Biological Sciences
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VIEW FROM THE DEPARTMENT: MULTICULTURAL SCIENCE

The Department of Biological Sciences is striving to build a diverse community of scholars that reflects and embraces the cultural and intellectual diversity of the world. Our goals are (1) to foster a climate of respect and appreciation for the value of a culturally and ethnically rich environment, and (2) to prepare students for careers in a globally connected economy and to promote their personal growth, maturity and responsibility. We pursue these goals not just to be good citizens, but also to become better scientists.

Science is a "search for truth" using a particular kind of approach or philosophy, to wit, curiosity leads to observations, which are followed by answerable questions or testable hypotheses that may explain underlying cause and effect. Then, experiments or further observations are made to answer the questions or support or refute the hypotheses. Finally, scientists challenge each other on the validity and interpretation of the evidence. If a hypothesis withstands multiple challenges, it begins to take on the stature of a broadly accepted theory. So what does this cut and dry, straightforward philosophy have to do with today's mantra for *multiculturalism*? The answer is, a lot!


Dr. Robert H. Jones, Head

Science is a great tool, but it is wielded by a species that is fraught with biases, many of which relate to its "social" nature. We humans live in families and communities. Our perceptions and behaviors are strongly influenced by parents, teachers, siblings and friends. Try as we might to do otherwise, we tend to observe and interpret facts and behave in ways that are influenced, sometimes very subtly, by this social context. Even the questions and hypotheses asked by researchers are influenced by social context, e.g., for many years, clinical trials of almost all medications were performed on adult men (and typically Caucasian men) because this demographic was considered the best "control group." So how then can we avoid such socially-related bias within science?

Enter multicultural science; i.e., the inclusion of people from different cultural backgrounds into the science enterprise. Studies suggest that: (1) multicultural science can reduce the negative impacts of bias and increase innovation, and (2) science education can operate best when cultural biases are openly discussed and recognized. In our own department, for example, a National Science Foundation funded project led by Drs. Muriel Lederman, Jill Sible and Rebecca Scheckler has shown that open classroom discussions of the social context of science can help students become more interested and successful in learning core biological concepts.

Multicultural science plays right into two key aspects of science: observation and challenge. Clearly, science is best when people look at ideas and evidence from all angles, and our ability to see from multiple angles is enhanced when scientists come from a diversity of cultures. Other reasons exist for creating a culturally rich environment. For me, one of the most compelling relates to unrealized potential. I wonder how many future Marie Curies, Barbara McClintocks, and Ruth Patricks are being lost to science because our culturally influenced educational system (from elementary school through college) does not encourage women to see science as a viable and rewarding career. Another important consideration is more parochial. How competitive can the economies of Virginia and the United States remain if we do not fully engage in the process of globalization, which will require paying attention to the perspectives and cultures of many of the world's people?

In sum, we will pursue our multicultural objectives on the basis of sound philosophical, ethical, scientific and economical justifications. We hope that you will support us.

Sincerely, **Robert H. Jones, Head**

RESEARCH HIGHLIGHTS

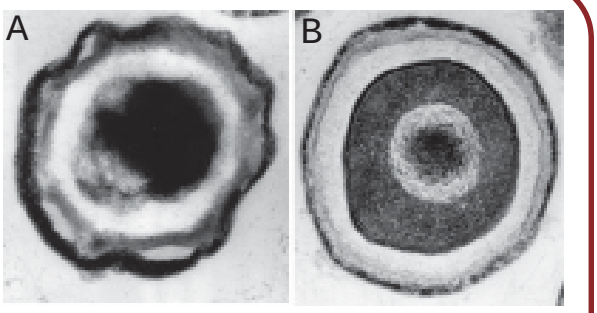
Building and Tearing Down Walls in Cells and Spores

Research by Dr. David Popham, Associate Professor

Bacteria are the simplest self-replicating organisms on Earth, and the cell walls they build have major roles in determining not only their shape but also their ability to survive in their surroundings. Research in David Popham's lab is looking at how cell wall synthesis and degradation are affected during different stages of some bacterial life cycles. The structural integrity of the wall is essential for the survival of the bacteria. If the wall is breached, then the cells will lyse and die. This important point is reflected in the fact that an enzyme called lysozyme, which degrades the bacterial cell wall, is found in human saliva and tears and forms a first line of defense against bacterial infections. The essential nature of the wall of the bacteria is also revealed by the fact that some of the most successful classes of antibiotics, including penicillin, are specific inhibitors of enzymes involved in bacterial cell wall synthesis.

