



Department of
Biology



VIRGINIA POLYTECHNIC INSTITUTE
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VIEW FROM THE DEPARTMENT:

GRADUATE EDUCATION

The university faculty is the engine that drives research and teaching programs. But graduate students are the fuel that makes the engine run. The contributions of graduate students are many. Some teach laboratories or assist faculty in lectures and, in rare cases, students with experience may take full responsibility for a lecture course. All are involved in learning how to be a scholar and more importantly, in making their own unique scholarly contributions.



Dr. Robert H. Jones
Department Head

Graduate students receive little pay, but they work hard and do much to enrich our academic community.

The Department of Biology is fortunate to have outstanding graduate students. Their research covers the waterfront from molecule to ecosystem, computation to experiment, and theory to application. Collectively, their scholarship and productivity are impressive. As an example, let us examine the output during 2002 from 38 students whose progress we evaluated in December of that year (the remaining students were evaluated in May). During a single year, each of these 38 students presented an average of 2.4 papers to professional meetings, received an average of 2 extramural grants totaling \$6,119 per student (\$119,315 for all 38 students!), and published a mean of 0.9 papers in peer-reviewed journals. All of these measures of success are noteworthy. Let me illustrate using the research grant data. To receive grants, students must first write and submit research proposals to institutions outside of our department or university. Experts review the proposals and rank them according to their scientific merit. The competition is usually fierce, yet our students have been extremely successful. Of the 38 students reviewed in December 2002, 23 received grant awards in 2002, and 2 received prestigious Dissertation Improvement Grants from the National Science Foundation.

Research is clearly a strong point for biology graduate students. However, equally impressive to me are their contributions to teaching and service. Our graduate teaching assistants (i.e., those paid to assist in the laboratory and classroom)

routinely achieve high teaching evaluation scores from undergraduate students. Our grad students have a reputation for being enthusiastic, effective, and innovative in the teaching lab or classroom. Not surprisingly, the top university teaching award for graduate assistants is often presented to a biology graduate student; most recently this award went to Becky Abler, a biology Ph.D. student. Biology graduate students also organize departmental and university social events and participate in public and professional service, including the organization of our department's first annual Biology Research Day, held September 19, 2003. Our students have caught university-wide attention for their service. In recognition of her exceptional contributions to the Virginia Tech community, Tracey Slotta, a Ph.D. student in biology and current president of the Biology Graduate Student Association, was the most recent recipient of the university's prestigious Graduate Service Award.

While graduate education is strong in our department, it is both the university's and department's goal to enhance the quality of graduate programs and increase graduate student enrollment. Although recent budget cuts have made these goals a real challenge (e.g., 10 biology graduate assistantship positions were lost to recent funding reductions), we are pursuing alternatives to boost the number of funded positions and to increase graduate student pay, a key goal if we are to recruit the very best students. Through generosity of our alumni and friends, and the hard work of our faculty, we now have four special graduate fellowships - the John Cairns Fellowship (held by Eric Sokol), the Cunningham Fellowship (Sue Daniels), Maly Fellowship (Glen Stevens), and Robert Patterson Fellowship (Yu Chen). Another new development is significant; the proportion of students pursuing Ph.D.s (versus Master of Science degrees) has slowly increased in recent years and has just surpassed 50% (36 versus 34). Obviously, both degrees have tremendous value, but an increase in the number of Ph.D. students is needed if we are to reach our goal of becoming a top-tier research institution. Much still needs to be done to build on our momentum, but forward progress is being made.

In short, I am very proud of our graduate program, its positive direction and, most of all, I am proud of our graduate students. Across the board, they are good scholars and solid citizens. I treasure the short time that they spend with us in Blacksburg and look forward to the productive careers and many contributions that they will make in the future.

Sincerely,
Robert H. Jones, Head

Team Investigates Nitrogen in Streams

Human activities are flooding the biosphere with fixed (i.e., biologically available) nitrogen (N) that changes the chemistry of the atmosphere, soils, and waters. Humans are now matching each gram of N that is fixed by natural processes with a gram of biologically available N generated from activities like combustion of fossil fuels, production of agricultural fertilizers, and legume cultivation. This anthropogenic N is distributed in amounts and locations where it is not merely stimulating primary production but actually disrupting the balance of life in a variety of ecosystems. Forests in many areas of the world are in decline as trees die in response to the syndrome called N saturation. The fate of much of the anthropogenic N is uncertain because studies show that most (on the order of 60 to 80%) of the added N is not exported to the oceans but is missing, having disappeared from our accounting. Nevertheless, the 20-40% that does get to the estuaries and coastal oceans is causing large areas of oxygen depletion in places such as Chesapeake Bay and the Gulf of Mexico at the mouth of the Mississippi River. We need to understand this aspect of the N cycle if we are to successfully manage and protect sensitive ecosystems and ecosystem services, such as drinking water and coastal marine fisheries.

