality of advising as exceptional.

The 2005-06 academic year has been marked by an increase in the number of PhD students and postdocs in the department, a continuing trend for interdepartmental graduate student recruitment and training, and a very successful 3rd annual graduate research day event.

Research productivity shows small increases in 2005 relative to the previous two years. The numbers of books, peer reviewed book chapters, peer reviewed journal articles in print or in press, presentations and invited seminars increased in 2005 relative to 2004. Similarly, various indicators of funding have increased in fiscal year 2006 relative to fiscal year 2005. Two new symposiums hosted by Virginia Tech faculty highlighted growth within the department and across Virginia Tech in two research fields: structural biology and innate immunity.

The department has chosen to focus its engagement and outreach efforts on: 1) learning and research partnerships with industry; 2) K-12 teaching in Science, Technology, Engineering, and Math (STEM education); 3) enhancing the opportunities for research funding by adding broader impacts to NSF and other funded research projects; and 4) keeping strong connections to alumni and friends. In all four of these areas, activities and accomplishments have remained the same or have increased relative to the previous academic year.

International aspects of the undergraduate curriculum remain a modest but high impact element within the total undergraduate learning environment, while international elements of research continue to be a strong element of the department.

Progress has been made this year in addressing work life issues, supporting science training for underrepresented groups, celebrating cultural diversity, and increasing the diversity of the faculty.

Department faculty and staff were very actively engaged in a broad array of service activities within the department, college, university, and profession.

Throughout the 2005-06 academic year, the department worked on an update to its strategic plan. A draft is included in this annual report. The plan will be modified slightly in 2006-07 to coordinate with new university and college plans that are also in the process of being updated.

PART 2: ACADEMIC ACCOMPLISHMENTS

I. Learning

a. Undergraduate programs

The undergraduate learning program in biological sciences impacts a large number of students and succeeds in providing high-quality learning environment where students excel. By many measures of performance (exams, honors, scholarships, participation in the University Honors program) biology majors are doing extremely well. Students who interact with their advisors regularly report the quality of advising as exceptional.

- Undergraduate enrollment in Biological Sciences increased over last year's number, remaining at a relatively high number (1377 majors in fall 2005 compared to 1335 in fall 2004). Biological Sciences enrollment is the largest for a degree granting program at Virginia Tech (the only programs with larger enrolments are Engineering Fundamentals and University Studies, both of which are strictly lower division programs that do not grant degrees).
- As seen last year, the quality of entering freshmen in the biological sciences major, as measured by high school GPA and SAT scores, is higher than that of the College of Science and the University as a whole. The number of students named to the Deans list every semester is proportionately greater for Biological Sciences Majors than for any other group in the Sciences. Nomination to and acceptance into honor societies (Phi Sigma, etc) from Biological Sciences is proportionately greater than for any other section of the College of Science.
- Participation in the University's Honors program provides another indicator of the quality of Biological Science Majors. In fall 2005:
 - 10.8% of all Biological Sciences Majors (127 out of 1377) were enrolled in the University Honors program
 - Out of the University's 446 Honors Students, 28.4% (127) were Biological Sciences Majors.
- Students accepted as freshmen at Virginia Tech who transfer into and out of Biological Sciences major, typically do so before the end of the sophomore year. The net change in majors is usually very small. Of the entering freshman in 2004-2005, 56 transferred out of the major and 54 transferred in prior to the end of their sophomore year.
- Transfer students from outside of the university who choose the biological science major typically come in at the sophomore or junior level, and comprise a relatively small segment of the total enrolment. In fall 2005, 31 students transferred in to the major, which is less than the mean for the previous five years (40.6) and much less than in the previous two years (50 in 2004 and 54 in 2003). Early indicators are that 41 will transfer in during fall 2006.

- The department administers a major in Biological Sciences (leading to a Bachelor of Science degree), seven options within the major, an Honors degree in Biological Sciences administered in partnership with the University Honors Program, and a minor in Biological Sciences (see table below). In fall 2005, it was clear that only a small proportion of Biological Majors were affiliated with the options; however, a relatively large number of non Biological Sciences majors have signed up for a minor in Biological Sciences.

Program	Option	Enrollment in fall 2005
Major in Biological Sciences (including honors students)	Bio-business	7
	Biotechnology	11
	Clinical Laboratory Science	1
	Ecology	3
	Food Science	0
	Microbiology/Immunology	41
	Pharmacy	3
Biological Sciences Majors enrolled in Honors Program		127
Minor in Biological Sciences		213

- In the 2005-06 academic year, 295 students graduated. Many achieved honors as shown in the following table.

	Dec 05	May 2006	Total
Total graduates	53	242	295
Magna Cum Laude	2	25	27
Summa Cum Laude	3	22	25
Cum Laude	3	26	29
Commonwealth scholars	0	13	13
In honors	1	7	8
Health scholars	1	4	5

- Retention of our students and success in graduating are high, and are comparable to university-wide performance. Only about 50 students out of a class size of 350 change out of the major during their first two years (which is balanced by about 50 that change majors to biological sciences). Approximately 73% of our students complete the B.S. degree program as shown in the following table, which tallies the freshman class plus transfers into the university from 2-year colleges and the graduating numbers of students four or two years later, respectively (we assume no net change in internal transfers among majors). Our weighted average estimate for the past two four-year cycles is 72.8%, which is very comparable for the university as a whole (6 year graduation rates were calculated as 74% for Virginia Tech freshman cohorts entering in 1997 and 1998).

Entering Freshman		Transfers		Total Class Size	Graduating		
Year	Number	Year	Number		Year	Number	% of class
2000-01	327	2002-03	25	352	2004-05	221	62.8%
2001-02	303	2003-04	54	357	2005-06	295	82.6%
Weighted average based on student totals in both 4-year cycles							72.8%

- Success in providing excellent pre-med and pre-dent advising, leading to a high percentage of applicants being accepted in medical and dental schools, has been a hallmark of the department and the university. Data for students who were juniors and seniors in 2005-06 provide a good example of the good preparation and guidance our students receive. For example:
 - For Pre-Dental Students in seeking placement in dental schools in fall 2006
 - 14 students applied from across the university
 - 11 were accepted = ~80% acceptance rate overall
 - Of the 14 students, 5 were Biological Science majors and all of them were accepted = 100% acceptance rate.
 - For Pre-Medical Students seeking placement in med schools in fall 2006
 - 46 applied from across the university; but not all were judged by a university interviewing committee to be qualified; those not judged competitive were encouraged to seek alternative educational and career paths (many more were encouraged to do so long before they reached this stage). The lack of qualification may have been related to low GPA, low MCAT score, modest or no clinical experience, or poor interviewing/interpersonal/communication skills.
 - 20 of the 46 were Biological Science majors; 8 were judged by the Committee to be unprepared in some way
 - Of the 12 candidates who were judged by the Committee to have potential as a competitive applicant, 10 have been accepted. This is an average of ~ 83%. The other two candidates are on a wait list and will probably not know their status until late summer.
- The quantity of classroom teaching declined in 2005 compared to 2004, but remains very high. In calendar year 2005, there were approximately 128 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 32,357 student credit hours (i.e., the product of course credits and number of students, summed across all courses taught). This is a reduction of 13.6% from the number we reported for calendar year 2004. Biological sciences faculty accounted for 22,721(70% of total) of this teaching, which is about 600 student credit hours per year for each of the department's 38 full time equivalent faculty involved in instruction. Most of the faculty teaching involves lecture and senior level laboratory courses. Faculty from outside the department taught 5698 hours (18% of total) and virtually all of these hours were in lecture courses as well. Approximately 39 biological sciences graduate student teaching assistants accounted for 3938 hours (12% of total; mainly lower division lab courses; ~101 hours per grad student).

