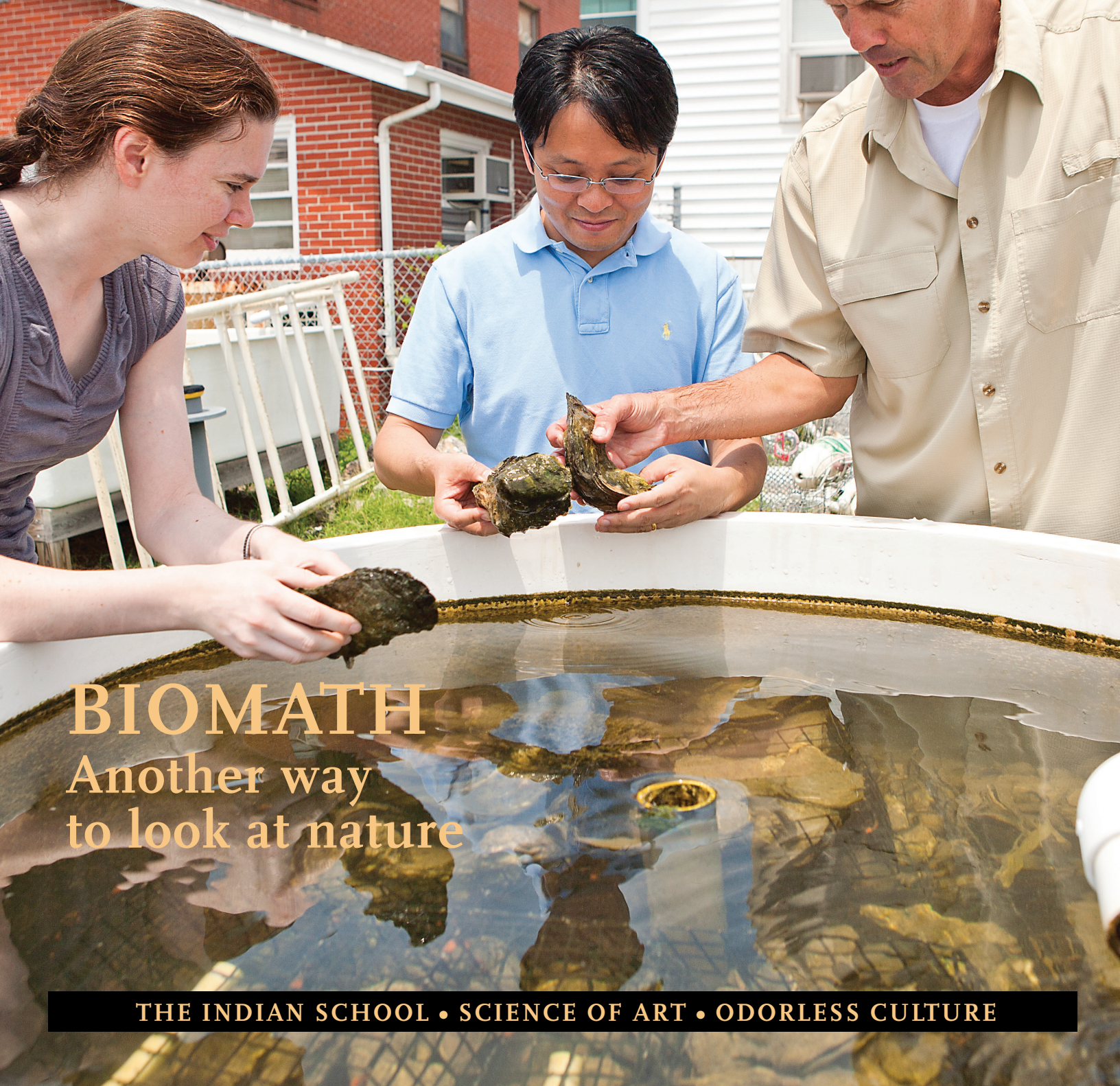


ideation

FALL 2011

RESEARCH & SCHOLARSHIP AT WILLIAM & MARY



BIOMATH
Another way
to look at nature

THE INDIAN SCHOOL • SCIENCE OF ART • ODORLESS CULTURE



Research through the curriculum

Thanks to the generous support of William and Mary's alumni and friends, we have made steady gains in recent years in the range and quality of the research taking place at the College. As this issue demonstrates, exciting research is conducted across the disciplines, and by undergraduate and graduate students, as well as by faculty.

As the director of the Charles Center, I have been especially involved with the impressive growth in research opportunities for undergraduates. I want to thank the Andrew W. Mellon Foundation in particular for providing us with invaluable support in this effort. Many institutions worry about a growing tension between their research and teaching missions; by bringing research opportunities into our undergraduate courses and degree programs, we have integrated these two missions in a way that now serves as a model for other colleges and universities.

Best wishes,

Joel Schwartz

Dean for Honors and Interdisciplinary Studies

page 1 **Lab, Field & Library**
Notes about research, scholarship and accomplishment.

10 **Uncovering our roots**
William & Mary's Historic Campus has many stories to tell. But first, you have to learn how to dig.

14 **Untying the knot**
We've all been to marriage ceremonies. Now, many people are opting for a ceremonial approach to divorce.

