

Biological Sciences

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 **VirginiaTech**
Invent the Future

Dear Biological Sciences Family and Friends,

We were well into production of this newsletter when the terrible tragedy of Norris Hall occurred. The events of April have had profound and long lasting effects on the fabric of our department. We dedicate this issue to our colleagues, students and friends who were lost, including those who received posthumous degrees at our commencement ceremony on May 12: Ryan Clark, Rachael Hill, and Michael Pohle Jr.

During this difficult time, the world has learned, and we have rediscovered, the special character that defines a Hokie; i.e., loyalty, compassion, intellect and a desire to serve.

While we continue to struggle with our sorrow, we feel comforted by the strength of our community and the tremendous outpouring of concern from around the world. We are especially grateful for the kind words and consistent support from our Alumni.

Sincerely,
Robert H. Jones
Department Head



RESEARCH HIGHLIGHTS

Light Guides Flight of Migratory Birds

Songbirds use multiple sources of directional cues to guide their seasonal migrations, including the Sun, star patterns, the earth's magnetic field, and sky polarized light patterns. To avoid navigational errors as cue availability changes with time of day and weather conditions, these "compass" systems must be calibrated to a common reference. Experiments over the last 30 years have failed to resolve the fundamental question of how migratory birds integrate multiple sources of directional information into a coherent navigational system.

Last autumn, Rachel Muheim, a post doc in Biological Sciences Professor John Phillips' lab at Virginia Tech, captured Savannah sparrows in the Yukon before they headed south. She was able to demonstrate that the birds calibrate their magnetic compass based on polarized light patterns at sunset and sunrise.

The research appeared in the Aug. 11, 2006, issue of *Science*, in the article, "Polarized Light Cues Underlie Compass Calibration in Migratory Songbirds," by Muheim, Phillips, and Suzanne Akesson. Muheim did her Ph.D. work at Lund University in Sweden with Akesson, who made the Alaska trip possible.

Polarized light is light that oscillates in one plane relative to the direction of propagation. At sunrise and sunset, there is a band of intense polarized light 90 degrees from the sun that passes directly overhead through the zenith and intersects the horizon 90 degrees to the right and left of the sun. Just as the sun location changes with latitude and the time of year, so does the alignment of the band of polarized light.

Muheim and Phillips argue that migratory songbirds average the sunrise and sunset intersections of the polarization band with the horizon to find the north-south meridian (geographic north-south axis), providing a reference that is independent of time of year and latitude. The birds then use this geographic reference to calibrate their other compass systems.

In other words, polarized light, the Sun and stars, and the geomagnetic field are all directional cues for migration, but polarized light appears to provide the primary reference system used to calibrate the other compass systems, said Phillips. However, previous research had suggested a much more confusing picture.

Migratory birds are born with an innate magnetic compass preference that coincides with their species' migratory direction. Previous research suggested that before the migration period, songbirds are able to recalibrate the magnetic compass when exposed to a "conflict" between magnetic and celestial (including polarized light) cues, but during migration it appeared that the reverse was true, -- the magnetic field was used as the primary reference for calibrating the birds' other compass systems. But in a few experiments with birds during migration, the birds did recalibrate the magnetic compass.

When Muheim and Phillips did a literature review, they noticed a difference between the experiments of the few scientists who saw migratory birds recalibrate their compass and of those whose birds failed to recalibrate.

"It is important how you do the experiments. It turns out that the part of the sky that matters is just above the horizon," said Phillips. "In cue conflict experiments carried out before migration, birds were usually housed in outdoor aviaries in a rotated magnetic field, where they had a view of the whole sky, including the horizon. Once migration starts, however, scientists usually exposed birds in "funnel cages". This is so, after exposure to the cue conflict, the birds' directional preferences could be recorded; songbirds in migratory condition leave tracks or scratches on the sides of the funnel as they attempt to take flight in the migratory direction. A problem arises, however, because funnels block the lower 20 degrees of the sky. In the only two experiments (out of 30 or so) carried out during migration where birds were exposed to the cue conflict with a view of the horizon, they did recalibrate their magnetic compass -- just as was previously observed only in experiments carried out prior to migration."