- Quality of classroom teaching also remained high. It is departmental policy to obtain student evaluations for each course using the student perception of teaching (SPOT) method. In the fall 2005 and spring 2006 semesters, 96 lecture classes were rated by students and the mean overall SPOT score was 3.42, which lies between “good” and “excellent”. Laboratories offered by our department, taught by our graduate students and evaluated by undergraduate students (total of 164 sections evaluated) had a mean overall SPOT of 3.46.
- To help build quality of teaching, the department also conducts peer evaluations (some formal and others more informal but all including classroom visits and review of teaching materials), and many of our faculty attend training sessions or workshops to build teaching skills. In the 2005-06 academic year, 7 faculty had peer evaluations, and in the 2005 calendar year, 13 faculty attended a total of 15 teacher training sessions or workshops.
- Undergraduate research provides a capstone experience for many of our students. In academic year 2005-06, there was a total 140 student-semester research experiences (i.e., number of students in fall semester plus number in spring) for Biological Sciences majors. Most (89) of these experiences were with biological sciences faculty, but the rest were in laboratories of faculty from all across the university including the colleges of Science, Agriculture and Life Sciences, Veterinary Medicine, Engineering, Natural Resources and Liberal Arts and Human Sciences, plus the Virginia Bioinformatics Institute and Department of Athletics. In addition to students who take research for formal course credit, many more work without receiving course credit in laboratories as technical assistants. Some receive support from locally and nationally competitive grants including these examples for AY 2005-06:
 - **Lediya Cheru**, a MEAMP student that worked in the Laboratory of **Dr. Ann Stevens** from 1/04-12/05, was selected by the NIH to participate in their Intramural NIAID Research Opportunities (INRO) program February 5-9, 2006. This program is targeted at underrepresented minorities.
 - **Jessica Green**, a work study student in **Dr. Stevens’s** lab during AY 2005-06 was selected to receive a Wilkins/Fralin Fellowship to support her research full time over summer 2006.
 - **Drs. Erik Nilsen, John Philips, and Brenda Winkel** applied for and received NSF Research Experience for Undergraduate (REU) program funds to support undergraduate research experiences at Virginia Tech.
- Undergraduate advising activities were extensive in 2005-06. Most academic advising and a large proportion of career advising were provided by the department’s Center for Academic advising, which includes two full time classified staff, one non-tenure track faculty member, and one tenure track faculty member. A special freshman advising program to help first year students deal with college life was led by the advising center, but included several other faculty; all of the freshmen class of ~ 353 students was involved in this program.

- Advising programs have maintained the hallmark excellence that led to the department being named an “exemplary university department” in 2003. The department’s one-credit-hour required freshman seminar course plus the accompanying manual titled *The Compass*, was presented as a model for success at a Department Head Breakfast Roundtable discussion focused on the topic of first-year experiences.
- Biological Sciences continued its active role in leading the Biological and Life Sciences Learning Community (BLSC) in 2005-06. **Dr. Joe Cowles** and **Ms. Betsey Waterman** organize this residential learning community for students to develop a sense of community and a focus on academics. In academic years 2005 and 2006, the BLSC has been recognized as the “Community of the Year” by the National Residence Hall Honorary. The NRHH is an organization of the top 1% residents on campus. Their main focus is to recognize the accomplishments of students on campus.

b. Graduate education and postdoc training programs

The 2005-06 academic year has been marked by an increase in the number of PhD students and postdocs in the department, a continuing trend for interdepartmental graduate student recruitment and training, and a very successful 3rd annual graduate research day event.

- Active full time students with GTA or GRA support have been averaging in the 60s to 70s over the past five years; 72 were enrolled in spring 2006.
- The numbers of PhD students, and ratio of PhD students to MS students, increased in 2005-06 relative to previous years (see table below).
- The funds expended for GTA stipends declined in 2005-06 relative to the previous year, while the funds expended on GRAs (almost all from grants) increased, reflecting an increase in the ratio of full time equivalent GRAs to GTAs (see table below).
- Postdoc numbers moved up substantially from 10 in 2004-05 to 17 in 2005-06.
- Because of new faculty recruitment and increasing emphasis on PhD training, it is anticipated that the number of PhD students will continue to rise over the coming several years.
- No progress has been made in the past year in increasing the total number of graduate students or the number of graduate course offerings (only one new graduate course was approved in 2005-06). We anticipate that new faculty hires now on board and planned for the future will make it possible to meet these goals.
- The department established an email listserv for the postdocs, and for the first time in recent years, postdocs were invited for a chat with the department head to gather input on successes and suggestions for postdoctoral training in the department.

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	2005-06
PhD students enrolled ¹	33	38	37	46
MS students enrolled ¹	34	31	40	26
PhD/MS ratio ¹	0.97	1.23	0.93	1.77
Funded GRAs ^{1,2}	26.0	27.5	27.0	32
Funded GTAs ^{1,2}	44.0	38.5	46.7	39
GRA/GTA ratio ^{1,2}	0.59	0.71	0.58	0.82
GTA stipend payroll ³	\$511,894	\$516,707	\$583,192	\$528,485
GRA stipend payroll ³	\$416,658	\$553,817	\$571,061	\$614,801
Full time postdocs ¹	8	9	10	17

¹ Snap shot taken in spring of academic year

² Includes a small number of students from other life science departments occasionally funded to meet critical teaching on short notice

³ Stipend data are for a 12 month basis, August through August.

- The third annual biology research day was held on Saturday, February 11, 2006 in Torgersen Hall.
 - Co-organized by graduate students **Alexandra Class, Derrick Scott, and Nick Jeremiah**, and by faculty members **Drs. Lisa Belden, Carla Finkielstein, Iulia Lazar and Erik Nilsen**.
 - 8 invited talks by current graduate students, 36 posters by current graduate students, and an invited plenary talk delivered by Dr. Charles Stewart (a former PhD student of the department's).
 - An abstract book was published, and over 100 people attended the meeting, including several from the Biological Sciences Alumni Advisory Board.
 - Also in attendance were 19 graduate student prospects (8 for ecology evolution and behavior fields, 5 for cell and molecular fields, and 6 who were candidates for the university microbiology graduate program).
- Department faculty and graduate students led the organization of two major university seminar series: the Molecular and Cell Biology and Biotechnology series (MCBB), and the Ecology Evolution and Behavior (EEB) series. Weekly seminars were held for both series in both fall and spring semester.
- The quantity of graduate recruits has not changed appreciably in recent years in terms of number of applicants, percent accepted and percent of the accepted who chose to enroll, as shown in the table below.
- The quality of recruits has also remained very stable as indicated by GRE and GPA scores of students enrolled in regular status, as seen in the following table.