16 **The chemist and the curator**
Paint analysis from historic paintings used to require a sample as big as the period at the end of a sentence. That was too big.

18 **Cuteness rules!**
A "cute" esthetic has taken over Japanese pop culture, which, in turn, has taken over the world.



Untying the Knot page 14



Translating Devotion page 20

20 **Translating devotion**
A sacred text to millions of Hindus is finally getting a proper translation into English.

22 **Teaching through research**
William & Mary faculty find innovative ways to integrate research into the classroom—and into the curriculum.

24 **The chicks go wild**
An endangered population of woodpeckers is outgrowing its habitat.

COVER STORY:
BIOMATHEMATICS

page 6



ON THE COVER: Collaborators Leah Shaw of applied science, Junping Shi of mathematics and Rom Lipcius of fisheries science at VIMS examine a tank of oysters. The three use mathematical modeling to help design reefs to restore native oysters in the Chesapeake Bay. Their work is only one part of William & Mary's Biomath Initiative.

The College of William & Mary in Virginia

Chartered February 8, 1693, by King William III and Queen Mary II of Great Britain. Phi Beta Kappa, the nation's premier academic honor society, and the honor code system of conduct both were founded at William & Mary.

CHANCELLOR

Sandra Day O'Connor

RECTOR

Jeffrey B. Trammell '73

PRESIDENT

Taylor Reveley

PROVOST

Michael R. Halleran

INTERIM DEAN OF ARTS & SCIENCES

Gene Tracy

VICE PRESIDENT FOR STRATEGIC INITIATIVES

James R. Golden

VICE PROVOST FOR RESEARCH & GRADUATE/PROFESSIONAL STUDIES

Dennis Manos

Ideation is the crystallization and conceptualization of ideas. It is part of the process through which thought ultimately becomes deed.

Ideation is published semiannually by the College of William & Mary, Office of Strategic Initiatives, P.O. Box 8795, Williamsburg, VA 23187-8795. Address all correspondence to the editor, Joseph M. McClain, at the address above or e-mail below. Phone 757-221-1615

EDITOR

Joseph M. McClain

LEAD GRAPHIC DESIGNER

Lucinda Baker

GRAPHIC DESIGNER

Rachel Folis '11

PRINCIPAL PHOTOGRAPHER

Stephen Salpukas

GRAPHIC ASSISTANT/PROOFREADER

Teresa Edmundson

PRODUCTION SUPPORT

Creative Services Team

WHAT DO YOU THINK?

research@wm.edu

READ IDEATION ONLINE:

www.wm.edu/ideation

IDEATION ON SOCIAL MEDIA

www.facebook.com/ideationmag

Twitter: IdeationWM



Fulbright Fellow Chi-Kwong Li helps Hong Kong universities expand curricula



Chi-Kwong Li

William & Mary mathematician Chi-Kwong Li has been awarded a Fulbright grant by the Council for International Exchange of Scholars.

Li, the Ferguson Professor of Mathematics, is working this year in Hong Kong with other scholars on the Fulbright Hong Kong General Education Project (FHKGEP). This initiative differs from other Fulbright teaching

and research awards in that the Fulbright scholars are assisting Hong Kong universities in making the transition from a three-year to a four-year curriculum.

He explained that FHKGEP is part of a larger initiative, the Hong Kong General Education Initiative (HKGEI). The HKGEI web site notes that the three-year curriculum that is the norm in Hong Kong higher education is a relic of British colonialism and no longer meets the needs of the students.

For the spring semester, Li offered a pilot session of a course, Mathematics in Daily Life, at the Hong Kong University of Science and Technology. He says the course was a success and will offer it again in the fall semester.

"Also in the spring semester, I shared my experience with general education issues in meetings with members of the university's Undergraduate Core Education Office," he said.

Li is a double alumnus (B.A. and Ph.D.) of the University of Hong Kong. In addition to being a Fulbright fellow in 2011, Li also is serving as the visiting professor of mathematics and core education advisor at the Hong Kong University of Science and Technology.

He has served as the chair of William & Mary's math department and is a recipient of the Plumeri Award for Faculty Excellence, the Simon Teaching Award and the Virginia Outstanding Faculty Award.

Li has published more than 250 papers on his research, which includes topics related to matrix theory, operator theory and quantum information science.

—Joseph McClain



Shirley Devan

Biology Professor Dan Cristol (right) is the first recipient of the Virginia Society of Ornithology's award. The Mitchell A. Byrd Award for Scientific Achievement honors the William & Mary professor of biology emeritus (left).

Study to investigate how cultural and social language patterns affect STEM learning



Stephen Salpukas

Anne Charity Hudley has been awarded a grant from the National Science Foundation (NSF) to study how cultural and social language patterns affect learning and student assessment in STEM (Science, Technology, Engineering and Mathematics) classrooms.

Charity Hudley, an associate professor of education, English and linguistics at William & Mary, received the grant with co-investigator Christine Mallinson, an assistant professor of language at the University of Maryland, Baltimore County.