Muheim's experiments proved that seeing polarized light cues near the horizon was the critical factor. "Once the right hypothesis came along, it all fit," said Phillips.



The research provides support for an observation Phillips had published 20 years ago. In the mid 1980s, he was doing research to determine how homing pigeons navigated. There was a theory that wind-borne odors provide pigeons with information about the locations of odor sources, which could then be used to determine their position relative to the home loft when they were released at an unfamiliar site. The birds were housed in a loft with a "pinwheel" arrangement of deflector panels attached to the four screened walls of the loft to rotate direction of the wind. Pigeons housed in the so-called "deflector lofts" showed the predicted (clockwise or counterclockwise) deflection of homeward orientation when released at a distant site. It turned out, however, that the panels influenced the distribution of polarized light patterns at sunset and sunrise, and it was the altered polarization patterns, rather than olfactory cues, that produced the directional biases. Moreover, the effect appeared to result from recalibration of the sun compass. Phillips published the research in the *Journal of Theoretical Biology* (1988, volume 131). "I've felt ever since that this was the key to understanding the integration of compass information in migratory birds" he said. ●

RESEARCH HIGHLIGHTS

Science Aiding Conservation

One of Jeff Walters' most successful scientific conservation research efforts to date – and the one that could potentially impact the greatest land area – is the story of the red-cockaded woodpecker. About the size of the common cardinal, this woodpecker's most distinguishing feature is a black cap and nape that encircles large white cheek patches. The male has a small red streak on either side of its black cap, called a cockade; hence the name.



The red-cockaded woodpecker makes its home in mature pine forests. Historically, its range extended from Florida to New Jersey and as far west as Texas. Gradually, more and more of these mature forests were cleared for private and commercial uses. Consequently, the woodpecker's population was declining everywhere throughout the late 1980s. Today the bird is found in about 1 percent of its original range.

"Most people thought they were headed for extinction," Walters says. "But now their numbers are increasing, and people say they think they can be recovered."

A large part of this turnaround is due to a research effort, headed by Walters, that studied the bird's population biology, specifically its nesting behavior.

The red-cockaded woodpecker is unusual in two very distinct ways. First, they make cavities in live pine trees, which means it can take years to make a single cavity. These small birds must excavate all the way into the inner hard wood of mature pine trees. Once they make a cavity, however, they may use it for years. This behavior is atypical of most woodpeckers, who make a cavity in a matter of weeks in hardwood trees only to use once and then move on.

"What this means, then, is that the cavities for the redcockaded woodpeckers become extremely valuable," Walters says. "A bird will wait around and try to take over a cavity that another bird started. They become very territorial."

The second characteristic of this species is that it lives in family groups rather than in pairs like most birds. Young birds sometimes stay with their mother and father for years to help them raise offspring.

"A certain fraction of the birds leave home the first year, but the rest stay at home and wait to either take over from Dad or move into a neighboring territory," which is within approximately a two-mile radius of where the bird was born, Walters says.

"So what we had to do to build a population was to make more good territories that these birds could move into," Walters says. "In other words, it was lack of suitable cavities that was keeping these birds from establishing themselves in new territories."

Walters and his team set to work to design a cavity mimicking the ones painstakingly constructed by the red-cockaded woodpeckers. His research focused on populations of the bird in longleaf pine forests in the Carolina Sandhills, including Fort Bragg Army Base, on Camp Lejeune Marine Base in North Carolina, and at Eglin Air Force Base in northwestern Florida.

Using a power drill, they made intersecting horizontal and vertical tunnels to create a cavity with an entrance diameter of approximately 1.25 inches and a cavity chamber six inches deep in live pine trees. The trees had to be old enough to have sufficient heartwood. If the tree was too young and the chamber only went into sapwood, the living conditions could be deadly for the birds.

The true test of the effectiveness of these new dwellings came in 1989 when the team placed 20 of these man-made cavities in trees in the Carolina Sandhills. They placed them in pine forests that were ecologically suitable but that had never been inhabited by the birds. Within a year, red-cockaded woodpeckers were living in 19 of the 20 cavities.