Peptidoglycan is the major structural element of bacterial cell walls. While the structure and the general mechanism of peptidoglycan synthesis have been known for decades, details of the process of insertion of newly synthesized material into the existing wall remain elusive. It is clear that insertion of new material must be tied to cleavage of old wall material in order to allow expansion of the cell. An NIH-supported project in the Popham lab is driving basic research into peptidoglycan synthesis. Researchers in the lab are using molecular biology methods to examine the precise functions of the various domains of several large proteins that play direct roles in peptidoglycan polymerization. Of special interest is determining the protein-protein interactions made by these enzymes. Assembling the interaction map of proteins involved in wall synthesis will help in understanding how wall synthesis is directed to particular cellular locations at different times during the bacterium's life cycle and how wall synthesis is coordinated with wall degradation. In the long run, a complete understanding of the functions of these proteins will allow the development of new classes of therapeutics directed against this proven antibiotic target.

With recent increases in federal support for biodefense studies, the lab gained NIH funding to expand into work on the peptidoglycan found in *Bacillus anthracis* spores. These spores are the infectious agent that causes anthrax. Spores are an attractive biological weapon because they are dormant cells that can be prepared months or years ahead of time, stored at ambient temperatures, and spread with any airflow. Spores are especially difficult to eliminate from a contaminated site because they are resistant to most chemical and physical treatments commonly used to kill bacteria. A specialized peptidoglycan wall within a spore is involved in maintaining a dehydrated state of the cell cytoplasm, leading directly to spore dormancy and heat resistance. However, when the spore arrives in a nutrient rich environment, in this case inside a host animal's body, the spore peptidoglycan must be rapidly degraded in order to allow the cell to resume metabolism. The lab's research is aimed at identifying the enzymes that carry out this peptidoglycan degradation and at determining how they are activated upon arrival in a favorable environment. This work on *Bacillus anthracis* led to initiation of another project in collaboration with Al Claiborne and Carleitta Paige of Wake Forest School of Medicine. The work is supported by a grant from the NIH-supported Southeast Regional Center of Excellence for Biodefense and Emerging Infections and involves an enzyme that plays a direct role in reactivation of enzyme activity in germinating spores. Current evidence indicates that the loss of this enzyme renders germinating spores extremely sensitive to oxidative stresses, exactly the type of stress these spores receive from the immune system when they germinate inside a host body. Both of these studies on *Bacillus anthracis* may lead to better methods of decontaminating spore-contaminated sites and potentially to strategies for treating anthrax early during the infection process.



A dormant spore (**A**) and a germinating spore (**B**). The darker central area is the spore core or cytoplasm, which is dehydrated and thus more dense in the dormant spore. This area is surrounded by the lighter spore peptidoglycan wall and multiple darker spore coat layers. In the germinating spore, the core is rehydrated, leading to swelling of the spore and revealing the DNA in the central nucleiod, and the spore wall is being degraded.

continued - see 'Spores' pg. 3

RESEARCH HIGHLIGHTS

'Spores' (continued from pg. 2)

Finally, a new project, in collaboration with the lab of Stephen Melville in Biological Sciences, has been funded by the USDA. This project pairs the Popham lab's experience in studying spore structure and resistance properties with the Melville lab's methods for genetic manipulation of *Clostridium perfringens*. This species is responsible for many cases of food poisoning, as well as several types of human infections, the most notable being gangrene. In both instances, spores are the culprit for infection of food and wounds. Research on this project will examine several aspects of spore structures and contents as factors in determining spore heat resistance. Comparison of spore characteristics among multiple strains and species will reveal which of these characteristics is most important in spore resistance properties overall and may help in the development of better spore-killing technologies.

Lawrence Aids Search for Causes of Lung Ailments

Associate Professor Chris Lawrence, Ph.D. has established a consortium with researchers at the Mayo Clinic, Rochester, MN, to investigate the role of fungi in chronic airway disease. Data generated over the last few years by Dr. Hirohito Kita, M.D. and colleagues at the Mayo Clinic and University of Buffalo Medical School strongly suggest that airborne fungi play a major role in the development of chronic airway diseases, in particular asthma and chronic rhinosinusitis (CRS). Moreover, the main fungus that appears to be most strongly associated with this phenomenon is Alternaria. Last year, Dr. Lawrence received a grant from the NSF-USDA Interagency Microbial Genome Sequencing Program to sequence and annotate the genome of one species of Alternaria. Another grant awarded in 2002 by the National Science Foundation Plant Genome Program centered on functional genomics and has allowed Dr. Lawrence to develop technology for manipulating Alternaria at the molecular level. He has been using the set of predicted proteins obtained from the Alternaria genome sequence and other Alternaria-related technologies to aid researchers at Mayo in identifying fungal proteins that have a profound effect on the human immune system. He uses a technique called proteomics which is also coupled with immunological experiments.