The Virginia Tech Stream Team (<http://www.biol.vt.edu/research/streamteam/>) is an integrated research program that combines the expertise and resources of Drs. Fred Benfield, Maury Valett, and Jack Webster. Our research addresses the ecology of freshwater ecosystems with a special focus on headwater streams, their role in processing energy and materials, and their responses to the changing natural and human landscapes. Over the past seven years, the Stream Team has been collaborating with eleven other institutions to generate a network (Figure 1) of studies that addresses how streams use N and what features of the aquatic and terrestrial landscape control the rates of N retention and transformation.

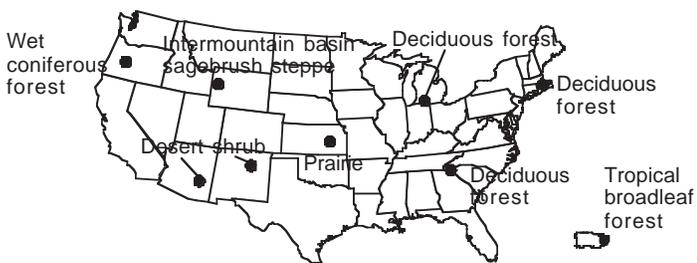


Figure 1. Streams located in different biomes across the country are sites for studying how N is retained, transformed, and transported. The research involves scientists from Virginia Tech, University of New Hampshire, Woods Hole Oceanographic Institute, University of Georgia, Oak Ridge National Laboratory, University of Notre Dame, Michigan State University, Kansas State University, University of Wyoming, University of New Mexico, Arizona State University, and Oregon State University.

As nutrients, such as N, cycle in streams and rivers they are displaced downstream so that their movement can be described as a spiral. This concept of nutrient spiraling guides our work on N retention. Using isotopic tracer (i.e., ^{15}N) studies, we determine the distance that N travels before it is removed from solution and the fate of the N within the stream (e.g., consumed by plants or algae, assimilated by bacteria on detrital surfaces). We do this by sampling the water and biota of the study streams (Figure 2) and analyzing their stable isotopic signatures. Recently, our work has focused on quantifying how much of the N removed from solution was returned to the atmosphere via denitrification (an anaerobic form of bacterial metabolism that converts nitrate to gaseous N forms). By combining studies of stream hydrology, N spiraling, and numerical modeling, we have provided some of the first whole-system measures of denitrification for running water ecosystems.



Figure 2. Dr. Valett and Dr. Webster collect samples to analyze N content in ground water of an agricultural stream.

Our initial N studies focused on how natural variation among biomes caused different degrees of N retention among the study streams. Intensive work on stream food webs illustrated that both autotrophic and heterotrophic pathways were important in the processing of N and their importance varied among the streams, reflecting the different terrestrial landscapes in which they reside. Our current studies have extended the spatial axis of interest to include comparisons among forested, agricultural, and suburban systems. Taken together, these studies will provide information on how streams function as biological entities and how critical ecosystem processes may be enhanced or diminished in the face of a changing world.

VT Biology on the Road

The Microbiology Group in the Department of Biology was well represented at the 103rd American Society for Microbiology general meeting held in Washington, D.C. from May 18th - 22nd 2003. Attending were six faculty members, Drs. **Robert Benoit, Joe Falkinham, Stephen Melville, Dave Popham** and **Ann Stevens**, fifteen graduate students (from Falkinham, Love, Melville, Popham and Stevens' labs) and four undergraduate students (from Melville, Popham, and Stevens' labs). A social event for VT microbiology alumni was co-sponsored by the Department of Biology and enjoyed by all.