Their results came just in time, because in September of that year, Hurricane Hugo blew through the eastern United States, causing millions of dollars in damage to the Carolinas and wiping out much of the birds' territories in the Francis Marion National Forest. Walters' team worked with the U.S. Forest Service to make more cavities for the birds.

"We figured if they hadn't replaced the cavities, they would have lost 90 percent of the bird's territories," Walters' says. "As it turns out, they lost only about 35 percent."

Walters calls the red-cockaded woodpecker project his most rewarding to date. "In 1989, anyone you asked would have said these birds were doomed, and now their populations are increasing. To me, the most rewarding thing is to apply basic science to conservation and then follow through with the implications of the science to improve the conservation. It's very exciting and gratifying." ●

Adapted from an article by Catherine Doss, College of Science. For entire article please see www.research.vt.edu/resmag/2007winter/walters.html

Congratulations Dylan Kesler!

Dylan, a postdoc in Jeff Walters' lab will be starting as Assistant Professor in the Department of Fisheries and Wildlife at the University of Missouri-Columbia in September. The position is directed toward wildlife conservation and ornithology.

RESEARCH HIGHLIGHTS

Microbial Inhabitants of Potting Soil May Cause Lung Infection

Mycobacteria, long known to inhabit soil, had been considered potential sources of pulmonary infection via inhalation of soil aerosols. A significant fraction of patients with nontubercular mycobacterial pulmonary disease seen at National Jewish Medical and Research Center in Denver, Colo., had been found to participate in gardening. Now Norman R. Pace of the University of Colorado, Boulder, and others show a correlation between abundant soil mycobacterial species from potting soils provided by patients, and patient pathogens, mainly *M. avium*, *M. intracellulare*, and *M. chelonae*. "Pulsed-field genome analysis showed near-identity of one patient and soil pair of *M. avium*," says Pace. "The results of the study indicate that dust masks should be considered when working with soil." The research "is part of a long-term study sponsored by the Sloan Foundation to gain some specific knowledge about our microbial surroundings, with emphasis on the aerosol and water microbiology of indoor environments," says Pace, adding that the line between "environmental microbe" and "pathogen" may in some cases be quite fine. ●

(*M. A. De Groot, N. R. Pace, K. Fulton, and J. O. Falkinham, III. 2006. Relationships between Mycobacterium isolates from patients with pulmonary mycobacterial infection and potting soils. Appl. Environ. Microbiol. 72: 7602-7606.*)

Virginia Bioinformatics Institute and Mayo Clinic awarded \$2.4 million grant to study debilitating nasal disease

Virginia Bioinformatics Institute and Department of Biological Sciences Associate Professor Chris Lawrence are teaming up with the Mayo Clinic on a \$2.4 million research project funded by the National Institute of Allergy and Infectious Diseases (NIAID), a division of the National Institutes of Health (NIH). The work could help researchers develop treatments, diagnostic tools, and preventative measures for patients suffering from chronic rhinosinusitis (CRS).

Chronic rhinosinusitis is a debilitating chronic airway disease that results in up to 18–22 million clinical cases per year and at least 30 million courses of antibiotic treatment (National Center for Health Statistics). CRS can produce inflammation of the lining of the nasal sinus. In some cases, this is followed by thickening of sinus mucosa and the formation of polyps or growths in the nasal cavity. Even with aggressive medical and surgical therapies, a significant number of patients with CRS have persistent or recurrent problems associated with the disease. The goal of the five-year project, entitled "The Pathogenesis of Chronic Rhinosinusitis," is to positively impact treatment, clinical decisions, and medical care costs involving CRS, as well as develop a better understanding of the mechanisms of the disease. ●

Article from Barry Whyte

For entire article please see <http://www.vtnews.vt.edu/story.php?relyear=2007&itemno=283>

New Plant Growth Facility

The Department of Biological Sciences at Virginia Tech in collaboration with the Virginia Bioinformatics Institute (VBI), is pleased to announce the opening of the Biological Sciences-VBI Plant Growth Facility. Located on Smithfield Plantation Road and attached to the Ecosystems Simulation Laboratory (building 209), the 3,240-square-foot facility features five large plant growth areas or bays (432 square feet each) and one smaller bay for plant propagation.