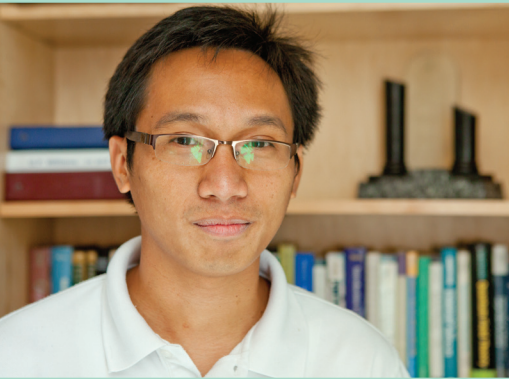
Charity Hudley and Mallinson will receive \$171,928 over a three-year period to work with 60 K-12 educators in Baltimore, Hampton Roads and Richmond. The two will assess the educators' knowledge of and their responses to language variation, particularly among African-American students. The two researchers will also work with participants to create "linguistically informed" materials for classroom use.

"There has been some strong research on the implication of language and culture in language arts classrooms but more information is needed about the intersections in STEM classrooms," said Charity Hudley. "I am currently working with (William & Mary faculty) Margaret Saha, Dan Cristol, and John Swaddle and Jerome Carter '11 thanks to a William & Mary interdisciplinary research grant on how cultural insights will help minority retention in the introductory biology courses. We hope to recruit students from the classrooms that participate in the grant right into William and Mary."

The new grant builds on a research starter grant that Charity Hudley received from the NSF in 2009 to "examine effective ways to communicate to educators about language variation," she said.

—Erin Zagursky

Ph.D. student in physics wins Fermilab fellowship to study dark matter



Stephen Salpukas

Reinard Primulando, a Ph.D. student in the William & Mary Department of Physics, is a recipient of a Fermilab Fellowship in Theoretical Physics. Primulando, who studies dark matter and dark energy, was awarded a year-long fellowship at Fermilab, one of the leading laboratories for high-energy particle physics in the world.

"Now, we actually know about 5 percent of the universe's content. The other 95 percent is still a mystery to us. We don't know what it actually is," he explained.

That other 95 percent, according to Christopher Carone, professor of physics



Stephen Salpukas

Lisa Landino studies the chemistry behind what she calls "the big three" neurodegenerative diseases: Parkinson's, amyotrophic lateral sclerosis and Alzheimer's.

Landino's work has drawn federal support for more than a decade. Recently the William & Mary professor of chemistry received \$415,000 from the National Institutes of Health (NIH). She investigates the constant attack, destruction and repair of the body's molecules by the free radicals that are a natural product of respiration.

"We breathe oxygen, so we can't get away from oxygen radicals. We can't get away from oxidative stress," Landino says. She focuses her research on oxidative damage to tubulin, a protein that acts as both scaffolding and as what she describes as a "railroad track" that facilitates intracellular transfer of other molecules. Landino believes that unrepaired damage of tubulin in nerve synapses is a major factor in neurodegenerative disease.

Her recent grant came from the National Institute of Neurological Disorders and Stroke. Landino has received a total of \$861,591 from the NIH since 1999 for her work on oxidative damage to proteins. Over the years she has had around 50 undergraduate students work in her lab, many of them co-authors on the 10 papers published in peer-reviewed journals.

Landino points out that involvement of undergraduates in her lab was partly responsible for securing the recent grant.

"It definitely helps to have undergraduates in the program," she said. "One of the goals of the program is to expose undergraduate students to research. They really want to see how you're training students. At William & Mary, one of the things we're best known for is training our undergraduate scientists, who go on to graduate school and then get Ph.D.s"

—Joseph McClain

NIH continues to support Landino's investigation into neurodegenerative disease

Lisa Landino studies the chemistry behind what she calls "the big three" neurodegenerative diseases: Parkinson's, amyotrophic lateral sclerosis and Alzheimer's.

Landino's work has drawn federal support for more than a decade. Recently the William & Mary professor of chemistry received \$415,000 from the National Institutes of Health (NIH). She investigates the constant attack, destruction and repair of the body's molecules by the free radicals that are a natural product of respiration.

"We breathe oxygen, so we can't get away from oxygen radicals. We can't get away from oxidative stress," Landino says. She focuses her research on oxidative damage to tubulin, a protein that acts as both scaffolding and as what she describes as a "railroad track" that facilitates intracellular transfer of other molecules. Landino believes that unrepaired damage of tubulin in nerve synapses is a major factor in neurodegenerative disease.

Her recent grant came from the National Institute of Neurological Disorders and Stroke. Landino has received a total of \$861,591 from the NIH since 1999 for her work on oxidative damage to proteins. Over the years she has had around 50 undergraduate students work in her lab, many of them co-authors on the 10 papers published in peer-reviewed journals.

Landino points out that involvement of undergraduates in her lab was partly responsible for securing the recent grant.

"It definitely helps to have undergraduates in the program," she said. "One of the goals of the program is to expose undergraduate students to research. They really want to see how you're training students. At William & Mary, one of the things we're best known for is training our undergraduate scientists, who go on to graduate school and then get Ph.D.s"

—Joseph McClain

Law School co-hosts international property-rights conference in China

As China continues to emerge as an economic superpower, one of the challenges it faces is deciding how to enhance its market economy through its private property laws. It is against this backdrop that, on Oct. 14-15, William & Mary Law School's Property Rights Project will host the law school's first international conference at Tsinghua University in Beijing, China. The eighth annual Brigham-Kanner Property Rights Conference will bring together scholars, jurists and practitioners from the United States and China to discuss the evolution of property rights on a global scale.