During the 2003 spring semester, University Distinguished Professor **John Tyson** took part of his research group to the Institute for Advanced Study in Budapest, Hungary, to participate in a Focus Group on Computational Cell Biology, funded by the Collegium Budapest, the Volkswagen Stiftung, and the Santa Fe Institute. Accompanying Dr. Tyson for the full six months were Chris Hong, Laurence Calzone and Andrea Ciliberto. Kathy Chen, Jason Zwolak and Emery Conrad came to Budapest for shorter stays. The group combined forces with Bela Novak, Attila Csikasz-nagy and Bela Gyorffy of the Technical University of Budapest to study computational models of cell growth and division, cell death, and circadian rhythms. The Focus Group hosted several workshops that brought distinguished experimentalists to Budapest to collaborate with the modelers. A highlight of the semester was a visit by Paul Nurse, 2001 Nobel Laureate in Physiology or Medicine, who works closely with Novak and Tyson on models of aberrant shapes of mutant yeast cells.

In July, Professor **Charles Rutherford**, along with Natasha Wiles and Brad Joyce, attended the 2003 International Dictyostelium conference in Lorne, Australia.

Professor **Anne McNabb** gave a seminar at the Slovak Academy of Sciences in Bratislava, Slovakia in July and will present papers on the disruption of developing thyroid function by chemical pollutants at the Society for Environmental Chemistry and Toxicology (November) and the Society for Integrative and Comparative Biology (January).

Associate Professor **Muriel Lederman** contributed papers to the meeting of the International Society for the History Philosophy and Social Studies of Biology in Vienna in July, the National Women's Studies Association in New Orleans in June, and the southeastern Women's Studies Association meeting in March in Blacksburg, VA.

Professor **Khidir Hilu** was invited to speak at a symposium by the Biennial Systematics Association in Dublin, Ireland.

At the 2003 annual meeting of the American Arachnological Society held in Denver in July Professor **Brent Opell** presented a paper entitled "Population structure of the spider *Waitkera waitakerensis* (Uloboridae): Does it really comprise a monotypic

genus?" Brent was also invited to participate in a DuPont Chesapeake Conference on "Bio-inspired micro-attachment devices" that was held September 9-12 in Chesapeake Farms, Maryland. He gave a presentation entitled "The evolution of adhesive mechanisms in spider prey capture threads." DuPont has initiated a series of these small conferences, modeled loosely after the Gordon conferences, to focus on emerging science areas that may be new to DuPont, to establish/bolster links with the academic community in these areas, and to provide an interesting forum for invitees to exchange ideas. This conference includes presentations by nine researchers from universities in the U.S., Canada, and Europe and by nine researchers from DuPont.



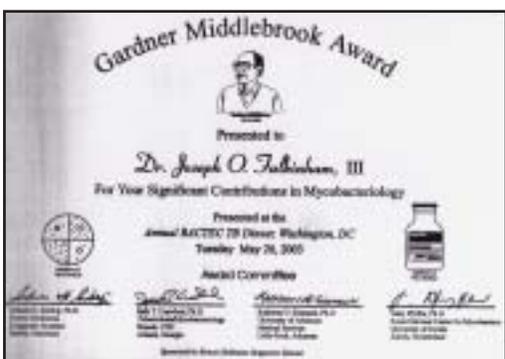
Mary Schaeffer (second from right) in Eleuthra, Bahamas.

This May, **Mary Schaeffer** joined Dr. Jon Cawley and a group of students from Roanoke College in Eleuthra, Bahamas at the Institute for Ecological Field Studies to conduct a class on tropical ecosystems. The group studied reef and terrestrial ecosystems of the island as well as the geology of the area. Dr. Roger Cuffey from Penn State was also present and gave the class a seminar on bryozoans and provided an opportunity to collect and study bryozoans found on the reefs. The group also studied the ecology of an island exploited by colonists who stripped the land of the native vegetation and grew a variety of plantation crops until little topsoil existed. Efforts are being made by Institute personnel to help the residents of Eleuthra improve the soil and re-establish vegetation.

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Milestones



At the American society for Microbiology meeting in May 2003 Professor **Joe Falkinham** was awarded the **Gardner Middlebrook Award** for “**Significant Contributions to Mycobacteriology**”. The Award is sponsored by Becton Dickinson Diagnostic Systems.



Dr. Buikema, second from left, in Africa for his Culture and Ecology of Southern Africa course this summer.

In April Alumni Distinguished Professor **Art Buikema** was one of several recipients to receive an award for **Innovative Excellence from the International Conference of Teaching, Learning and Technology**. Art has also been nominated by Virginia Tech for the Council of Advancement and Support of Education Award (CASE). In addition, Art served on the final selection committee for the USA Today High School All-American Academic Team in Washington, D.C. A preceptor for the University Honors Program, Art welcomes students who have recently become eligible for the University Honors Program and helps integrate them into the Honors community.