"We have recently combined our teams' efforts to continue to establish a new paradigm in immunology related to chronic airway disease"

"We have recently combined our teams' efforts to continue to establish a new paradigm in immunology related to chronic airway disease" said Lawrence. The team at VT led by Lawrence provides genomic, bioinformatics, and fungal resources to the team at Mayo led by Dr. Kita, which then uses the information to perform the immunology experiments using mice and cells derived from human patients. This collaboration has already led to the identification of several Alternaria proteins that appear to trigger and subsequently enhance the novel immune response associated with CRS. CRS affects over 30 million people in the U.S. annually, with a direct cost of the illness exceeding $5.6 billion per year according to the Center for Disease Control and Prevention. The more the pathology underlying CRS is understood, the more likely new therapeutic strategies for prevention and control can be designed. Future plans are to explore the relationship of these fungal proteins in the development and severity of asthma with additional researchers from the University of Minnesota. The research of Dr. Kita and colleagues is currently supported by the Mayo Foundation and several grants from the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health. Since this consortium was formed, it has been able to submit several grants that are currently being reviewed by NIAID. They highlight the team's combined strength in genomics, bioinformatics and immunology.

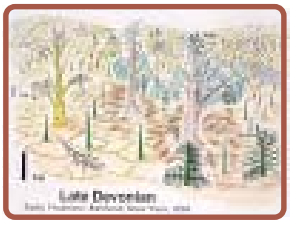
Dr. Christopher Lawrence joined Virginia Tech in fall 2003. He earned a Ph.D. in Plant Pathology from Auburn University in 1998 and was an Assistant Professor of Molecular Biology/Genomics at Colorado State University before accepting an Associate Professor position held jointly between the Virginia Bioinformatics Institute and the Department of Biological Sciences at Virginia Tech.

Stephen Scheckler Appears in International Television Series

Images courtesy: Dr. Stephen Scheckler

Dr. Stephen Scheckler was interviewed and filmed on site (*in situ* fossil forest at Ashland, NY) for three days (November 7-9, 2003) and in a follow-up at Virginia Tech for two days (March 8-9, 2004) by the Japan Broadcast Corporation (NHK) for the program ***"Miracle Planet II. The Evolution of the World. Episode 3: New Frontiers – Onto the Land."***

NHK is a PBS-like public television production company. ***Miracle Planet II. Episode 3*** aired in Japan (in Japanese) in June 2004 and was released to the public as VHS and DVD video. The program was sold to BBC for world distribution in 2005 (after translation of Japanese dialogue and overlays into English). The program series aired in the U.S. on the Discovery Science Channel. Scheckler appeared briefly in Episode 3, which aired on August 1, 2005, in the video footage and also in the two books (in Japanese) that were spun off from the TV program. One is a textbook-like hardcover edition with color illustrations and text for adults; the other a line-drawn 'comic book' meant to appeal to the younger audience with an amusing storyline and excellent caricatures. The Project Director, Shigenori Mizuno, took his film crew all over the world to film sites and events and to interview scientists. Episode 3 focused on secrets of the early colonization of Earth. Scheckler is one of only two North American paleobiologists to appear in the TV production and books. The other is Dr. Ted Daeschler, Curator of Vertebrate Zoology at the Academy of Natural Sciences in Philadelphia, PA. Daeschler's expertise is the archaic fish that swam in Devonian rivers — the first four-footed vertebrates that preyed and walked on the Late Devonian landscapes. Scheckler's expertise is the rise and expansion of the first forests (Late Devonian), which altered floodplain environments and increased river productivity sufficiently to have sustained the explosive evolution of fishes and tetrapods midway through this time.



Congratulations to Betsey Waterman!

Betsey was recognized as a Virginia Tech Employee of the Week on August 29, 2005. The scope of Betsey's involvement with the students, university, and college clearly exceeds any expectation one might have, and she is very deserving of this award.