Former U.S. Supreme Court Justice—and Chancellor of the College of William & Mary—Sandra Day O'Connor will receive the 2011 Brigham-Kanner Property Rights Prize at the conference and will be a featured speaker. A formal reception will

be held on Oct. 13 at the United States Embassy in Beijing to honor Justice O'Connor and the conference's Chinese host, Tsinghua University School of Law.

Holding the conference in China "will foster a comparative framework for the discussion of property rights that is long overdue given the strong ties between the United States and China and China's dynamic role in the world economy," explained Chancellor Professor of Law Lynda Butler, the director of the Property Rights Project.

William & Mary Law School Dean Davison M. Douglas said the slate of participants comprised many scholars "whose work forms the foundation of contemporary American property law jurisprudence." He added that while plans are still preliminary, he looked forward to having a number of China's scholars also participate.

The annual Brigham-Kanner Property Rights Conference is named in recognition of Toby Prince Brigham and Gideon Kanner for their lifetime contributions to private-property rights.

—Jaime Welch-Donahue



Steven River

Chancellor Sandra Day O'Connor

Former U.S. Supreme Court Justice—and Chancellor of the College of William & Mary—Sandra Day O'Connor will receive the 2011 Brigham-Kanner Property Rights Prize at the conference and will be a featured speaker. A formal reception will

VIMS course provides a large amount of knowledge about some small fishes

For many anglers, the point of fishing is to catch the biggest fish—whether it's for bragging rights or the frying pan.

In June, an international group of 16 fisheries students reversed this traditional piscatorial pursuit, focusing their attention on the smallest of the small—the eggs, larvae and juveniles of 180 fish families.

The students came to the Virginia Institute of Marine Science from as far afield as New Zealand for an intensive graduate-level lecture and laboratory course on the early life stages of fishes. Six students from the College of William & Mary's School of Marine Science at VIMS also took part.

The course was taught by a quartet of leading experts in fish development, classification, and ecology—Nalani Schnell and Troy Tuckey of VIMS, Ed Houde of the University of Maryland Center for Environmental Science, and G. David Johnson of the Division of Fishes at the Smithsonian's National Museum of Natural History.



Courtesy Nalani Schnell

A young Sciaenidae cynoscion

"The early life stages of fishes are key components of aquatic ecosystems," says Schnell, a post-doctoral research associate at VIMS. "Eggs, larvae and their survivors represent the level of a species' reproductive success."

Alison Deary, a Ph.D. student at VIMS, took the course to help in her dissertation research on the development of feeding structures in drum, croaker, spot, and other related recreationally important fishes in the Chesapeake Bay.

"I wanted to acquire the skills and techniques needed to identify the larvae not only of sciaenids but of other fishes," says Deary. "It's one thing to read a book, but it's better to get hands-on instruction on where to start when you get an unsorted sample."

—David Malmquist

be held on Oct. 13 at the United States Embassy in Beijing to honor Justice O'Connor and the conference's Chinese host, Tsinghua University School of Law.

Holding the conference in China "will foster a comparative framework for the discussion of property rights that is long overdue given the strong ties between the United States and China and China's dynamic role in the world economy," explained Chancellor Professor of Law Lynda Butler, the director of the Property Rights Project.

William & Mary Law School Dean Davison M. Douglas said the slate of participants comprised many scholars "whose work forms the foundation of contemporary American property law jurisprudence." He added that while plans are still preliminary, he looked forward to having a number of China's scholars also participate.

The annual Brigham-Kanner Property Rights Conference is named in recognition of Toby Prince Brigham and Gideon Kanner for their lifetime contributions to private-property rights.

—Jaime Welch-Donahue

William & Mary physics team has important role in multinational Daya Bay neutrino experiment

A team of William & Mary physicists has an important role in the Daya Bay Reactor Neutrino Experiment, a multinational collaboration to advance science's understanding of ubiquitous, yet mysterious, particles known as neutrinos.

Daya Bay in southern China is the site of a large nuclear power complex. Near the power plant, scientists have built mammoth underground apparatus designed to detect the neutrinos emitted from the power plants.

Robert McKeown is Governor's Distinguished CEBAF Professor in William & Mary's physics department as well as being deputy director for science at the Jefferson Lab. His William & Mary group has substantial responsibility for the installation, commissioning and calibration of the detection apparatus.

The Daya Bay experiment is an attempt to measure an elusive value related to neutrino oscillation. McKeown explains that neutrinos come in three "flavors." A quality of neutrinos is that they

work forms the foundation of contemporary American property law jurisprudence." He added that while plans are still preliminary, he looked forward to having a number of China's scholars also participate.

The annual Brigham-Kanner Property Rights Conference is named in recognition of Toby Prince Brigham and Gideon Kanner for their lifetime contributions to private-property rights.

—Jaime Welch-Donahue

undergo a transformation—or oscillate—from one flavor to another. Two of the oscillation values are known, he said, and the Daya Bay experimenters hope to determine the third and final value, known as θ_{13} .