Class ¹	No. Applicants	% Accepted	% of Accepted Enrolled	GRE Verbal ²	GRE Quantitative ²	GRE Total ²	GPA ²
1991	125	46	14	530	650	1180	3.1
1992	114	26	11	566	654	1220	3.5
1993	99	32	22	539	640	1179	3.5
1994	108	56	66	550	605	1155	3.45
1995	154	28	72	582	626	1208	3.59
1996	121	24	59	591	670	1261	3.66
1997	113	25	68	517	601	1118	3.43
1998	93	31	69	502	635	1137	3.68
1999	102	25	54	538	636	1164	3.43
2000	98	33	73	540	637	1177	3.46
2001	93	32	90	505	639	1144	3.52
2002	115	25	59	522	671	1193	3.39
2003	113	31	69	490	625	1115	3.42
2004	79	20	80	N/A	N/A	1199	3.50
2005	105	20	76	N/A	N/A	1174	3.65
Mean	108.8	30.27	58.8			1174.93	3.49

¹ Students applying for spring and fall semester of indicated year

² Calculated for students entering in regular status, GPA is for undergrad degree

- Although there is consistency in our graduate recruiting, and often students choose Virginia Tech over peer institutions and top-30 research institutions, there is a persistent concern that the quantity of sufficiently qualified students has not been enough to meet demands. Therefore, groups of faculty with significant leadership from our department, have formed two university-wide graduate recruiting programs:
 - The Graduate Program in Microbiology was initiated in 2003 and includes over 40 faculty participants from across the university. Students who apply and are recruited spend their first semester rotating through laboratories before the decision is made on a major advisor. For details, see http://www.biol.vt.edu/vtmicro/g_study.html
 - The Graduate Program in Molecular Plant Sciences was initiated with 20 participating faculty from 7 departments; this year marked the second year of an aggressive recruiting effort at regional schools, followed by students rotating through labs before a decision is made on a major advisor. For details, see <http://www.molplantsci.org.vt.edu/INDEX.HTM>
- We entered the second year of the “preparing the future professoriate” project whereby graduate students who wish to build a strong resume in teaching and in preparation for academic careers, can participate in a graduate school certificate program, or teach a lecture course in our department, provided that they have taken a course in pedagogy or teaching at the college level, and provided that they find a willing faculty mentor.

- This year, we decided to push the teaching experiences into summer sessions, which provides a funding mechanism and is less disruptive on our GTA resources needed for teaching laboratories in fall and spring semester.
- Participants this year (summer sessions 2006) included **Mohannad Al-Saghir** who taught the 3-credit Principle of Biology BIOL 1105 course, and **David Dommer** who taught the 3-credit second semester principles course (BIOL 1106).

II. Discovery

Research productivity shows small increases in 2005 relative to the previous two years. The numbers of books, peer reviewed book chapters, peer reviewed journal articles in print or in press, presentations and invited seminars increased in 2005 relative to 2004. Similarly, various indicators of funding have increased in fiscal year 2006 relative to fiscal year 2005. Two new symposiums hosted by Virginia Tech faculty highlighted growth within the department and across Virginia Tech in two research fields: structural biology and innate immunity.

Summary of research outputs for the departmental faculty (~39 FTE research and teaching faculty) for calendar years 2002 – 2004 (except fiscal year where noted).

Indicator of research/scholarship activity	2002	2003	2004	2005	2006
Books, book chapters, and journal articles in print or press (calendar year basis)	142	133	132	146	
Presentations at professional meetings and conferences (calendar year)	104	110	103	129	
Invited seminars (calendar year)	54	44	26	51	
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	\$45,543,627	
Research expenditures (actual dollars spent during fiscal year)	\$2,219,357	\$2,871,899	\$2,607,532	\$3,113,895	\$3,438,121
New research awards (Fiscal year basis; source=Office of Sponsored Programs awards data base)	\$4,437,212	\$3,651,453	\$3,450,181	\$4,123,917	\$4,394,819

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

Other significant contributions and accomplishments include:

- In Calendar year 2005, 17 faculty were invited to present their research at other institutions (an increase over 11 faculty invited in 2004)
- **Dr. Ignacio Moore**, Assistant Professor, received a prestigious NSF CAREER award that provides 5 years of funding to promising young scientists. He joins **Dr. Iuliana Lazar** who also obtained an NSF CAREER award in 2004 and **Dr. Ann Stevens** who completed her CAREER award in 2004 and is now a tenured Associate Professor.
- An inaugural conference on structural biology was hosted by Virginia Tech with leadership from Biological Sciences. This follows from two years of developing a protein crystallization and analysis facility with collaboration with Oxford Diffraction Corporation, and the hiring of three faculty in Biological Sciences, **Drs. Nancy Vogelaar, Carla Finkielstein, and Florian Schubot**. The conference included local faculty across the university who are doing protein structure work, plus two outside guests. A hundred-fifty people (mostly faculty) from VT and regional schools attended. For more information see: http://www.biology.vt.edu/structural_symposium/index.htm
- **Dr. Liwi Li**, an immunologist who joined our faculty in August 2005, hosted a regional conference on innate immunity at Virginia Tech. Innate immunity is a fast moving research field that cuts across many kinds of organisms (plants and animals). The conference showed that VT and its partners at Wake Forest have become leaders in this field. For more information see: <http://www.conted.vt.edu/innate/schedule.html>
- **Dr. Duncan Porter**, who serves as the director of the Darwin Correspondence project in Cambridge England, published volume 15 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. M. Pearn, A. Sclater, & P. White (eds.). 2005. *The Correspondence of Charles Darwin. Volume 15: 1867*. Cambridge: Cambridge University Press. xlii + 626 pp.
- **Dr. Dorothea Tholl**, who joined the department as an assistant professor in 2005, published a paper that made the cover of the Plant Journal. The full citation is: **Tholl, D**, Chen, F, Petri, J, Gershenzon, J, and Pichersky, E. (2005). Two sesquiterpene synthases are responsible for the complex mixture of sesquiterpenes emitted from *Arabidopsis* flowers, *Plant J.*, 42, 757-771.
- **Dr. Khidir Hilu's** paper on phylogeny for angiosperms, published in 2003 in the American Journal of Botany, has become one of the top 1% of cited papers. The full citation is: **Hilu, Khidir W.**, Thomas Borsch, Kai Müller, Douglas E. Soltis, Pamela S. Soltis, Vincent Savolainen, Mark W. Chase, Martyn Powell, Lawrence A. Alice, Rodger Evans, Hervé Sauquet, Christoph Neinhuis, Tracey A. Slotta, Jens G. Rohwer, Christopher S. Campbell, and Lars Chatrou. 2003. Angiosperm phylogeny based on *matK* sequence information. *American Journal of Botany* 90: 1758-1776.
- **Dr. Brenda Winkel** (Biological Sciences) received a \$460,000 grant from NSF's Molecular Biochemistry Program to continue characterizing the structure and subcellular localization of the flavonoid multi-enzyme complex in *Arabidopsis thaliana*. Co-PI **Erin Dolan** (Biochemistry) will carry out an associated study on the impact of NSF Research Experience for Undergraduate supplements on the careers of the 35 undergraduates who have done research in the Winkel lab over the past 12 years.

- **Dr. Brent Opell** received a \$235,000 grant from the National Science Foundation to study the design, diversity, and function of viscous prey capture threads that are produced by over 4000 species of orb-weaving spiders. These sticky threads are formed of small adhesive droplets suspended on elastic fibers and serve to retain insects that strike a web.
- **Drs. Carola Haas** (Fisheries and Wildlife Sciences), **Tom Fox** (Forestry) and **Robert Jones** (Biological Sciences), received a \$624,000 grant from the USDA to study the impacts of forest management activities on biological diversity and ecosystems processes in Appalachian Forests.
- **Dr. Jeff Walters** received a \$648,880 research grant from the Department of Defense, Camp LeJeune to study the demographic and population response of red-cockaded woodpeckers on Camp LeJeune Marine Base, and use the data to help build a basewide management plan.
- **Dr. Liwi Li** received a grant for nearly \$1,875,000 from the National Institutes of Health to study the novel role and regulation of the Interleukin-1 Receptor associated Kinase (IRAK) family proteins, which are key to innate immunity functions.
- **Mr. Brian Olsen**, a graduate student supervised by Dr. Jeff Walters, received the Smithsonian Institution Predoctoral Fellowship Award, which consists of a \$20,000 stipend awarded from May 1, 2005 until April 30, 2006. He will be traveling to the Smithsonian National Zoological Park to conduct research with Zoo Biologists Russell Greenberg and Robert Fleischer. His project will examine how the mating system of two sub-species of the Swamp Sparrow has diverged using DNA microsatellites to evaluate rates of extra-pair fertilization.