ACTIVE EMERITUS FACULTY

The OWLS (Older Wiser Learned Scientists) met for lunch September 23, 2005 in Blacksburg. Several times each semester, this active group of emeritus faculty meets to discuss science and keep up with departmental and university activities. Shown here from left to right are Bob Benoit, Noel Krieg, Charles Rutherford, Al Hendricks and co-organizer Bruce Parker.

Meet Our New People.....

Administrative Staff: Wendy Conner, Debbie Cruise, Thomasine Dixon, Karen Fraley

Technical Staff: Charles Clarkson, Emery Conrad, Rob Gunter, Jaan Kolts, Mike Renner, Sharon Sible, Noah Stevens, Ingred Wilson

Faculty: Daniela Cimini, Carla Finkielstein, Dana Hawley, Liwu Li, Florian Schubot

Postdocs: Steve Fasciano, Anya Hinkle, Gordon Lightbourn, Kathleen Richter, Jianmin Su, Pradeep Vasudevan, Jonathan Watkinson, Qifa Xie

Adjunct: Ross Angel, Daniel Capelluto

VT Hosts International ABLE Conference

In June 2005, the Department of Biological Sciences hosted the 27th Annual Association for Biology Laboratory Education (ABLE) meeting. Attended by 130 biology teachers from across North America, the five-day meeting included workshops, tours, invited presentations, poster sessions and business meetings. The local planning committee was chaired by Mary Schaeffer, Biology Laboratory Coordinator, and also included Dr. Art Buikema, Alumni Distinguished Professor and coordinator of our freshman biology teaching program. Many of the ABLE participants stated that this year's conference was the best that they had ever attended.

PUBLICATIONS

Two sesquiterpene synthases are responsible for the complex mixture of sesquiterpenes emitted from *Arabidopsis* flowers

Photo courtesy: Dr. Dorothea Tholl

Summary

Dr. Dorothea Tholl, an Assistant Professor who just joined Virginia Tech from The Max Plank Institute of Chemical Ecology in Jena, Germany, recently had a publication that made the cover of the "The Plant Journal" (Vol. 42, No. 5, June 2005), an international peer-reviewed outlet for plant science research. Her work focused on the production of sesquiterpene volatiles in the flowers of *Arabidopsis thaliana*, a model plant used widely in studies of plant genetics. She identified only two proteins, encoded by the florally expressed genes *At5g23960* and *At5g44630*, that are responsible for the formation of virtually all 20 plus sesquiterpenes found in the *Arabidopsis* floral volatile blend. As an approach to determine the crucial function of these two genes and their encoded proteins, she examined the sesquiterpenes produced in plants where each gene was mutated and, therefore, rendered inoperable, leading to distinct changes of the sesquiterpene volatile blend. She also inserted the genes into the bacterium *Escherichia coli* and found that the proteins encoded by the bacteria performed the same biochemical steps that occur in the plant, providing further evidence that the genes she has identified are the keys to floral terpene production. Although *Arabidopsis* is largely self-pollinating, the detected floral terpene volatile emissions may be important for the short range attraction of pollinators such as solitary bees, which may facilitate cross-pollination. Outcrossing events can have important consequences for the population structure of *Arabidopsis* plant communities by increasing reproductive fitness and mitigating inbreeding depression. Furthermore, given the antimicrobial activity of terpenes reported in other studies, Tholl has suggested that their production in both the stigmas (female flower parts) and nectaries of *Arabidopsis* may serve to inhibit microbial infection at these vulnerable sites. Further evidence that sesquiterpenes are important to the ecology of *Arabidopsis* was provided when Tholl surveyed 37 wild ecotypes of *Arabidopsis thaliana.* She found quantitative, but almost no qualitative, variations of floral monoterpene and sesquiterpene emissions, which suggests that most or all of the floral terpene volatiles play some significant role in the life of the *Arabidopsis* plant.

View full article at: http://www.blackwell-synergy.com/doi/full/10.1111/j.1365-313X.2005.02417.x

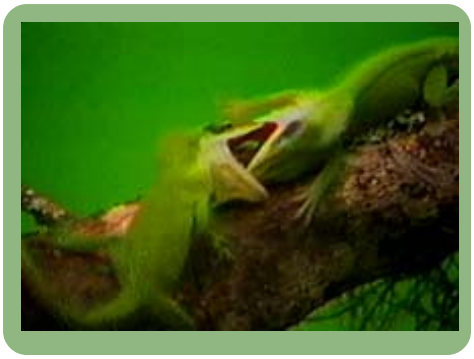
Assessment in contests of male lizards (*Anolis carolinensis*): how should smaller males respond when size matters?

