



VIEW FROM THE DEPARTMENT:

A VISION FOR RESEARCH

Virginia Tech has a tradition of biological research well over 100 years old. Its scholars have described and catalogued organisms in almost every imaginable environment from forest to stream, ocean to desert, Antarctica to tropics, and agricultural field to pristine ecosystem. In keeping with its land grant mission, many studies at Virginia Tech have centered on methods to increase crop yields, protect farm animals from disease, and enhance the human condition through improved sanitation, nutrition, and medicine. Early in the 20th century, work focused on the questions “what” and “where” and the number of sub-disciplines within biology was rather limited. For example, in 1900, my field of study, ecology, was barely known as a discipline, and no one knew what DNA was, much less what it did. Today, bioscientists spend more time pondering the questions “how” and “why,” and many new sub-disciplines have emerged, including computational cell biology, neuroscience, molecular microbiology, disease ecology, and nano-medicine. Virginia Tech faculty has expanded its range of studies well beyond agriculture to ponder, as the famous popular physicist Carl Sagan might say, the fundamental stuff of life.



Dr. Robert H. Jones
Department Head

To ponder or have a strong sense of curiosity is a basic component of successful research. But it is not the only ingredient. Science is expensive and time consuming. Competition from other universities for the research funds, and for the best minds, is fierce. Thus, to be successful in research, one must develop a comprehensive strategy that will attract funding from outside the university and bring in the best faculty and students.

For many decades the Department of Biology has used strategic planning to build excellence in research. An early approach was to hire the best faculty possible from individuals seeking jobs and to build a broad waterfront of expertise. This strategy worked because productive people create a productive environment, which attracts even more productive researchers to apply for positions. Using this mode of faculty hiring, the department boasted great scholarship, epitomized by having two members of

the very prestigious National Academy of Science, one of the highest honors for American scientists. The department also developed a diverse portfolio of biological sub-disciplines and had experts in almost every major group of biological organisms, including fish, insects, algae, fungi, anaerobic bacteria, birds, mammals, plants, reptiles, and so on.

However competition from other universities has intensified, and so, the department now focuses its hiring within a more limited set of sub-disciplines. The disadvantage of this approach is the loss of expertise in whole classes of organisms (e.g., retirements recently ended the expertise in fish physiology and algal biology). The advantage is maintaining international prominence in research and developing more depth in teaching within the areas that have been chosen for emphasis.

In fall 2004, the latest version of the research strategy took shape when three thrust areas were chosen for growth. Building on existing strengths within the department and across the university, the department has decided to concentrate new faculty hires in: A) *cell signaling and regulation*, B) *integrated behavioral and organismal biology (IBOB)*, and C) *ecosystem processes at the aquatic/terrestrial interface*. The first area, *cell signaling and regulation*, takes a subcellular view and aims to uncover the fundamentals of host — pathogen interactions, biochemical controls of cell division, communication between different biochemical pathways and between cells, and the process of development. Fundamental discoveries made by these researchers will be useful for controlling infectious disease and cancer. The *IBOB* researchers will use physiology, population biology, and ecology to study vertebrates (mammals, birds, reptiles, etc.) and organisms that interact with vertebrates. These researchers will investigate behavior, evolution and disease epidemics to solve problems in conservation and public health. The last group of researchers will consider how terrestrial and aquatic ecosystems are linked. Nutrient cycling, aquatic-terrestrial interchanges, and the influences of human social and economic systems on natural ecosystems will be investigated to solve problems with water quality, public health, and global climate change.

The target of the department is to grow its faculty from approximately 40 full-time positions at present to nearly 70 by 2010. Faculty groups representing the three thrust areas will grow stronger and increasingly competitive for attracting research funding from outside the university. In conjunction with new hiring strategies that the College of Science is pursuing, the departmental plan will also add to the capacity for interdisciplinary research, which is important in making new breakthroughs in science and technology.