Associate Professor **Muriel Lederman** received the **Advancing Woman Award for 2003** from the Women’s Center at Virginia Tech. She also received an NSF award “Teaching Science with the Social Studies of Science for Gender Equity” with co-PIs Research Assistant Professor **Rebecca Scheckler** and Assistant Professor **Jill Sible**.

A talk at the APRES meeting based on collaboration between Professor **Khidir Hilu’s** lab and NC State University was nominated for the **Bailey Award**. The talk is on the molecular

evolution in peanuts and involves **Sheena Friend** from Khidir’s lab, an undergraduate student, and **Mohannad Al Saghir**, a graduate student. A manuscript will be submitted based on the talk for the selection of the winner for the award.

Dr. Dietmar Quandt from the University of Bonn, Germany, is joining Khidir’s lab as a postdoctoral fellow. Dietmar has recently received a grant from the DAAD program in Germany; congratulations! And **Ms. Elke Doering**, a Ph.D. student from Martin-Luther University at Halle-Wittenberg - Germany, is working in Khidir’s lab on the molecular evolution of grasses. She plans on returning late November with a lot of valuable molecular data on the oat grass group. Elke is here on a scholarship from Martin-Luther University.

Khidir is also happy to announce that an 80-page manuscript that he and his collaborators wrote on the evolution of flowering plants using gene sequences has made it to the cover of the December issue of the American Journal of Botany. Two graduate students from Khidir’s lab received grants from the Virginia Academy of Sciences: **Michelle Barthet** and **Mohannad Al Saghir**. Finally, **Amanda Melillo**, an undergraduate in Khidir’s lab since her freshman year received a **Young Botanist Award** from the Botanical Society of America, a national award that was given to twenty-seven students this year.

Professor **Don Cherry** has had a wonderful year. Don’s lab received a one-year grant with Lee Daniels researching toxicity of coal combustion byproducts sponsored by AEP and Alpha Energy/Dickerson-Russel Coal. Another one-year grant has been received with Carl Zipper to evaluate settling pond ecology on hollow fill drainages in Virginia and West Virginia sponsored by the Powell River Project. A current multi-year grant has been continued through September 2004 with the US Fish and Wildlife Service studying acute/chronic toxicity of total residual chlorine upon unionid mussels. Another current multi-year grant with the US Fish and Wildlife Service has been continued to determine chronic toxicity of residual mercury in N. Fork Holsten River sediments. The development of a new multi-year grant with USGS in Tennessee to evaluate influence of coal fines and particulates in Tennessee River sediment upon unionid mussels is underway with budget details still being negotiated.

Don has been invited to write two book chapters in SETAC Press book, *Freshwater Bivalve Ecotoxicology*. He was also invited by the US Office of Surface Mining to be a speaker and chapter author for the State Regulation of Coal Combustion Byproducts Interactive Forum in Harrisburg, PA (May 4-6, 2004).

Milestones *Continued on page 5*

Comings & Goings

No retirements to report this time. New staff and faculty hires include **Dr. Lisa Belden** and **Dr. Ignacio Moore** (Assistant Professors), **Dr. Iuliana Lazar** and **Dr. Christopher Lawrence** (joint faculty appointments with the Virginia Bioinformatics Institute), **Dr. Dharmendar Rathore** (Adjunct in Biology, primary appointment in Bioinformatics Institute),

Dr. Richard Seyler (Research Assistant Professor hired jointly with the Via College of Osteopathic Medicine), **Dr. Nancy Vogelaar** (Postdoctoral Research Associate), **Johanna Barron** (Field and Lab Research Technician), **Nicole Ganzala** (Laboratory Specialist), **Renee Ripley** (Natural Resource Specialist) and **Lourdes Oztolaza** (Natural Resource Specialist).

Milestones *Continued from page 4*

Professor **Robin Andrews** received a three-year renewal of her Morris Animal Foundation Grant for studies on the effects of incubation temperature on embryonic development and phenotypic characteristics of post-hatching individual. She also saw the publication of the third edition of the co-authored textbook, 'Herpetology' and was invited to write a review chapter on embryonic development for a book titled 'Reptilian Incubation: Environment and Behavior' which is scheduled for publication in early 2004. Finally, Robin was elected president of the Society for the Study of Amphibians and Reptiles to serve 2005-2006

In September Professor **Brent Opell** completed a two-year term as president of the American Arachnological Society. This fall he will begin serving a two-year term as a member of the society's board of directors. He continues to serve on the editorial board of the Journal of Arachnology. A paper entitled "Van der Waals and hygroscopic forces of adhesion generated by spider capture threads" by Anya Hawthorn and **Brent Opell** will appear in a fall issue of the Journal of Experimental Biology. This paper has been selected as one of the three articles to be featured in that issue's "Inside JEB" section. Brent has also been invited to contribute a chapter to North American Spiders, a new volume that will provide an introduction to spider features and phylogeny and illustrated identification keys to the spider families and genera found north of Mexico.