The value of θ_{13} , McKeown says, will open the way for a new generation of neutrino experiments that will address fundamental questions of nature, such as the relative scarcity of antimatter in the universe. Neutrino study has more immediate practical applications in fields that range from astronomy to nuclear power, including the detection of hidden nuclear reactors.

Wei Wang, William & Mary research scientist, is at the Daya Bay site overseeing the installation and calibration of the detector equipment. McKeown said much of the team's work can be done here in the United States, working with data sent from the detectors and the reactor plant.

—Joseph McClain



Stephen Salpukas

Marine scientist Deborah Steinberg shows the polite way to eat a jellyfish.

Pass the jellyfish—but hold the sea nettle!

Passengers on the schooner *Alliance* out of Yorktown in July were offered fresh seafood snacks—jellyfish.

Comb jellies, or *Mnemiopsis*, fresh from the York River, were offered for passengers to observe, to hold or to eat. “Go ahead and try it,” Deborah Steinberg urged. “It tastes just like saltwater-flavored Jell-o!”

The hors d’oeuvres came toward the end of a two-hour “Science Under Sail” cruise, during which Steinberg, a zooplankton ecologist and a professor of marine science at the Virginia Institute of Marine Science (VIMS), spoke about her work.

“In the Chesapeake, we’re particularly interested in the jelly-plankton,” she said. She described how “blooms of jellyfish” occur in summer, including vast increases in sea nettles, the creature most likely to sting a bather in the Bay. These blooms, she noted, are occurring around a month earlier than 10 years ago, a pattern change she attributed to global warming. Because jellyfish are carnivores, eating fish larvae and young invertebrates, including crabs, the impact of their earlier arrival on the overall ecosystem is the subject of intense concern, she explained.

A highlight of the cruise was the plankton tow. Working with *Alliance* captain Greg Lohse, Steinberg dropped a plankton net over the side and pulled up several specimens, including a sea nettle and comb jellies. Each was passed around, with a caution not to touch the nettle but with encouragement to handle—and even partake—of the comb jellies.

Steinberg passed around specimens recovered from her work worldwide, produced a package of jellyfish available in Chinese markets and quizzed fellow passengers on jellyfish stings. Dousing a sting with fresh water heightens the release of stinging toxins, she said. Likewise, the folk remedy of urinating on the affected area aggravates the sting. The best thing to do is to scrape the affected area with a credit card to remove the stinging cells and then to apply meat tenderizer, Steinberg said.

—David Williard

Emmett Duffy is awarded inaugural Kobe Award for contributions to marine biology

Emmett Duffy of the Virginia Institute of Marine Science (VIMS) has been honored with the inaugural Kobe Award for his achievements in marine science.

The international award, which includes a prize of a million Japanese yen (US \$11,900), was established by Suma Aqualife Park in Kobe, Japan, to recognize and honor an individual who has contributed to progress in the fields of marine biology and ecology.

Duffy, Loretta and Lewis Glucksman Professor of Marine Science at VIMS, was flown to Japan for a formal award ceremony on July 10. The ceremony was originally scheduled for March 26 but was postponed due to the earthquake and tsunami that devastated the island nation. Duffy donated half of his cash prize to Japanese relief efforts and used the remainder to fund research travel.

The five-member selection panel recognized Duffy for his pioneering work in marine ecology and biodiversity, with special mention of his discovery of “eusociality” among shrimps. Eusociality—most familiar among ants, bees and other social insects—refers to life in large, cooperative colonies. Duffy was the first to discover a case of eusociality in a marine animal, the sponge-dwelling Caribbean shrimp *Synalpheus regalis*. His subsequent work has identified several other eusocial shrimp species in this group.

—David Malmquist

Love’s Whipping Boy probes the twin American phenomena of violence and sentimentality

How can America be so violent, and yet so sentimental at the same time?

It’s a question that has intrigued Elizabeth Barnes for almost a decade and forms the basis for her seminar, Christianity and 19th-Century American Literature. It’s also the subject of her new book *Love’s Whipping Boy: Violence and Sentimentality in the American Imagination*.

“I wondered how 19th-century Americans understood the role of violence in a democratic, sympathetic nation,” says Barnes, associate professor of English at William & Mary. “During this time, there were lots of acts of domestic violence—slavery, Indian removal, naval flogging, corporal punishment—that contradict an antebellum ethos of democratic, Christian love.”

Barnes turned to period literature to trace American understanding of violence and sentimentality. She discovered a literary pattern of privileged people engaging in acts of violence, then identifying with the victim, and ultimately seeing themselves as the victim—it’s something she calls the “whipping boy effect.”

“Whipping boy” refers to a practice of discipline that was first recorded in the 16th century. Because of his royal blood, Prince Edward, son of Henry VIII, could not be whipped for bad behavior. So a boy of similar age was whipped as a surrogate. By watching another be punished for his mistakes, he was expected to feel shame and guilt, making him more mindful of how his actions affected others.

—Leslie McCullough

Who owns this meteorite?

Two law students make a persuasive argument

William & Mary Law School students Lillian McManus and Brittany Law will be able to add “space law” to their lists of practice areas.