Continued on Page 6

Understanding the Role of Disease in Amphibian Declines

When cold and flu season arrives, we all begin to appreciate the effects that pathogens can have on our lives. However, it is becoming increasingly apparent that parasites and pathogens play a large role in important ecological processes and that they have very important implications for the conservation of threatened species. Research in Dr. Lisa Belden's laboratory is focused on understanding the impacts of disease in natural populations of amphibians. Dr. Belden, a new addition to the Department of Biology in 2004, is working with two distinct model systems with a common goal of understanding the consequences of infection in amphibians and of understanding the role of stress in altering amphibian susceptibility to pathogens and parasites. Her primary research involves infection of amphibians with trematode parasites. Trematodes are responsible for hundreds of thousands of cases of human disease each year (e.g., schistosomiasis) and have been linked to some limb deformities, which have been increasingly observed in natural populations of amphibians. In particular, many cases of multi-limb deformities in frogs and toads have been experimentally linked to encystment of an intermediate life stage of a trematode in and around the developing limb buds of tadpoles. The trematode cuts the limb bud into multiple segments and each segment produces its own limb, resulting in amphibians with too many legs. While these "outbreaks" of deformed frogs have not been definitively linked to ongoing worldwide declines in amphibian populations, it certainly seems likely that they may play a role in declines for some species.

Dr. Belden recently discovered that treatment of amphibians with corticoid "stress" hormones (these are the hormones that elicit longer-term responses to environmental stressors) increases trematode infection rates in developing amphibians. She also found that these hormones are elevated in tadpoles that are exposed to 30 minutes of confinement stress. So, it is likely that environmental stressors that naturally increase levels of stress hormones could result in increased trematode infection rates in amphibians. Her research group will be exploring this possibility by examining the effects of both a naturally occurring stressor (pond drying) and a potential human-induced stressor (nutrient addition to ponds) on both hormone levels and trematode infection rates. Another interesting finding is that the effects of trematode infection can be delayed. Belden and colleagues have demonstrated that, while infection in tadpoles may not have obvious effects on growth or survival of the tadpoles, it can alter how individuals respond to predators after they metamorphose into juvenile frogs. Experimental trials demonstrated that juvenile wood frogs (figure 1) that were infected as tadpoles were less likely to respond to cues from snake predators than individuals that were not infected.



Figure 1. Juvenile wood frog
Rana sylvatica
(Photo by J. M. Klesecker)

More recently, in collaboration with Dr. Joseph Falkinham, also in the Department of Biology at Virginia Tech, Belden is beginning to explore the possibility of stress-induced bacterial infections in amphibians. To date, they have identified several species of bacteria that appear to live on amphibians in the field. Several of these have previously been associated with stress-induced disease in laboratory populations and the researchers are excited to begin exploring this possibility in free-living amphibians. This summer, they will explore how environmental stressors alter the types and quantity of bacteria that live on the skin, and they will determine if stress-induced alteration of bacterial populations is associated with any disease symptoms.

By examining amphibian responses to disease in these two distinct systems, Belden will gain a better understanding of the role of disease in natural populations of vertebrates. In addition, she will elucidate important interactions between environmental stressors and disease susceptibility, which should be applicable to other vertebrates. Ultimately, she hopes that her studies will provide critical information on the potential contribution of pathogens/parasites to worldwide amphibian population declines.

Department of Biology
is a publication of the College of Science,
2119 Derring Hall, Blacksburg, VA 24061 USA
Phone: (540) 231-5712 Fax: (540) 231-9307
Editors: Tina Pavlik and Robert H. Jones
E-mail: tinap@vt.edu

VT/004000/0205/6.5M/252156

VT Biology on the Road

The department's microbiology group was well represented at the annual meeting of the VA branch of the American Society for Microbiology at Bridgewater College on November 5-6, 2004. The department's microbiology group of 12 researchers attended the meeting and 9 graduate students presented talks and posters on their work.

Khidir Hilu and collaborators presented six talks at the annual meeting of the Botanical Society of America (BSA) held in Utah in August. He also presided over the Monocots session and attended the Deep Time meeting that followed the BSA meeting.

Michelle Barthet, a Ph.D. student in Hilu's lab, presented two talks in Utah, one at the Botanical Society annual meeting and the other at the Deep Time meeting.

Michelle Barthet and Sheen Friend (undergraduate student) from Hilu's lab presented two talks at the annual meeting of the Virginia Academy of Science held in Richmond. They both received awards for the best talks in the botanical section of the meeting. Congratulations to both.

Hilu taught his Botanizing the Alps course last summer. The class started at the University of Bonn, Germany, and proceeded to the southern Alps in Switzerland and concluded the course in the Italian Mediterranean region. This class is already full for next summer.

In June, Brent Opell presented a paper at the annual meeting of the American Arachnological Society held at the University of Oklahoma. This study was titled "Population Structure of the Marine Coastal Spiders *Amaurobioides maritimus* and *Amaurobioides picinus* (Anyphaenidae) from New Zealand's South Island" and was coauthored with three Virginia Tech undergraduate students: Sophia Bous, Andrea Berger, and Michael L. Manning.