The plant growth facility has been designed as a university service center and will operate on a cost recovery basis. The current weekly user fee is \$25 per bench.

Biology professor Erik Nilsen, the Executive Director of the new BIOL-VBI Plant Research Facility, remarked: "The new facility will act as a focus point for promoting interdisciplinary research and interactions among faculty and students in plant sciences from across the campus and the region. The Department of Biological Sciences is excited to have a state-of-the-art plant growth facility to enhance our competitiveness for research funding and promote scholarship in the plant sciences."

VBI's Executive and Scientific Director Bruno Sobral commented: "We are very pleased to be working closely with the Department of Biological Sciences at Virginia Tech in setting up this cost recovery facility for plant growth resources. The facility operates on the same cost recovery model that has proven to be successful for other resources at VBI. The services are available to anyone on the Virginia Tech campus who has an interest in growing plants under carefully defined conditions." ●



NEW IN THE DEPARTMENT...



Jeb Barrett joined us in the winter of 2006 as an Assistant Professor of Ecology. Jeb earned his Ph.D. in Ecology from Colorado State University and held an Adjunct Assistant Professorship at Dartmouth College before joining our department.

Dana Hawley started an appointment as Assistant Professor in the winter of 2006. Dana earned her Ph.D. in Ecology and Evolutionary Biology from Cornell University and was a postdoc at the Smithsonian Institution before joining our department.



Diaga Diouf of the University of Cheikh Anta Diop, Senegal, has been appointed as an adjunct professor in the department. Dr. Diouf works closely with Dr. Khidir Hilu.

Doug Bruggeman joined the department in March as a post-doctoral Research Associate working with Jeff Walters. Doug earned a Bachelor's degree in Environmental Biology from Ohio University, and a master's from Oklahoma State where he studied effects of ozone depletion on amphibians in southern Patagonia. He earned his Ph.D. in Fisheries & Wildlife Biology and Ecology, Evolutionary Biology, and Behavior from Michigan State University.

Three postdocs have joined John Tyson's research group this spring. **Sandip Kar** and **Debashis Barik** were both trained in Physical Chemistry at the Indian Association for the Cultivation of Science and received their PhD degrees from Jadavpur University. They will be working with Dr. Tyson, Dr. Baumann (Electrical Engineering) and Dr. Paul (Mechanical Engineering) to build stochastic models of cell cycle regulation in budding yeast. Experimental tests of the models will be carried out simultaneously in Dr. Peccoud's laboratory in the Virginia Bioinformatics Institute. **Zerrin Bagci**, from Istanbul, received her PhD in Biochemistry and Molecular Biology from the University of Pittsburgh. She will be developing mathematical models of the regulation of cell growth, division, and death in mammalian cells, in response to DNA-damaging agents and accumulating mutations. Her work will be done in collaboration with the Integrative Cancer Biology Centers at MIT and Vanderbilt Medical School.

Congratulations Mike Rosenzweig!

Mike Rosenzweig has been selected to receive the 2007 College of Science Award for Outreach Excellence. As Bob Jones notes: *"Mike is a dedicated scholar who is using hard work and enthusiasm to create a comprehensive outreach program...he is an inspiration for students, faculty, primary and secondary school teachers, and the citizens of Blacksburg."*

ALUMNI

Somil Mehta, graduate of Biological Sciences class of 2000 has been working for six years as a research scientist, and has decided to further his career by going back to school for a third degree. He is looking to acquire the skills needed to move over to the business side of the pharma/biotech industry. Somil will be pursuing an International MBA at University of South Carolina's Moore School of Business.