On Jan. 18, 2010, a meteorite fell out of the sky and into the examining room of the Williamsburg Square Family Practice in Lorton, Va. The rock was small, only 2x3 inches, but clearly from outer space. Doctors Marc Gallini and Frank Ciampi chose to donate the meteorite to the Smithsonian National Museum of Natural History. The landlords of the building, however, claimed the meteorite should belong to them, and legal arguments ensued.

The doctors retained Keith R. Marino, B.A. ’89, J.D. ’94, a partner at Arent Fox LLP in Washington, D.C. Marino contacted his old property professor, Associate Dean Ronald Rosenberg, and asked if he had students who might want to provide some legal research on a particularly novel issue.

“I tasked the students with researching the law of ownership rights for meteorites in Virginia,” recalls Rosenberg. “There wasn’t any.”

In their memo, the students argued that as the meteorite fell out of the sky, it was akin to lost or abandoned property. “In these cases,”

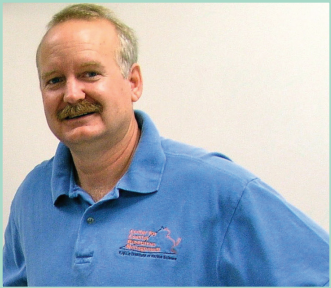
Kirk Havens of VIMS appointed vice chair of Chesapeake panel

The Chesapeake Bay Program’s Scientific and Technical Advisory Committee (STAC) has appointed Kirk Havens of the Virginia Institute of Marine Science, College of William and Mary, to serve as the committee’s vice chair and chair-elect.

Chris Pyke, a 1996 William & Mary graduate and a former fellow with the Center for Coastal Resources Management at VIMS, was elected chair. Pyke is currently vice president of research for the U.S. Green Building Council.

STAC is an advisory committee of scientists from across the Chesapeake Bay watershed who provide scientific and technical advice to the Chesapeake Bay Program. Their independent advice is used by decision-makers at the state, local and federal level to more effectively manage protection and restoration efforts within the Chesapeake Bay Watershed.

Havens, director of the coastal watersheds program at VIMS, is an expert in the ecology and functional assessment of tidal



Courtesy of VIMS

Kirk Havens

and non-tidal wetlands, land-use and watershed issues and environmental public policy.

Havens was originally appointed to STAC by former Virginia Governor and current U.S. Senator Mark Warner and has continued to serve STAC through re-appointments by former Virginia Governor Tim Kaine and current Virginia Governor Bob McDonnell.

STAC provides scientific and technical advice through technical reports and papers, discussion groups, assistance in organizing merit reviews of CBP programs and projects, technical conferences and workshops and service by STAC members on CBP subcommittees and workgroups.

—David Malmquist

they wrote, “the property rights rest with the finder against all but the ‘true owner.’ Because a meteorite, unlike a dropped piece of jewelry or wallet, has no ‘true owner,’ rights rest with the finder, or in this case the tenant.”

Their work was presumably persuasive. The landlords dropped their claims and the doctors were able to donate the Lorton Meteorite to the Smithsonian, where it is kept in the Mason-Clarke Meteorite Vault in the Smithsonian’s Mineral Room.

—Ami Dodson



Chip Clark, Smithsonian Institution

Finder’s keepers? Owners of the building struck by the Lorton Meteorite dropped their claim of ownership after two law students argued on behalf of the finders.

Schroeder Center will study impact of Medicare system on health services

A \$117,000 grant from the Robert Wood Johnson Foundation will allow researchers from William & Mary’s Schroeder Center for Health Policy and Department of Economics to study the impact of Medicare’s Outpatient Prospective Payment System (OPPS) on health services.

Researchers will look at the growth of outpatient services since the August 2000 implementation of OPPS and the potential impact of cuts proposed in the Patient Protection and Affordable Care Act of 2010. OPPS is the way that Medicare pays for outpatient services at hospitals under Medicare Part B.

Jennifer Mellor, director of the Schroeder Center and the principal investigator of the project, noted that in recent years Medicare’s outpatient spending per beneficiary has grown more than twice as fast as inpatient care spending, and that it now constitutes more than 20 percent of Medicare’s total payments to hospitals.

Researchers will use data from Florida hospital records from 1997 to 2008. These data will be combined with data from the U.S. Census Bureau, Medicare Cost Reports, American Hospital Association Annual Survey data and data on private-sector prices.

Assistant Professor of Economics Daifeng He, the study’s lead author, says this project is unique in several ways.

“This study is the first to look at OPPS’ effect on Medicare volume,” he said. “It’s also the first study to test whether this Medicare payment change led healthcare providers to change how they treat other types of patients or where they treat patients in general—in the inpatient setting or the outpatient setting.”

—Suzanne Seurattan



Stephen Salpukas

Jennifer Mellor of the Schroeder Center

ALMOST LIKE MAGIC

Mathematical modeling uses equations as a window on the workings of nature

By Joseph McClain



Stephen Salpukas

Looking at the processes of nature through the lens of mathematics, Kiah Hardcastle '12 uses a handy window in McGlothlin-Street Hall as an impromptu whiteboard to write out some formulas.

ALL ACTIONS IN NATURE CAN BE EXPRESSED NUMERICALLY.