In October, Opell presented two seminars at Cornell University entitled "The Evolution of Adhesive Mechanisms in Spider Prey Capture Threads" and "Functional Properties of Capture Threads and Their Role in the Evolution and Performance of Spider Orb Webs."

Anne McNabb organized and spoke at the symposium "Effects of Endocrine Disrupting Chemicals: From Field to Lab" at the 8th International Symposium on Avian Endocrinology, Scottsdale, AZ, in June 2004.

McNabb participated in a workshop in Beaver Creek, CO, in July 2004 by coordinating a book project "Perchlorate Ecotoxicology" for which she is the lead author on the chapter Perchlorate Effects on Birds and one of the coauthors of two other chapters. The book will be published by the Society for Toxicology and Chemistry (SETAC) Press in 2005. McNabb is also an organizing committee member for the 15th International Federation of Comparative Endocrinological Societies meeting in Boston, May 2005. McNabb presented papers at SETAC World Conference in Portland, OR, in November 2004 and at the national meeting of the Society for Integrative and Comparative Biology in San Diego in January 2005. She is also an invited symposium participant in

15th International Federation of Comparative Endocrinological Societies meeting in Boston, May 2005.

In July, Jeff Walters was appointed to the National Academy of Science, National Research Council (NRC) Committee for Independent Scientific Review of Everglades Restoration Progress. This committee, mandated in the enabling legislation for the Everglades restoration, is to provide independent oversight with respect to restoration of the natural system, especially with respect to issues of science and engineering, and is to report directly to Congress. The panel is comprised of 14 engineers, hydrologists, and biologists, several of whom will be familiar to some of this faculty (Barbara Bedford, Linda Blum, Donald Boesch, Rita Colwell, Gordon Orians, Leonard Shabman). For the past four years Walters served on another NRC committee, the Committee on the Restoration of the Greater Everglades Ecosystem (CROGEE), which provided advice, through seven published NRC reports and numerous meetings, to the federal and state agencies responsible for the Everglades restoration. Walters is one of three long-time CROGEE members serving on the new committee.

Zhaomin Yang received a new NIH research award (estimated total \$1,170,507 for 2004-2009) and a noncompetitive NSF grant renewal (total \$408,160 for 2002-2005). He had two publications in 2004: 1) Black WP, Z Yang. 2004. Myxococcus xanthus chemotaxis homologs DifD and DifG negatively regulate fibril polysaccharide production. *Journal of Bacteriology*. 186(4):1001-8. 2) Lu, A, K Cho, WP Black, X Duan, R Lux, Z Yang, HB Kaplan, DR Zusman, W Shi. 2004. Exopolysaccharide biosynthesis genes required for social motility in *Myxococcus xanthus*. *Molecular Microbiology*. Online Early. Two of Yang's PHD students, Wesley Black and Zhuo Li, passed their preliminary examination this fall.

Anne McNabb's lab participated in some diversity activities this fall. The lab hosted Kirbie Clark, a biological sciences major from the University of Southern Mississippi, as a summer MAOP intern. Clark's project was on the effects of PFOS, an environmental contaminant that is a component of Scotchgard, on thyroid function in birds. McNabb was the Chair of the Biology and College of Science Diversity Committees. McNabb was a speaker on "The Scientific Method" to new Mid-Eastern Alliance for Minority Participation (MEAMP) students September 2004.

Jeff Walters recently assisted his former graduate student Michelle Reynolds (PhD 2002) in establishing a new population of the endangered Laysan Teal. Reynolds examined the ecology of this duck in her PhD research and then accepted a position with the USGS Biological Research Division in Hawaii. The Laysan Teal occurs only on 900-acre Laysan Island in the northwestern Hawaiian Islands, and it declined to only 11 individuals at one point. It was thought to have been confined to Laysan and nearby Lisianski Island until Helen James (you may remember her departmental seminar on Hawaiian fossil birds a few years ago) discovered their fossils in lava tubes on the main Hawaiian Islands. Once it was clear that the species was distributed historically throughout the Hawaiian Islands, establishing additional populations of the species on other islands to improve the precarious existence of this rare duck became a conservation goal. Developing a plan to execute this goal fell within Reynold's job duties with USGS-BRD in Hawaii, and in only two years, she developed this

Continued on Page 6

Milestones

Jack Cranford is the 2004 recipient of the Alumni Advising Award, a very prestigious honor given to one individual each year at Virginia Tech who serves undergraduate students in exemplary ways. With this award, Cranford becomes a member of the University Academy of Advising Excellence. Congratulations to Jack!