Photo courtesy: Dr. Thomas Jenssen

Summary

Not unlike people, most species of animals engage in conflict resolution because of frequent competition over limited resources (e.g. attracting or defending mates, controlling quality food supplies and shelters). Resolution is usually accomplished by some form of aggression, such as forming and defending territories to settle ownership of resources. Dr. Tom Jenssen has been using the territorial behavior of green anole males (the common green lizard of southeast U.S.) to study the rules of combat, the signals of deception and bluff, and ultimately the traits of males that win. Two primary traits of winners, and these certainly have human analogues, are being bigger and being the resident (home field advantage).

In a recent study, Jenssen and colleagues reported* a rather controversial and counter-intuitive expression of conflict resolution. Because big males in the field always have larger territories and more females than small males, Jenssen hypothesized that males should be able to assess an opponent's body size relative to their own so that they could effectively push their advantage if they are larger or bluff and retreat if smaller. The research team established size-matched contestants, where contests should be long because assessment is difficult, and size-mismatched contests, where contests should be short because smaller males easily assess their disadvantage. Pairs of males were individually provided a large patch of habitat that contained a female and was provisioned daily with food. A conflict was created by removing a partition that had previously visually isolated the males of a pair. The ensuing contest was videotaped and analyzed for 12 kinds of signals, their manner of use, duration of contest, contestant body size, and who won or lost the contest.



The researchers found, as expected, that size-matched males fought long and intensely. The size-mismatched con-

continued - see 'Lizards' pg. 6

Microbiology Club presents display for Alumni Reunion

At the September 17 College of Science alumni reunion, the Virginia Tech Microbiology Club presented a special display that highlighted the science and history of microbiology, as well as its importance to society. Exhibits included the development of microbiology knowledge, highlighting many women scientists who have had a major role. Also included were outreach materials used in preK-5th grade education, microscope slides of stained bacteria, Petri dish cultures of live bacteria and Dr. Ann Stevens' signature display of bioluminescent bacteria in a black box. The Microbiology Club is a university-wide club sponsored by the Department of Biological Sciences.

Article and photo courtesy: Dr. Ann Stevens

Left to right: Steven Abbott, Jessica McElligott, Dr. Ann Stevens, Sandra Jabre and Allison Meade

'Lizards' (continued from pg. 5)

tests, however, held a surprise. Although the larger male of a pair won, as expected, the smaller male of a pair did not bluff and retreat, but took the fight to his opponent. Smaller males: 1) invaded their opponents' habitats, 2) showed no tendency to stay away from their opponents, 3) matched or intensified their aggressive signals relative to those of their opponents, and 4) initiated or readily engaged in physical combat (locking jaws and wrestling), despite losing 90% of contests. These observations support a recent game theory construct ('Napoleon complex') that models size-asymmetric contests in which the smaller males initiate fights they usually lose. The generalization seems to be, "beware of the underdog – he may risk more than you estimate." * T.A. Jenssen, K.R. DeCourcy, & J.D. Congdon. 2005. Animal Behaviour, Vol. 69, 1325–1336.

Full article can be viewed at: http://www.biol.vt.edu/pdfs/jenssen.pdf

Known for his great academic advising, Dr. Jack Cranford's unselfish, caring and compassionate side allowed us to laugh during an otherwise somber situation in dealing with the catastrophe of Hurricane Katrina. Not only did Cranford make the first donations, he also spent time organizing all the donations and delivering them to the appropriate people.

Students, faculty and staff donations were overwhelming. After just one week, the department took a full-truck load of items to a group delivering aid. One week later, another load was taken. The Biological and Life Sciences Learning Communities organized and manned a collection site in front of Kroger. Donations included: personal care items, baby items, baby food, canned food, and bottled water.

People who deserve special thanks for their part are: Dr. Bob Jones, Jack Evans, BLSC, Betsey Waterman, Karen Fraley, Jennifer Clem, Debbie Cruise, Wendy Conner, Dr. Art Buikema, Dr. Joe Cowles, and Dr. Mike Rosenzweig. We also acknowledge the work of 'Pepe' the skunk, shown on the right of this picture, who worked with many administrators in Burruss Hall and Jamerson Athletic Center to get the message out for help. Everyone's generosity and willingness to give to those who have lost so much means a great deal and sincere thanks go out to all.

ALUMNI NEWS

W. David Crews, Jr., Ph.D. is founder and president of CogniCheck, Inc. and CogniCheck.com and is a licensed clinical neuropsychologist.