Bill Gorcica graduated in 1982 (B.S. Biology), Magna Cum Laude, with a minor in Art. Bill subsequently received an MA in Fine Art from Montclair State University (1990) and a MFA in visual arts from Rutgers University (1992). He then received a Fullbright Scholarship to do printmaking in Poland in 1993. Bill currently teaches art and graphic design at St. Cloud State University in St. Cloud, MN as a full professor. He also entered two pieces (see below) in the art show at the 2007 Research Day. You can check out more art work by Bill at his website www.billgorcica.com



SCHOLARSHIPS

Biological Sciences Scholarships Awarded in the 2006-2007 academic year:

Undergraduate:

I.D. Wilson Memorial Scholarship - Desiree Herrick

Deborah Koller Scholarship - Genine Lipkey and Alicain Carlson

Joe and Barbara Cowles Scholarship - Julie Karfakis

Dr. Stephen D. Lutz Scholarship - Rose Laignel

Ralph E. Carlson Memorial Scholarship - Nicole McGrail and Danielle Blevins

Ralph Carlson Scholarship in Ornithology - Brooke Akright

Dr. John Palmer Memorial Graduate Studies Scholarship - Kwang-Hyung Kim

Graduate:

Mark Maly Tuition Scholarship - Damon Ely

John Cairns Jr. Scholarship - Eric Sokol

Robert and Marion Paterson Scholarship - Yu Chen

Ph.D. 2010 Fellowship - Pamela Widder, Lu Gan, Kristen Huntington, Raymond Danner

Cunningham Fellowship - Alexandra Class

Graduate Dean's Assistantship - Sara Sebring

James F. Powell Scholarship - AbdulShakur Abdullah

Check out the New Department Website!

The new department website went "live" on March 1st. We would like to thank the website committee: Robin Andrews, Diya Banerjee, Wendy Conner, Tracy Price, Mike Renner, and Rob Gunter.

If you have any problems with the website or have any additional suggestions, please contact the web designer, Tracy Price, at (540) 231-3447 or by email at tbolling@vt.edu.

www.biol.vt.edu

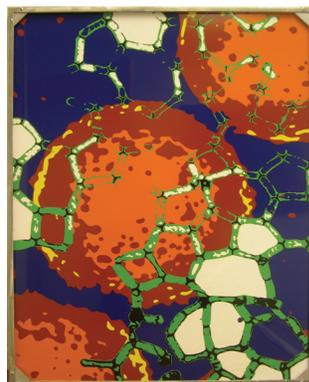
2007 RESEARCH DAY

At the 2007 Research Day, Biological Sciences held an art show in the Torgersen Bridge with the theme of Life Science, especially but not limited to aspects of molecular and microbiology, including representations and interpretations of living structures and scientific methods. There were twenty eight (28) artists showing seventy nine (79) pieces. The following four works were chosen for a purchase award. They will be housed in the new Life Science I building slated for completion in fall 2007.



Carl Pfeiffer
Professor Emeritus of
Biomed VMRCVM
Title: "Microflora of Equine
Colon"

Brad Whitney
Associate Professor, Interior
Design Architecture
Title: "Chemically Organic"



Elijah Bailey
Research Associate
Software Technologies Labo-
ratory
Title: "Algae"

Patricia Bevan
VT Alumnus
Title: "Petri Quiz"



GRANTS, PRESENTATIONS & AWARDS

Art Buikema is the recipient of the ADA Accessibility Honor Roll Certificate for working with students with learning disabilities.

Laura Link received a Master of Science in Education, December 2006 from Virginia Tech.

Michelle Barthet (recent Ph.D. graduate from Khidir Hilu's lab) received an accommodation from the graduate school for her dissertation in the science and engineering category. There was only one accommodation this year in this category for the entire university. Michelle is doing a postdoc at the University of Sydney, Australia.

Khidir Hilu and collaborators presented five talks at the 2007 meeting of the Botanical Society of America held in Chico, California, three at an International Symposium on "Biodiversity and Evolutionary Biology" held in Bonn, Germany, and one in a conference held in Barnaul, Russia. Dr. Hilu also organized a symposium on land plants evolution for the Centennial meeting of the Botanical Society of America. The symposium, entitled "Land plants evolution: Phylogenetics and beyond," was sponsored by the society and Deep Gene Colloquium.