Betsey Waterman received the University Outstanding Leadership Award for 2004. The award is given by the University Leadership Development Office and recognizes staff and/or mid-level university officials who exhibit exemplary leadership within the community, department, and university. Congratulations to Betsey!

David Popham and Stephen Melville have received a 3-year grant for \$348,000 from the USDA to study "Factors affecting heat resistance of *Clostridium perfringens* spores." The study will compare *Clostridium perfringens* strains normally associated with food contamination and food poisoning with strains found in other environments. Mutant strains will be constructed that are defective in individual spore properties believed to play important roles in producing heat resistant spores. The research will contribute to the understanding of the extreme resistance properties of bacterial spores and potentially to improved methods for food preservation.

David Popham and Al Claiborne, a collaborator at Wake Forest University, have received a 2-year grant for \$108,000 from the NIH-sponsored Southeast Regional Center of Excellence for Emerging Infections and Biodefense (SERCEB) to begin a new study of "Coenzyme A-linked Redox Control in *Bacillus anthracis*." Carleitta Paige, a Wake Forest graduate student supported by a graduate fellowship from the U.S. Department of Homeland Security, will be spending time in the Popham lab for the next couple of years to work on this project. Control of the reducing/oxidizing environment of the cell is predicted to be important in both the resistance properties of anthrax spores and in the pathogenesis of this disease.

Robin Andrews had a visitor from Mexico for 2 weeks in October. Martha Caldaron, a PhD student in the laboratory of Dr. Fausto Mendez (UNAM), was here to analyze data and prepare a manu-

script from her dissertation research. Andrews serves on Caldaron's committee and is a collaborator on this project concerning the evolution of viviparity in *Sceloporus* lizards.

Khidir Hilu received a collaborative NSF Tree of Life grant of \$3 million to work on the evolution of flowering plants using molecular and structural information. This 3-year grant is in collaboration with colleagues from the University of Florida, Yale University, University of Michigan, University of California at Davis, University of Wisconsin at Madison, and the University of Washington.

Brenda Winkel (Biological Sciences) has 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.

Lori Blanc, PhD student in Jeff Walter's avian ecology lab, received the university's Graduate Student Service Award for 2004-2005. Lori is conducting a 4-year study on cavity-nesting bird community interactions, with a focus on direct and indirect impacts of endangered species management on non-target avian species. This award recognizes Lori for her contributions to professional, university and community service. Lori's service includes working on the student affairs and strategic planning committees of the American Ornithologist's Union, serving on the Biology department's Diversity Committee, helping the BGSA plan departmental events, participating in cleanup and educational programs with Blacksburg's Heritage Park (formerly Brown Farm), giving talks at local Audubon Society meetings and her past work with coordinating an educational outreach program with the BGSA, local schools and the Virginia Museum of Natural History.

Digital Atlas of the Virginia Flora

Tom Wieboldt and Rob Hunter have completed development of a Digital Atlas of the Virginia Flora and made it available on the web courtesy of the Department of Biology. A group of Virginia botanists known as the Virginia Botanical Associates (VBA) have been working for several years to revise an earlier hardcopy Atlas of the Virginia Flora. Numerous changes in plant classification and nomenclature brought about by the "revolution" in molecular systematics have been part of the impetus for a "modern" atlas. The Digital Atlas allows continual updating in this rapidly changing science. In addition, Tom Wieboldt has been working with VBA to incorporate additions to the flora as well as thousands of new distributional records. Nearly 700 species and intraspecific taxa have been added to the

previous hardcopy edition. The Digital Atlas is unique in providing information specific to Virginia for many plants. Additional comments and habitat descriptions are planned. Rob Hunter has been instrumental in developing the web interface allowing nearly instant access to the present knowledge of Virginia's flora. This is an important development for the Flora of Virginia Project with whom VBA has a memorandum of agreement to provide up-to-date distributional information, and for the Flora of North America whose hundreds of contributing authors may now easily access the information necessary to well represent our state in its forthcoming volumes.

Comings & Goings

New faculty and staff hires include Xiaohui Cui (Postdoctoral Associate), Farooq Kittur (Postdoctoral Associate), Roberto Martins (Postdoctoral Associate), Michael Rubbo (Postdoctoral Associate), Changhe Zhou (Postdoctoral Associate), Jennifer Clem (Fiscal Technician), Courtney Culp (Research Specialist), Holly Goyert (Research Technician), Kelly Sloan (Research Specialist) and Laurie Yee (Research Specialist). The department has said goodbye to Lynn Adler (Assistant Professor), Paige Warren (Research Scientist), Yusuf Turan (Postdoctoral Associate), MeiYing Zheng (Postdoctoral Associate), Anne Walton (Postdoctoral Associate), Karen Boone (Office Assistant), Michelle Wooddell (Fiscal Technician), Kathy Pennington (Research Technician), Kathy Gault (Wildlife Worker), and Kristina Witter (Wildlife worker).