Article and photo courtesy: Dr. W. David Crews Jr.

Dr. W. David Crews, Jr. (left) and colleague Dr. David W. Harrison (right)

In an email to our department, Dr. Crews provided this statement:
"I have extremely fond memories of being an undergraduate Biology major at Tech and can unequivocally state that the education and training that I received through the department continues to prove very beneficial to me as a licensed clinical neuropsychologist."

Crews received his B.S. in Biology from Virginia Tech in 1983, his M.S. in clinical psychology from both Radford University and Virginia Tech in 1992; and.his Ph.D. in clinical psychology at Virginia Tech in 1995. He completed his residency/internship in clinical psychology, with an emphasis in neuropsychology, at the University of Virginia Health Sciences Center. Crews then served a two-year post-doctoral fellowship in clinical neuropsychology through the Division of Neuropsychology, Department of Psychiatric Medicine, at the University of Virginia Health Sciences Center.

Upon completion of his post-doctoral fellowship, Crews was appointed an Assistant Professor of Clinical Psychiatric Medicine at the University of Virginia Medical Center and Director of the Westminster Canterbury/University of Virginia Neuropsychiatric Evaluation Center. He has also held an appointment at Lynchburg College as Researcher-in-Residence and currently retains an appointment as an Adjunct Assistant Professor within the Department of Psychology at Virginia Tech. Crews has been awarded Diplomate statuses through the American Board of Psychological Specialties (i.e. Neuropsychology) and American Board of Disability Analysts. He was elected as a Fellow by the National Academy of Neuropsychology for his contributions to the field of neuropsychology.

Crews has authored/co-authored over 50 peer-reviewed publications, including book chapters, journal articles, and abstracts in the fields of clinical neuropsychology and behavioral medicine and has presented numerous scientific papers at state and regional conferences and national conventions. He served as Principal Investigator and Senior Program Director for an innovative "Memory Screening Outreach Program" that provided free, detailed memory screenings to middle-aged and older adults in underserved regions. Among other research pojects, he also served as a Principal Investigator on a large clinical trial that examined the efficacy of Ginkgo biloba extract on the neuropsychological functioning of cognitively intact older adults. *Learn more about CogniCheck, Inc. at http://www.cognicheck.com/*

Congratulations to:

Ms. Lisa Hatch '80 - Appointed as Director of Clinical Operations for PRA International

Mr. Michael Szymanski '94 - Promoted to Associate Director of Quality Assurance, Women's Health of Johnson & Johnson

Drs. Tom Waller and Ken Dickson - both retired on October 14, 2005. Waller is the Regents Professor and Dickson is Director of the Institute of Applied Sciences at the University of North Texas. Since their courses are in great demand, they will continue teaching part time. Both Waller and Dickson received their Ph.D. with Emeritus Professor of Biology, Dr. John Cairns, Jr.

Alumni and Friends

We need your support !

Your gifts to the Department of Biological Sciences and alumni projects have helped us move forward in our quest for excellence. Thank you!

With continued support, you can help us build strong scholars, make higher education affordable, and attract the brightest and best students and faculty to Virginia Tech. Tangible gifts reflect a donor's dedication to enriching the university experience for students and faculty alike.

We are also seeking large gifts to equip the new biology building and establish chaired faculty positions. Your contributions are tax deductible. For more information on "Ways to Give," visit http://www.giving.vt.edu.

DONORS CAN TRULY SEE THE FRUITS OF THEIR LABOR AND FEEL A SENSE OF PRIDE WITH EACH VISIT TO CAMPUS

MAKE A GIFT THAT WILL LAST FOREVER

Make check payable to the Virginia Tech Foundation.
*Write **"for Biological Sciences"** on your check and mail to:*

Dr. Robert Jones
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Virginia Tech
Blacksburg, VA 24061

(see enclosed envelope)

Help us keep our records updated

Please help us by updating your address and providing comments and items of interest for future newsletters. Fill out the form below and mail to: Dr. Robert Jones, Biological Sciences 0406, Virginia Tech, Blacksburg, VA 24061. You may also send an email to Debbie Cruise at (debbiec@vt.edu) or Robert Jones at (rhjones@vt.edu) or visit our webpage at http://www.biol.vt.edu/alumniupdate.php.

Name _____

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Had a Favorite Teacher?

Please drop us a line (rhjones@vt.edu) about your favorite Biology teacher. We will use your comments to support excellence in teaching at Virginia Tech.

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