That's biomathematics in a very, very small nutshell.

Kiah Hardcastle has her own way to describe the concept.

"To me, it's just magical," she says. Hardcastle, a member of William & Mary's class of 2012, is working with scientists in two departments on a project modeling the neuroscience of impulsive reactions. "It's mind blowing that you could use equations to predict these kinds of things. It's fast; I can make predictions in a few seconds, or as long as it takes my computer to run the program.

It's just really useful in a lot of ways!"

Margaret Saha says both today's and tomorrow's practitioners of the life sciences need to become adepts at this sort of magic.

"The major reason is that biology has changed over the last few decades. Now we are able to collect so much data that we do not know how to analyze it all without quantitative and computational approaches," explains Saha, Chancellor Professor of Biology. "This goes for any field within biology. In ecology and evolutionary biology, you have these GIS systems which amass a huge amount of spatial information which needs to be analyzed. We apply molecular approaches to ecology, as

well. Look at phylogenetics. All of this is now on the molecular level. It's going to require quantitative approaches."

A number of William & Mary scientists—undergraduates, graduate students, post-docs and faculty—are working within the College's Biomathematics Initiative. Greg Smith, associate professor of applied science, is the director of the biomath program. Smith and Saha both say that the computational trend is not only changing the constellation of life-science disciplines, but also will likely attract new types of practitioners.

"Traditionally, people who major in biology have been those students who enjoy science, but they don't necessarily like mathematics or the physical sciences," Smith said. "The exception has been in a few areas of biology that have been quantitative for quite a long time—for example, biophysics and electrophysiology. But molecular biologists, developmental biologists, evolutionary biologists, ecologists, conservation biologists and so on—have often not had strong quantitative backgrounds. It's becoming increasingly accepted that mathematics is the language of all natural sciences, the biological as well as the physical."

Saha says she expects many students who are attracted to the quantitative elements of disciplines such as chemistry, physics and mathematics to become more interested in majoring in biology. She points to a real sign of the times: In the very near future, standardized tests for graduate school admission—particularly the Medical College Admission Test—will contain a much stronger quantitative aspect.

"In medical research, *everything* is statistically analyzed these days," Saha explained. "Students intending to become physicians are going to need to understand how research studies are conducted. Is a drug effective or not? What populations are sampled? How was the data analyzed? Ensuring that future physicians understand these concepts is one reason why the MCAT is getting more quantitative."

Computational concepts also are an increasingly large part of the lab life, and William & Mary's researchers have demonstrated that biomathematical approaches are naturally interdisciplinary and often fruitful. One continuing collaboration among faculty in three William & Mary departments has already made contributions

to the health of Virginia's endangered oyster fishery. Rom Lipcius, a marine ecologist at William & Mary's Virginia Institute of Marine Science, has been working on ways to restore the Chesapeake Bay's native oyster population, which has declined at least 100-fold since the late 1800s.

Several years ago, he began working with Junping

Shi, associate professor of math, and Leah Shaw, assistant professor of applied science. The three began meeting each week, working out mathematical models of oyster population dynamics.

SKETCHING THE MODEL—LITERALLY

The earliest meetings were quite basic, as Lipcius literally drew sketches: "Here is the oyster. Now the sediment comes along and the oyster filters the sediment..." Shi and Shaw caught on to the idea and soon were writing equations that described mathematically the dynamics of how oyster filtration increased, then abruptly dropped, as the mollusk became clogged by sediment. They found that filtration rate is critical to the success of a reef.

"If the water isn't too murky, the oysters filter it and make it even better for future oyster growth. They also grow the reef higher out of the bottom muck," Shaw explained. "This is a positive feedback loop—oysters promoting growth of more oysters."

If sediment concentration gets too high, though, the oysters start suffocating.

The group began focusing on the relation of reef height to oyster abundance. Lipcius knew from field studies that oysters living on higher reefs tended to do better than the oysters on lower-relief reefs. The models backed him up.

"We modeled the feedback interactions between oyster reefs and sediment and showed that the system has two stable states. If the reef is too low, it further degrades toward the extinct state," Shaw explained. "If the reef is high enough, it grows up to a stable, healthy state."

Modeling showed a critical "tipping point" in reef height. "Less than 10 centimeters makes a difference whether a reef degrades or survives," Lipcius says.

The group is now trying to find the "sweet spot" of minimum reef height, an elusive value because locations that receive more sediment require a higher reef height to maintain a healthy population of *Crassostrea virginica*.

Finding that "sweet spot" of reef height has enormous

continued on page 8

Collaborators (from left) Rom Lipcius, Leah Shaw and Junping Shi discuss mathematical modeling of sediment and oyster reef growth.