III. Engagement

The department has chosen to focus its engagement and outreach efforts on: 1) learning and research partnerships with industry; 2) K-12 teaching in Science, Technology, Engineering, and Math (STEM education); 3) enhancing the opportunities for research funding by adding broader impacts to NSF and other funded research projects; and 4) keeping strong connections to alumni and friends. In all four of these areas, activities and accomplishments have remained the same or have increased relative to the previous academic year.

International aspects of the undergraduate curriculum remain a modest but high impact element within the total undergraduate learning environment, while international elements of research continue to be a strong element of the department.

- In March 2006, PPD Incorporated and Virginia Tech announced a significant corporate gift to increase student learning and training on state-of-the-art equipment, thereby increasing the skill levels of graduates and providing increased value to the work force for industry. PPD provided two Sciex API 3200 mass spectrometers valued at over \$500,000 to the Department of Biological Sciences. The machines are capable of identifying small to large molecules in biological samples, even if present in trace quantities, and will be located in a biological sciences teaching and research labs in Derring Hall.

- Oxford Diffraction Limited has announced that it will be consolidating its North American operations in Blacksburg Virginia to increase the collaboration between the company and the College of Science (including programs in Chemistry, Geosciences and Biological Sciences). The department and Oxford Diffraction are partnering to create state of the art structural biology facilities that will boost the quality and recognition of protein science research at Virginia Tech.
- Activities for the Science Outreach program (SOuP, <http://www.socm.vt.edu/>; led by **Dr. Mike Rosenzweig**, in collaboration with the Department of Geosciences and the College of Science) in FY 2005-06 include:
 - \$60,000 in extramural funding from two NSF grants (in collaboration with PIs Maroof and Opell), one DCR grant, and other small grants. Additional efforts are underway to develop broader impacts and outreach for three more NSF proposals coming from the department from PIs Nilsen, Finkielstein, and Barrett.
 - Served **4132 teachers and students directly** in FY 2005-06 through outreach programs and kit loans.
 - Worked closely with the Montgomery County Public Schools (MCPS) curriculum coordinators. Organized a task force including the MCPS curriculum coordinators along with VT-STEM K-12 professionals. The group identified several programmatic needs and has split off into two main work/grant proposal groups. Dr. Rosenzweig is leading the science curriculum support group and participates in the Vocational/Technical workgroup.
 - **Mike Rosenzweig** along with **Llyn Sharp** (Geosciences) have been chosen to co-coordinate the VT-STEM initiative. This is a statewide leadership role involving the main campus and all VT geographic centers. This is a two-year appointment with a Aug 06 – July 08 term with some salary funding and support from the outreach division.
- Massey Herbarium activities included:
 - Associate Curator **Tom Weiboldt** has further refined the atlas of the vascular plants of Virginia, which is available to the public at: http://www.biology.vt.edu/digital_atlas/
 - Between June 2005 and May 2006, the herbarium added 2385 plant specimens to its collection, had 34 officially recorded visits, about 10 requests per month for information in addition to requests for identification of 391 plants.
- The alumni advisory board met in Blacksburg on November 12, 2005 and on February 11, 2006 (the latter coinciding with our graduate research day event). Four new people were invited to and accepted positions on the board. The Alumni Board remains active in recruiting scholarship funds and in providing advice on departmental operations.
- The OWLS, our emeritus faculty group, had another very active year. They have established monthly meetings, for which they invite the department head and an individual faculty member to keep up on departmental activities. The OWLS attended most of the department's functions and socials. Specific activities include:
 - **Dr. Ernie Stout** assisted in organizing the department's award ceremony held on May 4, 2006
 - **Dr. Bruce Parker** assisted in building scholarship funds toward endowment status
 - **Dr. Robert Benoit** taught general microbiology and medical ethics

- **Dr. Noel Krieg** taught prokaryote diversity
- International aspects of the undergraduate curriculum remain a modest but high impact element within the total undergraduate learning environment.
 - Plants and Civilization (BIOL 2204; fall 2005, 76 students enrolled), taught by **Dr. Khidir Hilu**, continues as an Area 7 course within the university core curriculum, and Plant Taxonomy (BIOL 3204; spring 2006, 52 students) is of international scope.
 - **Dr. Ignacio Moore**, with help from **Drs. Art Buikema, Duncan Porter** and **Rick Fell**, took a class to Ecuador in summer 2006 to study plant and animal communities and their relationships to different environments and human impacts.
 - **Dr. Khidir Hilu** took a class in summer 2006 to the European Alps to study plant biodiversity and ecology
- International aspects of discovery are a strong element of the Department of Biological Sciences. Twelve of the department's faculty had substantive research interactions with researchers or field sites outside of the United States in a total of 16 different countries.

IV. Diversity Activities (faculty, staff, student)

Progress has been made this year in addressing work life issues, supporting science training for underrepresented groups, celebrating cultural diversity, and increasing the diversity of the faculty.

- In 2005-06, the department diversity committee, led by **Dr. Anne McNabb**, developed the following activities and projects:
 - Through the department head, encouraged everyone in the department to attend the Advance Workshop on Jan. 9 and the Diversity Summit on Jan. 20
 - Developed a new folder that includes short informational items on work life issues and policies and resources on campus to assist employees; e.g., a flyer was developed for the university stop the tenure clock policy; The notebook is in final stages of preparation and will be delivered to faculty in fall 2007, and also posted on the web
 - On April 6, the department hosted its second annual international day luncheon, a pot luck lunch attended by over 60 people, with recipes from around the world
- The department continues to participate in minority scholarship programs for undergraduates and graduate students. Since 2003:
 - 14 undergraduates have participated with Biological Sciences faculty under the Mid Eastern Atlantic Minority Program (MEAMP)
 - 13 students have participated in the summer Multicultural Academic Opportunities Program (MAOP) with Biological Sciences Faculty, and one of these students is now enrolled in the master of science program in Biological Sciences
 - 7 minority undergraduate students have participated in undergraduate research programs with Biological Sciences Faculty funded by NSF REU minority grants or the McNair scholarship
 - 5 minority graduate students have been funded by MAOP, NIH minority fellowships or the Powell fellowship

- In the past 4 years, the Department of Biological Sciences has hired 11 tenure track faculty. Six of the 11 are women. Two of the 11 are of Hispanic and two of Asian cultural/ethnic background. Six of the 11 were born outside of the United States and either currently hold, or held at one time, foreign citizenship.

V. Service (departmental, college, university, professional)

Department faculty and staff were very actively engaged in a broad array of service activities within the department, college, university, and profession.