The student award for best presentation in Session B at the 2003 Virginia Water Research Symposium was won by **Elizabeth Hagen** for the talk "Effects of agricultural disturbance on autumn allochthonous input in southern Appalachian streams", which was authored by Elizabeth M. Hagen and Professor **Jackson R. Webster**.

Professor **Anne McNabb** was a member of a panel in March on "Women's Paths Through Promotion and Tenure" sponsored by the Organization of Women Faculty at Virginia Tech.

Dr. Andre Levchenko from John Hopkins University and Assistant Professor **Ann Stevens** have been awarded a five-year NIH grant to study "Cell-Cell Communication in Bacterial Quorum Sensing" using a combination of computational/mathematical and experimental methods.

Assistant Professor **Edward Wojcik** recently discovered that he is in the enviable position of having to choose between an awarded 4 year NSF grant or a 5-year NIH grant. Funding begins in December for either one. He's also proud to announce that an undergraduate in his lab, **Thomas Wall**, won the 2003 Pfizer Undergraduate Research Award, a national award that provides a generous summer stipend and research money to undergraduates interested in pursuing a biotechnology career.

Graduate student **Chris Burcher** was honored with the Frigid Units cash award for best presentation emphasizing methodology at the 2003 NABS conference in Athens, GA. Chris' presentation focused on his recent work involving hydrologic models in GIS to predict riparian zones. His was one of four awards given from over 350 presentations.

Natasha Wiles was awarded the best student paper in Biology at the meeting of the Virginia Academy of Science, held in Charlottesville this year.

Two student scholarship awards have been given to biology majors: The Robert C. Davis Scholarship was awarded to **Lindsey Nordstrom** and The Dean's Scholarship was awarded to **Heather Wright**. These students have been awarded \$2,000.00 and will attend a reception with the College of Science Roundtable at Virginia Tech.

This summer **Mary Schaeffer** agreed to host the Association for Biology Laboratory Education 2005 Conference at Virginia Tech. The group is comprised of approximately 400 professors from across the country and Canada who teach college level biology laboratory courses in all areas of study. The purpose of the conference is provide an opportunity to share new ideas and techniques used in teaching everything from freshman level biology to subjects such as molecular biology, genetics, ecology, and microbiology classes.

Alumni Advisory Board

The Board has been developing two special alumni events and we hope that you will join us. The first is our **Hokie Alumni Celebration** on Saturday, November 22, 2003 in conjunction with the Boston College vs. VT football game (for complete details visit our website at <http://www.biol.vt.edu>). The second is a special event on Saturday, April 24, 2004 - mark your calendars. Details will be coming soon.

Anyone interested in being part of the Department of Biology Alumni Advisory Board should contact Dr. Jones at rhjones@vt.edu or (540) 231-5712.

VT Science Outreach Coop and Museum

Through the support of the Research Division and Outreach Division Chiefs, our vibrant Natural History Museum's public outreach education program will be saved and hopefully better noticed and taken advantage of by research faculty. The new program is called the VT Science Outreach Coop and Museum (SOCM).

We are a University-wide program, but our home base will be in the Department of Biology. We look forward to working as a team with biology faculty towards increasing our grant funding and public outreach. SOCM will be moved into Derring Hall by mid-November.

During FY 2003, SOCM directly served 15,000 K-12 teachers and students in rural southwestern Virginia.

Alumni in the News

Scott Obenshain '59 received the **Distinguished Achievement Award** from the Wake Forest University School of Medicine's Medical Alumni Association.

David Mullins '93 received the **Huang Foundation Achievement Award** from the American Association of Immunologists.

Joel Schmidt '80 was promoted to colonel in the U.S. Army Medical Corps.

Llewellyn Welstead '93 celebrated his fourth year anniversary as a dentist at Dayton Air Force Base in Dayton, Ohio, and Whitman Air Force Base in Missouri.

We'd like to proudly congratulate our alumni for their fine achievements.

Want to share yours? Please feel free to send them by email or mail to:

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Students in our Biological and Life Sciences Community this year.



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