Alumni in the News

Jan Callaway '71, after 6 years of private hospital work and 15 years as a supervisor in the Clinical Microbiology Department of the National Institutes of Health, is currently working for the Food and Drug Administration in the Ophthalmic Devices Division of the Center for Devices and Radiological Health where she has been promoted to Master Reviewer.

David Carter '99 received a Pharm.D. degree from the Medical College of Virginia School of Pharmacy.

Robert Phillips '81 was promoted to national sales manager of U.S. wholesalers for Principal Financial Group.

Sharon Morgan '75 was promoted to assistant regional director for migratory birds and state programs of the U.S. Fish and Wildlife Service in the Northeast.

In Memoriam

On Thursday November 18, Susan J. Daniels passed away at the age of 44. Sue has been a member of the Department of Biology since 1994 working in many capacities, including technical support, data analysis, editorial work, research associate and graduate student. She earned a M.S. in 1997, and recently had been working toward a PhD. Dr. Jeffrey Walters, Bailey Professor of Biology, was her major advisor for both of her degrees. Sue was an exceptional scholar with expertise in the field biology of birds, animal behavior, and conservation. She was a Cunningham Fellow, and has published ten papers and book chapters, all of high quality in prestigious journals and books. Sue was a friend to many, and a positive force within the Virginia Tech and Blacksburg Communities.

Please help us by updating your address and providing comments and items of interest for future newsletters: email to tinap@vt.edu **OR** go to <http://www.biol.vt.edu/alumniupdate.php> **OR** write below and mail to Dr. Robert Jones, Department of Biology, VPI & SU, Blacksburg, VA 24061.

Your Name _____

Class _____

Mailing Address _____

Email _____

Notes/Comments _____

VT Biology on the Road

Continued from page 3

plan and brought it to fruition with the release of 20 ducks into restored habitat on Midway Island in early October (Midway, like Laysan, is one of the northwestern Hawaiian Islands). Walters and Reynolds, with four others, traveled the 1000 miles from Honolulu to Laysan by boat in 5 days, captured 20 ducks overnight, cared for the ducks during the 36-hour boat trip from Laysan to Midway, established them in an aviary on Midway, and then released them in groups of four beginning 2 days later. At this writing, one month after release, all 20 ducks are doing well in their new home.

The Journal of Neuroscience, the official journal of the Society for Neuroscience, contains in its November 10 issue a paper by Ignacio Moore, an assistant professor in the Department of Biology, and his colleagues John C. Wingfield and Eliot A. Brenowitz, departments of biology and psychology, respectively, of the University of Washington in Seattle. The paper discusses their

work which considers seasonal changes in the brains of birds that account for their singing, which is a part of the male mating behavior.

At the July meeting of the Mycological Society of America, Emeritus Professor, Orson Miller was surprised at a dinner in which 60 of his students and close colleagues roasted him and presented him with an honorary volume. The book was published by the New York Botanical Gardens and includes scientific papers by many of his students and colleagues and an introductory chapter detailing his life, listing his students, publications, new taxa which he has published, etc. Dr. Cathy Cripps at Montana State University was the chief editor. The web site (<http://plantsciences.montana.edu/alpinemushrooms/fungiinforestecosystems.htm>) gives illustrations and information on the book. Miller wished to share this honor with all his friends at Virginia Tech.

View from the Department

Continued from page 1

People often ask me why the department is focused on research rather than first considering the teaching mission. My answer is straightforward: by building a strong research program, the department IS focusing on good teaching. If the best faculty can be convinced to come to Virginia Tech, the department is bringing cutting edge researchers into the classroom and developing very strong, well-focused sequences of courses that provide depth of knowledge. Using this new strategy of building research groups,

the department will not be the best in all of the biological sciences, but it WILL be the very best within the thrust areas chosen.

Well, that's the news from Lake Blacksburg, where all the scientists are strong, all our classrooms are attractive, and every student is above average.

Sincerely,
Robert H. Jones, Head



Department of Biology
2125 Derring Hall
Blacksburg, VA 24061

Non-Profit Org.
U.S. Postage
PAID
Blacksburg, VA 24060
Permit No. 28