- The following table of committee assignments for academic year 2005-06 shows that the department's faculty members were involved in many governance and service activities on behalf of the department, college, and university. In addition to the regular standing committee assignments shown in this table, faculty are often called on for special service to ad hoc committees, including search committees for various administrative, faculty and staff positions, and committees to examine curricula, university policies, or resource issues.
- Significant activities for the profession included:
 - 11 faculty participated in a total of 14 national grant review panels for the National Institutes of Health (6 panels), National Science foundation (5 panels), NSF of China (1), EPA (1), and USDA (1).
 - **Dr. Robin Andrews** served as the president of the Society for the Study of Amphibians and Reptiles.
 - **Dr. Fred Benfield** is a member of the Virginia Department of Forestry Riparian Research Team, member of the Virginia Gap Analysis Advisory Panel, member of the Virginia Division of Environmental Quality Academic Advisory Committee, and voting member of the Joint Task Force "Standard Methods for the Examination of Waster Water" of the American Waterworks Association. Dr. Benfield is also very active with the North American Benthological Association, holding three committee posts, co-editing the Association's professional journal, and judging graduate student papers at the national meeting.
 - **Dr. Art Buikema** served as a judge for the USA Today 2006 All-USA College Academic Team. He also served as the Chair of the Sub-Saharan Africa Review and Selection Committee for the National Fulbright Fellowship program.
 - **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, and has recently been become an active member and appointed officer in the U.S. Coast Guard Auxiliary.
 - **Dr. Joe Falkinham** is 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. Robert Jones** chaired a university ad hoc committee to examine the university core curriculum and recommend changes to make the curriculum better serve the university's learning objectives.
- **Dr. Christopher Lawrence** organized the "Secret Life of Rots" symposium for the American Phytopathological Society meeting held in Austin, Texas, July 2005.
- **Dr. Liwu Li** was invited as a reviewer of the North Carolina Biotechnology Center and a national Institute of Health program project.
- **Dr. Brent Opell** is a member of the board of directors for the American Arachnological Society.
- **Dr. David Popham** is serving as Chair of Division J (Ultrastructure and Function) of the American Society of Microbiology.
- **Dr. Duncan Porter** served as the director of the Darwin Correspondence Project at Cambridge University.
- **Dr. John Tyson** serves on the Board of Governors, National Resource for Cell Analysis and Modeling, University of Connecticut Health Center, Framingham CT.
- **Dr. Maury Valett** is a member of the Executive Committee for the North American Benthological Society (NABS) and is participating in the NABS mentor enhancement program.
- **Dr. Jeff Walters**, Bailey Professor of Biology, serves as Member of two National Research Council committees: the Committee on Restoration of the Greater Everglades Ecosystem (CROGEE), and the Committee on independent Scientific Review of Everglades Restoration Progress. He is also a member of several teams and committees involved in recovery and protection of the red-cockaded woodpecker and protection of the sandhills ecosystem, the US Fish and Wildlife Service (USFWS) recovery committee for the Guam Micronesian KingFisher, president of the Sandhills Ecological Institute, and chair of the American Ornithologists' Union Conservation Committee.
- **Dr. Brenda Winkel** was co-organizer of the 16th International Arabidopsis Conference held in Madison Wisconsin, and serves on the Arabidopsis Biological Resource Center Advisory Committee and North American Arabidopsis Steering Committee.
- A number of our faculty are editors or on the editorial board of professional journals:
 - Fred Benfield - *J North Amer Benthological Society* and *Southeastern Naturalist*
 - Jack Cranford – *Southeastern Naturalist*
 - Joe Falkinham – *Applied and Environmental Microbiology*
 - Khidir Hilu - *Kurtziana (South American)*
 - Bob Jones – *J Forestry Research* and *J Ecology*
 - Liwu Li – *J Immunology*
 - Anne McNabb - *J Experimental Zoology, Poultry & Avian Biology Reviews*
 - Erik Nilsen - *J American Rhododendron Society*
 - Brent Opell - *J Arachnology*

- John Tyson - Co-chief Editor, *J Theoretical Biology*, and on editorial board of *J Nonlinear Science*
- Jeff Walters – *Ecology* and *Ornithological Science*
- Jack Webster - *Freshwater Biology*

2005 -2006 GOVERNANCE AND SERVICE SCHEDULE

Curriculum Committee

Cranford and Walker, Co-chairs
Cimini / Evans / Melville / Opell
Phillips / Scheckler

Diversity Committee

McNabb, Chair
Link/ Jenssen / Stevens
Jones / Turner / Blanc

Executive/Personnel Committee

Jones, Chair
Cowles / Cranford / Falkinham
Melville / Moore / Sible
Webster / Winkel

Faculty Recognition Committee

Buikema, Chair
Cowles / Esen / Jones / Turner
Yang / Kerri Huffman, President BGSA

Faculty Search (bio members only)

Computational Sciences: Tyson and Sible
College Cluster Committee rep: Valett
Others: TBA

Graduate Evaluation Committee

Walters, Chair
Cherry / Elgert / Lawrence
Nilsen / Sible

Graduate Selection Committee

Andrews, Chair
Benfield / Finkielstein / Li / Moore
Rasmussen / Yang

Honors Advisors

Buikema / Cowles
Simmons / Jones / Porter

Student Recognition Committee

Lipscomb, Chair
Cranford / Evans / Rosenzweig
Tholl / Via, ex officio / Waterman

Programs and Technical Functions

Alumni: Falkinham and Conner
Animal Care: Elgert and Jarrett
BGSA President: Kerri Huffman
Collections: Porter/Weiboldt/Cranford/Rosenzweig
Computers: Webster, Gunter & open position
Facilities: Benfield and Waller

Freshman Labs: Buikema and Schaeffer
Greenhouse: Hilu and Wiley
Micro/immuno labs: Popham and Link
Research Day: Nilsen/Lazar/Finkielstein/Belden
Class/Jerimiah/Scott
Strategic plan: Scheckler and Moore
Web page: Andrews, Conner, Cruise

University/College Reps

Academic Support: Cowles
Animal Care: Tom Jenssen
College Curriculum: Opell
College Faculty Association: Cowles
College Grad Affairs: Andrews
College P&T: Hilu
College Research: Tyson
College Teaching Excellence: Buikema
Commission on Research: Phillips
EEB Seminar: Belden
Faculty Senate: Valett / Evans
Library: Cherry
Life Sciences Learning Community: Cowles
MCBB seminar: Melville
Phi Sigma advisor: Popham
Senate Committee on faculty ethics: Cranford
Sigma Xi: McNabb / Scheckler / Winkel
University Council: Cranford
Univ. Intellectual Properties: Falkinham
Univ. Micro Grad Program: Popham (chair)
Univ. Plant Mol Bio Grad Program: Winkel (chair)

OWLS (retired faculty association)

Bruce Parker and Ernie Stout, Co-chairs
Curt Adkisson / Bob Benoit
John Cairns / Bill Claus
Al Heath / Al Hendricks
Buck Holliman / Noel Krieg
Orson Miller / Bob Patterson
George Simmons / Harry Steeves
David Stetler / Charlie Rutherford / Al Youston

Assistant Professors: & Their Official Mentors

Lisa Belden: Jeff Walters
Iuliana Lazar: Brenda Winkel
Dorothea Tholl: Brenda Winkel
Ignacio Moore: Anne McNabb
Tad Seyler: David Popham
Zhaomin Yang: Charles Rutherford
Daniela Cimini: Rich Walker
Carla Finkielstein: Jill Sible
Florian Schubot: Dave Popham

VI. Honors and Awards (faculty, staff, student)

- *Teaching and Advising*

- The department's 2006 Outstanding Undergraduate Advisor award was presented to **Mr. Jack Evans**. This honor is based on a vote from the senior undergraduate class of 2006. Jack is a leader in our pre-medical, pre-pharmacy advising, teaches our freshman orientation course, and is especially skilled at working with students who are getting into academic trouble. He is currently working on a PhD in student affairs programs to hone his skills in advising and counseling.
- In spring 2005 (AY 2004-05 but not reported last year), **Dr. Jack Cranford**, the faculty supervisor of the advising center, received the Virginia Tech Alumni Academic Advising Award in 2005 and the National Academic Advising Association's Certificate for Faculty Academic Advising.
- Three faculty received departmental recognition for excellence in teaching. **Dr. David Popham** has contributed to our sophomore genetics teaching and occasionally to various graduate level topics courses. But his main classroom contributions have been in the Microbial Genetics lecture and Microbial Molecular Genetics and Physiology Lab, two of our key senior level courses for the microbiology and immunology option. His consistently strong student evaluations in these courses, and the lasting impressions he has left with the students are clear indicators of a high level of dedication and skill. David is also one of our strongest graduate mentors and has provided leadership in supervising the overall microbiology and immunology laboratory teaching operation. **Dr. Anne McNabb's** main undergraduate contributions have been in comparative endocrinology and environmental animal physiology, both senior level, writing intensive courses. Anne has typically taken an overload in enrolment to help our students get their writing intensive requirement. Her student evaluations are consistently excellent, and many consider their experience with her the best they have had at Virginia Tech. Anne has also been a major force in our graduate program, serving not only as the department's graduate coordinator for eight years and more recently as an associate dean in the graduate school, but also as an excellent mentor of graduate students herself. **Dr. Joe Falkinham**, in both his research and teaching is an entrepreneur. He is able to exploit this trait to good effect, bringing his sophomore course in genetics to life. Joe has established a reputation for excellence, and has received consistently high student evaluations. He has also served on numerous graduate student committees, directing the thesis project for 24 of them. More recently, he has used his teaching reputation to help the department reconnect with its alumni, many of whom have very fond memories of Joe and frequently ask me about him. Through his excellent teaching, Joe is continuing to build a legacy for our department.