Arthur Buikema, Mary Schaeffer, and undergraduate, Arya Iranmanesh, have been awarded a 2007 XCaliber Certificate of Teaching Excellence for their exemplary work in teaching with technology. This effort was developed to help standardize and manage the education of 1000 to 1400 students in our introductory biology labs and the presentations of our 30 to 35 graduate teaching assistants (GTAs) each semester. As many as 40% of our GTAs turnover every semester.

Lori Blanc has been selected for the 2007 College of Science Outstanding Graduate Student Award. Lori will receive \$1,000 and a plaque in recognition of her achievements and will be honored at the College of Science Awards Banquet and at the Graduate Student Awards Banquet.

Travis Belote was selected as one of the four graduate students in the College of Science for a "Making a Difference" Scholarship, which is founded by The College's Alumni Roundtable.

Jill Sible received a College of Science Diversity Award, the first time this award has been given.

Duncan Porter gave the department's Ecology, Evolution, and Behavior seminar, titled "Why Did Wallace Write to Darwin? and other Findings of the Darwin Correspondence Project." Also, Dr. Porter served on the Scholarly Editions Panel for Philosophy, History of Science, Religion, and Music Editions of the National Endowment for the Humanities in Washington, DC. Dr. Porter gave a talk in Boston to the Oxford and Cambridge Society of New England at their Spring Reception, in conjunction with a tour of the new Darwin Exhibit at the Boston Museum of Science.

Allison Smith (dual Biological Sciences and Chemistry major), has received high honors; i.e., recognition as the 2007 College of Science Outstanding Senior. Also, Allison was this year's Woman of the Year.

Two students from the Popham lab presented posters at the National Conference on Gram Positive Pathogens in Omaha, NE from October 15-18, 2006. **Benjamin Orsburn** presented "Factors Contributing to the Heat Resistance of *Colstridium perfringens* Endospore" and **Jared Heffron** presented "Studies of Cortex Lytic Enzymes Active during Germination of *Bacillus anthracis* Spores."

Jeff Walters is completing a two-year stint on the National Research Council's Committee on Independent Scientific Review of Everglades Restoration Progress. This panel reports directly to Congress, and its charge is to evaluate the \$11.5 billion Everglades restoration effort, with particular attention to use of relevant science. The first biennial report of the Committee will be released in December.

Daniel Slear was honored to have his work published in the book "Composition at Virginia Tech: Written, Spoken, and Visual Composition." Daniel's assignment was "Writing about Comics."

Muriel Lederman, Associate Professor Emeritus of Biology, lives in Little Rock, Arkansas and is still researching feminist science theory and practice, writing articles for an encyclopedia on Gender & Science.

The Walters lab contributed six members – **Lori Blanc, Erin Hewett, Dylan Kesler, Jonathan Moore, Brian Olsen and Jeff Walters** – to the largest gathering of ornithologists in history, at the North American Ornithological Congress, held in Veracruz, Mexico in early October. Over 800 graduate students attended the meeting, and two from the Walters lab, Lori Blanc and Erin Hewett, were among the 45 selected for best presentations.

Congratulations to Dr. Ann Stevens!

Ann Stevens has been awarded the Dr. Carroll B. Shannon Certificate of Teaching Excellence by the College of Science. "Ann is one of our department's most skilled lecturers, using active learning exercises to build interest and enhance learning outcomes," said Robert Jones, professor and department chair. "Furthermore, she has an amazing number of high quality contributions to our overall teaching mission, including graduate student advising, curriculum development, engagement of students with professional activities, undergraduate research, outreach to local primary and secondary schools and classroom teaching."

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
Biological Sciences 0406
Virginia Tech
Blacksburg, VA 24061**

Help us keep our records updated

We welcome comments and items of interest for future newsletters. Please contact Dr. Robert Jones, Biological Sciences 0406, Virginia Tech, Blacksburg, VA 24061. You may also send an email to Tracy Price (tbolling@vt.edu) or Robert Jones (rhjones@vt.edu).

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.



*Graduate students,
faculty, and others
enjoying the art show
part of Research Day
held on February 24th.*

Photo taken by Deb Sims



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