- The department's 2006 Most Influential Professor Award, as determined by a vote of the senior class, was presented to **Dr. Jill Sible**. Jill has been recognized frequently by the students and faculty in our department for excellence in teaching. She teaches cell and molecular biology regularly, and has just started teaching developmental biology. Jill has led or contributed to a number of innovative graduate level courses, and has become a scholar of teaching as a collaborator on an NSF funded project to incorporate social studies into biology teaching. Recently, she has become active in local secondary school science teaching issues and has participated with others to seek funding for bringing underrepresented groups into college level biological sciences education. Jill has made a strong impression on many of the students in the senior class through her teaching, mentoring, and major operation in undergraduate research.
- **Dr. Jill Sible** received a College of Science Certificate for Excellence in Teaching, and was named an Edward Singleton Diggs University Teaching Scholar.
- PhD student **Brian Olsen** received a Virginia Tech Graduate Teaching Special Commendation from the Virginia Tech Graduate School.
- **Chelsea Black** received the department's Undergraduate Research Award at spring 2006 commencement. She started her undergraduate research with Dr. Khidir Hilu in 2004, working on three plant molecular biology projects in Dr. Hilu's lab, and presenting her work twice at the Virginia Academy of Sciences meetings. She also received a grant from the academy to support her research on the molecular structure and evolution of a peanut allergen, which makes peanut consumption very dangerous for some people. In addition, Chelsea interned at NIH National Cancer Institute in the summer of 2005 and has been invited for a second internship this summer. Chelsea received several scholarships and academic honors, was a member of the VT Women's Rugby team, and volunteered often for community service. After her internship this summer Chelsea will return to Blacksburg to work on the Tree of Life project in Dr. Hilu's lab. She plans to begin graduate studies the following year.
- The 2006 Outstanding Senior Award was presented at spring 2006 commencement to **Sophia Bous**. Sophie completed a double major in Biological Sciences and Philosophy with a minor in Chemistry and graduated with a Commonwealth Scholar degree, earning a Grade Point Average of 3.95. Her contributions to the department have been many and diverse. The most notable is perhaps her role as teaching assistant for the Biological Sciences Learning Community for two years. She also conducted research on the embryological development of spiders with Dr. Brent Opell. Sophie has volunteered or interned at several medical clinics and medical research laboratories including the National Institutes of Health. She has served as a mentor to local middle and high school students and has worked as a chemistry recitation instructor. Sophie has been accepted by multiple medical schools and has the luxury of choosing where she wants to go.

- *Research*
 - Virginia's Life Achievement in Science 2006 Award was presented to **Dr. Duncan Porter** by the Virginia Museum of Science. This is the highest honor in science one can receive from the state of Virginia, and it was presented to Dr. Porter for his studies of plant systematics and the history of Charles Darwin.
 - **Dr. Jeff Walters** received the 2006 Department of Biological Science Research Award. This award is in its inaugural year, and it is fitting that it was presented to Jeff for his high profile studies in conservation biology and animal behavior. Since arriving on our campus in 1994, he has gone well beyond our high expectations for this position. The quality, scope, and international reach of Dr. Walters' research have been impressive. They derive from a long-term fascination with animal behavior, which drove his interest in biological research, and resulted in two career goals: to make significant contributions to basic biological knowledge, and to promote application of new basic science to animal conservation. His success in reaching both of these goals is evidenced by his many publications in basic science journals, the diversity of his grant support, which has totaled to \$6 million at VT, his involvement with management of endangered species and habitat across the world, and his extensive participation in efforts to evaluate science relevant to important conservation efforts. In 2002, he received the Elliott Coues Award from the American Ornithologists' Union, the major research award from the major professional society in Jeff's field. Jeff's well known expertise in conservation biology has made him a target for work on national level committees in the national academy of sciences and the US Fish and Wildlife Service.
 - The John Neal memorial Sigma Xi Award for PhD Research was presented to **Dr. Wes Black**, who completed his PhD in microbiology in fall 2005 under the supervision of Dr. Zhaomin Yang.
 - Best poster awards for the department's Research Day event held February 11, 2006 were presented to four of the department's graduate students: **Travis Belote, Eric Weigel, Tongli Zhang** and **Hyun Young Yu**.
 - **Dr. Daniela Cimini**, who joined the department in December 2005, won an award for a cell movie contest organized by the American Society for Cell Biology (ASCB). The award was officially presented during the 45th ASCB annual meeting and consisted of \$500 plus free meeting registration.

- *Service*

- In 2006, two Department of Biological Sciences Service Awards were presented. **Dr. Brenda Winkel** was recognized for her major portfolio of service activities during the past 10 years. She was a leader and organizer of the university's new plant molecular science graduate program, organized a national Gordon conference, served on many national, university and college committees, and has been tapped many times by many groups to review grant proposals, papers, and the dossiers of people being considered for tenure and promotion. **Dr. Bruce Parker** recently retired from Virginia Tech after a little over 30 years of excellent service. He has since continued a very active role in our Biological Sciences community by co-organizing the OWLS (along with Dr. Ernie Stout), and has been working for the department to organize our scholarships and recruit new funds to bring them to a level where they become officially endowed. He is also the keeper of our departmental history and has updated our history documents each year.
- **Ms. Betsey Waterman**, who holds a classified staff position in academic advising, was recognized as one of Virginia Tech's Employees of the Week.

VII. Future directions (highlight from the department's strategic plan)

Throughout the 2005-06 academic year, the department worked on an update to its strategic plan. A draft is included in this annual report. The plan will be modified slightly in 2006-07 to coordinate with new university and college plans that are also in the process of being updated.

STRATEGIC PLAN FOR THE DEPARTMENT OF BIOLOGICAL SCIENCES, VIRGINIA TECH

December 11, 2005; Updated June 12, 2006

Drafted by R. Jones

INTRODUCTION

Since entering the “Century of Biology” five years ago, humanity has witnessed explosive growth in the breadth, depth and importance of biological knowledge. Biology is increasingly an integrative science, absorbing and contributing toward new advances in mathematics, information science, chemistry and physics. Biological career opportunities remain plentiful, with no decline in sight. But training in life sciences must reflect and anticipate world-wide trends for integration of cultures and economies.

The Department of Biological Sciences at Virginia Tech is well-positioned for success in the 21st century. It offers integrative, high-tech, and increasingly interdisciplinary research programs, and comprehensive training for people pursuing careers in life sciences. It is embedded within a newly created College of Science that is building highly interdisciplinary programs at the frontiers of traditional science fields. Furthermore, in the tradition of Virginia Tech’s “land grant” mission, the department has developed important synergies between research, teaching and outreach.

The university and college have set their sights high for excellence and relevance within our rapidly changing society. Within the framework of the university and college visions, the Department of Biological Sciences has charted its own future, with help from students, staff, alumni, and faculty.

MISSION AND VISION FOR THE FUTURE

The department’s mission includes:

- (1) *DISCOVERY: Use innovative research to generate new knowledge in the biological sciences.* Although focused primarily on fundamental relationships, research conducted by the department’s faculty is directed toward improvement of the human condition.
- (2) *LEARNING: Provide comprehensive education in the biological sciences at the undergraduate, graduate and postdoctoral levels.* The department’s programs encompass learning, training and experience in all levels of biological hierarchy from molecular to global.
- (3) *ENGAGEMENT: Develop partnerships with the public to facilitate understanding of the natural world and enhance the quality of life.* Biological Science faculty, students, and staff are actively engaged in service to their profession and society.

The department's vision is to become a community of scholars who are:

- (1) *National and world leaders of biological DISCOVERY, LEARNING and ENGAGEMENT, driven by curiosity, responsive to societal needs, and involved in setting the nation's research agenda;*
- (2) *Increasingly interdisciplinary, reaching across science and non-science fields to solve problems at the frontiers of knowledge, using both fundamental and applied approaches;*
- (3) *Socially and culturally diverse, recognizing science's place within a social context, and positioning the department, college and university to take advantage of a future marked by rapid advances in technology, and globalization.*

CURRENT OPPORTUNITIES AND CONSTRAINTS

The department has many existing strengths that afford opportunities for fulfilling its mission and realizing its vision of excellence, including:

- *Diverse, high quality research programs* spanning many of the major life science disciplines including computational biology, cell and molecular biology, immunology, microbiology, organismal biology, ecology, evolution, and behavior. Strong, well-funded and internationally recognized scholars exist within each of these areas. Interdisciplinary research projects are common, and extramural funding to support research is increasing.
- *High-quality learning* in the classroom, laboratory and field, led by award winning teachers. Quality elements to our teaching include innovations in teaching methods, a thriving undergraduate research program, and a growing array of study abroad opportunities.
- *Emerging campus-wide graduate recruitment* programs that promise to increase the number of high-quality graduate students within the department.
- *A large, high-quality undergraduate student body* seeking B.S. degrees in Biological Sciences. In fall 2005, there were ~1300 undergraduate majors; many of these students have received national academic scholarships, top university awards, and other academic accolades.
- *Excellent undergraduate and graduate student academic advising*, that includes a well-staffed undergraduate advising center, the innovative freshman seminar course, and a rigorous, annual graduate student review system. Because of its excellence in academic advising, the department was recognized by the university in 2003 as "Exemplary" for its academic advising programs.
- *A highly collegial environment* that celebrates diversity and emphasizes a view of biological sciences within the context of a globalizing society.

Reaching the department’s vision will require strategic investments and actions to overcome or ameliorate the following constraints:

- *A relatively low number of faculty coupled with a high number of majors and high service teaching loads*, which have the following consequences:
 - Limited capacity for faculty to develop competitive research grant proposals;
 - Limited capacity for faculty to teach important upper division undergraduate and graduate courses that would increase the quality and attractiveness of our learning programs;
- *Insufficient quantity of high-quality building space for research, teaching and outreach*;
- *Increasing quantity and complexity of work for classified staff* in all areas of staff responsibilities (i.e., administration, teaching and technical);
- *Difficulties in recruiting the very best graduate and undergraduate students* in a highly competitive market (e.g., we rarely recruit valedictorians or salutatorians, and we often lose top graduate prospects to other universities that have greater financial packages);
- *Insufficient operating budgets and endowments* to advance the quality of scholarship at all levels (research, teaching and outreach);
- *Relatively low cultural and ethnic richness* (when compared to Virginia’s general population, or to other high quality research universities) among the students, staff and faculty.

STRATEGIC PLAN

The department has devised (1) goals, (2) strategies, and (3) metrics to assess progress toward goals in each of four mission categories, and four operational areas that cut across all of the departmental missions:

<u>Mission Areas</u>	<u>Operational Areas</u>
Discovery	Diversity
Learning: undergraduate programs	Staffing
Learning: graduate programs	Infrastructure
Engagement	Funding

DISCOVERY

Goals: The department has the following general goals in research:

- Maintain and enhance international prominence
- Align departmental vision with college and university strengths and goals to take advantage of locally available talent, and investments planned by Virginia Tech (e.g., in the biomedical, nano-biotechnology, and environmental areas)

Strategies: National and international recognition is best achieved if the department invests resources in a few targeted research areas, rather than in a wide variety of disciplines. Hiring new faculty to create groups focused on major problems or disciplines, has major advantages, including enhanced competitiveness for research funding, and the ability to recruit the best faculty and students. After examining our existing strengths, and looking to the future of biological science funding opportunities, the department has chosen three research areas to focus on: (1) Cell Regulation and Signaling, (2) Integrative Behavioral and Organismal Biology, and (3) Ecosystem Ecology at the Aquatic/Terrestrial Interface.

Metrics for determining progress:

- Total number of peer-reviewed publications, books, and book chapters published per year
- Number of papers in high profile journals such as Science and Nature
- Grant funding received and research expenditures
- Awards presented to faculty for their research

LEARNING: Undergraduate Programs

Goals:

- Increase ability of students to use interdisciplinary approaches to solve the problems facing humanity in the 21st century
- Maintain or improve the quality and success of learning experiences within and outside of the classroom
- Increase the quality of academic majors choosing the Biological Sciences major without increasing the quantity
- Increase international perspectives among students

Strategies: Assuming that resources will be available to alleviate current constraints and increase integration, the department will invest those new resources to:

- Maintain excellence in undergraduate advising and in first year experiences
- Maintain a university leadership role in offering a residential learning community (i.e., the BLSC)
- Increase the level of active and inquiry based learning within lecture courses
- In conjunction with other departments in the College of Science Develop physics, math, computational, and chemistry sequences for our majors that are more in tune with needs in biological sciences
- Increase laboratory class offerings available to undergraduates

- Develop more senior level courses in thematic clusters (i.e., within the research thrust areas where there will be large pools of faculty expertise to tap)
- Expand undergraduate research as a capstone experience for our majors
- Add cooperative experiences with industry, government and non-governmental entities
- Add new courses in education abroad within the department and encourage students to take full advantage of opportunities across the Virginia Tech campus and world

These goals will have to be met with new investments in staffing (see staffing section below), classrooms (see infrastructure section below), and increased coordination of teaching programs across the College of Science and other science colleges. Faculty development will be crucial for increasing the use of inquiry based, active learning methods. Finally, it will be important to align our efforts with those of the university's VT Pathways initiatives, which emphasize integration across knowledge domains and links between different kinds of learning experiences, and provide new resources to improve undergraduate learning.

Metrics for determining progress:

- Assessment of learning outcomes, including:
 - Student self-assessment through senior surveys and ePortfolios or other tools
 - Standardized tests inserted at key points in the curriculum (e.g., in freshman courses)
- Student enrolment within, and diversity of, the following types of courses:
 - Laboratory
 - Upper division lecture
- Number of faculty and biological sciences undergraduates participating in undergraduate research
- Number of biological sciences courses that use active and inquiry based learning
- Number of physics, chemistry and mathematical courses that adopt substantial numbers of biological examples
- Number of students engaged in international learning opportunities
- Number of students engaged in various types of learning communities, including residential, honors, and leadership

LEARNING: Graduate studies and postdoctoral training

Goals:

- Maintain excellent quality of advising and mentoring
- Increase number and quality of incoming PhD students
- Increase the diversity of our graduate student body
- Enable broader learning experiences

Strategies:

- Continue our mechanism for rigorous annual review of individual student progress
- Take advantage of, and lead the development of new campus-wide graduate recruitment programs such as the Plant Molecular Biology and Microbiology programs

- Increase financial packages and reduce teaching loads for incoming grad students
- Develop pipelines to recruit more students, including those from underrepresented groups
- Build incentives or mechanisms to increase number of students applying for high-prestige extramural grants and fellowships (e.g., NSF DDIG)
- Partner with the graduate school to provide substantive, and supervised teaching opportunities for graduate students in lecture courses
- Continue to conduct an annual departmental research day to celebrate graduate education and invite top recruits to see our programs
- Continue to provide matching funds for research grants obtained by graduate students
- Use rotations more as a tool for learning and training
- Lead or participate in training grant programs
- In recruiting, emphasize opportunities for Ph.D. studies and interdisciplinary programs

Metrics to assess progress:

- Number, quality (indicated by GPA, GRE, prior experiences and degrees) and diversity of recruited graduate students (A specific target is to increase number of PhD students from 46 in 2005-06 to ~ 80 by 2011)
- Number of high-prestige extramural grants and fellowships (e.g., NSF DDIG) obtained by graduate students
- Number of graduate student awards for excellence in learning, discovery and engagement

ENGAGEMENT

Goals:

- Build cooperatives with industry
- Grow K-12 science teaching program
- Enhance success in gaining funding that supports basic research that can be integrated with substantial engagement activities
- Maintain alumni involvement in departmental programs

Strategies:

- Designate and provide stable funding for faculty position(s) with outreach responsibility
- Provide leadership for the college and university in STEM education efforts in partnership with the existing university wide VT STEM group
- Obtain extramural grants to launch new programs

Metrics:

- Number of workshops and teachers trained in workshops for enhancing K-12 STEM education
- Extramural grant funds and gifts in kind or equipment obtained to support engagement activities
- Number of programs with industrial partners, and number of people impacted
- Evaluations of the learning outcomes and perceptions of quality in workshops

DIVERSITY & WORK LIFE

Goals:

- Improve climate
- Build family friendly environment
- Proactively encourage full participation
- Build a diverse faculty/staff/student body

Strategies:

- Regularly discuss work life issues in meetings and other venues in order to increase understanding and sensitivity to the challenges faced by faculty, staff and students
- Provide faculty, staff and students with suggestions and incentives for actively engaging in improving the diversity and quality of work life in the department
- Develop pipeline arrangements with other universities to attract more graduate students from underrepresented groups

Metrics for assessing progress:

- Numbers of individuals in underrepresented groups included within the faculty, staff and students
- Quality of work life surveys conducted by the university and department

STAFFING

Goals:

- Increase number of faculty and staff to meet anticipated growth in research and teaching programs
- Train faculty and staff to meet changes in demands and use new technologies

Strategies:

- Use the following faculty hiring plan to build research and teaching groups

Faculty Group	Current (2006)	Target (2011+)	Notes
(1) Cell regulation and signaling	TOTAL = 20 5 microbiologists 6 cell biologists 9 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	9 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	5 in sub-disciplines not strongly related to thrust areas 1-3	0	(a) with retirements, we will redirect hires into our three thrust areas
Instructors and dedicated teaching scholars	4 FTE	7 FTE	When possible, use senior faculty retirements to support instructor hires
TOTAL	44	70	

* Others include plant molecular scientists, immunology, and structural biology

- Grow the permanent technical and administrative staff to match growth in faculty, using the approximate guideline of 2 faculty FTEs per staff FTE.
- As faculty move in groups to new buildings, move some staff to each new building to support the faculty groups.
- Encourage continuing education and training among faculty and staff to learn new technologies, adopt paperless business practices, and maintain the quality of work.

Metrics:

- Number of FTE faculty and staff
- Progress toward building research and teaching groups
- Number of training and continuing education activities
- Proportion of business transactions that are paperless.

INFRASTRUCTURE

Goals:

- Obtain more research and teaching space to accommodate anticipated growth in demand
- Increase the quality of research and teaching space to increase efficiency and quality of programs
- Increase access to high-end, high-technology analytical tools
- Maintain a cutting edge computer network, associated with university facilities to take advantage of existing space and support systems
- Create spaces that will maintain collegiality and foster increased collaborative work

Strategies:

- Participate in the university's plans to relocate researchers from crowded, poor quality space (i.e., Derring Hall) to new life science buildings, including temporary swing space in the Corporate Research Center. The ultimate goal is to move all research to permanent buildings constructed in the new Life Sciences Corridor area in and around the new VBI buildings. Because of their greater need for quality indoor lab space, molecular biologists will have the highest priority to move to new buildings.
- The proposed distribution of faculty as faculty size increases and faculty move to new facilities is shown in the following table.

Building Name	2004-2006	2006-2010	2011+
CRC – Old Building	1	0	Life Sciences I + Life Sciences II And/or Other Life Science Buildings
CRC – New Building 1	--	12-16	
Fralin	2	Unknown	
Latham (Plant Sciences)	0	2	
Ecosystems Sim Lab	**	**	
Life Sciences I	--	10-14	
Chem Physics	*	*	
Derring	36-38	20	7
Total Faculty	39-41	44 - 52	70

* = teaching space, room for ~ 3 instructional staff and ~ 3 teaching labs

** = research space currently shared by two faculty members and soon to be expanded to include a greenhouse facility

- Develop partnerships with other academic units and corporations to purchase and maintain expensive new analytical tools (e.g., the X-ray Crystallography Laboratory, which is a partnership between Geosciences, Chemistry and Biological Sciences)

- Continue to update computer networks and take advantage of university computing facilities
- When moving to new spaces, to the degree possible, co-locate Biological Sciences faculty, staff, and graduate students with each other and with those in other life science programs; In other words, strive to minimize fractionation of the department's personnel as we move from Derring Hall to the ultimate solution of having all non-teaching researcher programs in life science corridor buildings
- Redesign and renovate Derring Hall to increase the availability of high quality teaching spaces
- Increase the number, floor space and quality of break and seminar rooms

Metrics:

- Total quantity of research and teaching space, and quantities per FTE faculty, FTE graduate student, and FTE staff
- Proportion of space that is at or above standards to meet teaching or research needs
- Number of leading edge analytical equipment centers owned or shared by the department
- Number, size and location of groups of departmental personnel who are distributed in various buildings
- Floor space and quality of break rooms and seminar rooms controlled by the department.

FUNDING

Goals:

- Obtain increased levels of internal and external base funding (i.e., in addition to extramural grant funds) to support anticipated increases in the quantity and quality of teaching and research programs
- Enhance stability of external funding streams to buffer fluctuations in university budgets

Strategies:

- Build endowment funds to support:
 - General excellence (in scholarship) funds, that provide flexibility for department to fund any activity that improves quality of discovery, learning or engagement
 - Faculty chairs, to be used to recruit the highest quality senior faculty to join our program
 - Graduate and undergraduate scholarships and fellowships (with priority for graduate)
- Advocate for new funding models within the university that allocate operational funds based on measures of productivity and activity in discovery, learning and engagement, and then align departmental programs to optimize chances to receive new allocations in base funds
- Increase partnerships with industry, but in ways that enhance all parties and do not compromise the integrity and independence of our programs

Metrics:

- Number of endowed faculty chairs, graduate fellowships and undergraduate scholarships
- Value of total endowment
- Level of annual giving from alumni and friends

PRIORITIES

Investments of capital, personnel, space and time will be needed to reach the relatively ambitious goals we have set. Since limits in these resources are a fact of life, there will likely be times when progress on some goals will have to be slowed in order to meet higher priorities. The top priorities will be:

- 1) **Increasing faculty size:** progress in this area will automatically have positive impacts on many of our other goals, particularly the quality of undergraduate learning, ability to attract high quality students, prominence in discovery, and increases in the quantity of engagement activities
- 2) **Increasing staff support system to match growth in faculty and programs**
- 3) **Adding new, high quality research and teaching space**
- 4) **Increasing the diversity of our faculty, staff and students**
- 5) **Build endowments to support new chaired faculty positions and graduate fellowships**