Stephen Salpukas

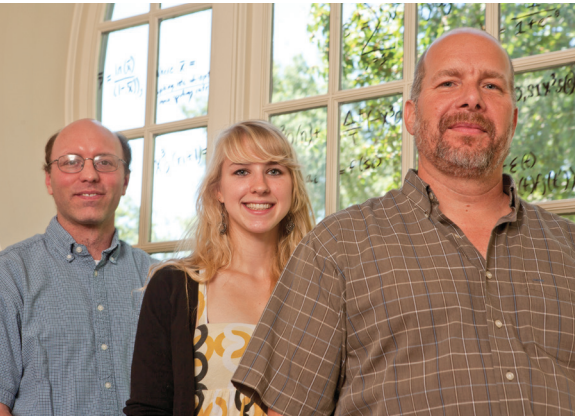
Biomath: Looking at the world through an equation

continued from page 7

economic and ecological consequences. Lipcius says artificial oyster reefs are expensive to build, and if they’re not high enough, it’s money literally washed away. The U.S. Army Corps of Engineers Norfolk District is already taking the group’s model into account as it designs new oyster reefs for the Chesapeake.

Will Jordan-Cooley ’10 did his mathematics honors thesis on work he did as part of the oyster modeling team. His honors thesis formed the basis of a paper now in press at the peer-reviewed *Journal of Theoretical Biology*. Jordan-Cooley is the first author, joined by Lipcius, Shi, Shaw and Jian Shen, a research associate professor of marine science at VIMS.

The Biomath Initiative has been a fertile ground for undergraduate participation in research projects, a result of a biology curriculum that is increasingly quantitative and a faculty in applied science and mathematics that are interested in taking on problems



Stephen Salpukas

Faculty researchers Joshua Burk (left) and Greg Smith flank Kiah Hardcastle. The three collaborate on a study of impulse control.



Joel Pattison

Allison Corish (center) updates faculty mentors Drew LaMar and Sarah Day. Their project models pulse-coupled oscillator networks.

based in the life sciences. There has also been considerable support from William & Mary’s own Charles Center as well as the National Science Foundation (NSF), which funded several years of biomath activity through its Undergraduates in Biological and Mathematical Science program.

CSUMS STEPS IN

Some of the highest-quality undergraduate biomath participants (including Will Jordan-Cooley) have been products of CSUMS, another NSF initiative. CSUMS is an acronym for Computational Science Training for Undergraduates in the Mathematical Sciences, a collaborative program among the departments of mathematics, applied science and computer science.

Associate Professor of Mathematics Sarah Day, one of the co-principal investigators on the CSUMS grant, explains that the program funds individual students for mentored computational research experience. CSUMS, she says, is aimed primarily at math majors. Many of the research projects focus on aspects of the life sciences.

“One goal of our CSUMS program is to promote interdisciplinary research collaborations that include undergraduate research students,” Day said. “This is an NSF requirement.”

Day says that while any student in the sciences can benefit from a background in computational math, the principles of mathematical modeling are also becoming more important in disciplines such as economics, population modeling, engineering and operations research. She’s even heard of a computational-math exploration of *Romeo and Juliet*.

CSUMS is an all-year project. Day says that students often start in the summer and they continue working in the CSUMS program during the following year. Over the past four years CSUMS has supported the work of 55 students, and 22 of its projects involved computational biology.

Day and mathematician Drew LaMar worked over the summer of 2011 with CSUMS student Allison Corish ’12 on a project involving the modeling of pulse-coupled oscillators. “‘Pulse-coupled’ means interactions between oscillators are brief,” Corish explains. A network of pulse-coupled oscillators might be a group of synaptically connected neurons—or it could be a yard full of lightning bugs.

“When it first gets dark, the fireflies start off blinking at random, then one firefly sees another and they all start pulsing together as one or two big groups,” she said. “Likewise, neurons fire and advance the phase of other neurons, causing them to fire sooner than they otherwise would have. The equation we look at shows an oscillator firing, resetting, and at the same time causing downstream oscillators to phase advance.”

Support from HHMI’s freshman research program and William & Mary’s own Monroe Scholars program allowed Kiah Hardcastle to begin a biomath collaboration with Smith and psychologist Joshua Burk that combines empirical observation with modeling.

“This is an important study because impulsivity is a core component of several disorders, including attention deficit/hyperactivity disorder,” explains Burk, the new director of William & Mary’s Neuroscience Program. “In particular, we’re trying to understand the contribution of a particular brain region, the basal ganglia.”

The empirical portion comes from something known as the stop signal reaction time test. Burk explains that the test looks for subjects to refrain from making a particular response when a stop signal (for example, a light) is presented.

“If the stop signal is ignored, that’s considered impulsivity, a failure to withhold a previously initiated response,” Hardcastle explains.

The researchers take the information they’ve learned from the experiments and have begun to assemble a set of differential equations that model, quantitatively, the neural actions in the basal ganglia that are driving behavioral inhibition. Burk says the computation aspect brought to the project by Smith and Hardcastle has enhanced his study in several ways.

“There are a number of brain regions involved, and a mathematical model can incorporate all of them,” he said. “You can manipulate one brain region and see what changes in neural firing rates occur in a number of other brain regions. That can be difficult to do in the living organism.”

Burk, a seasoned lab experimenter, says that the 18 months of biomathematical collaboration with Smith and Hardcastle has caused him to approach his work a bit differently.

“In a lot of empirical studies, you’re predicting a change in one direction or

another,” he said, “but with a math model, you need to specify exactly how much change you’re going to get. It forces you to think more specifically about what it is you’re measuring, what it is you expect to find.”

GENESIS OF BIOMATH

Margaret Saha dates the beginning of William & Mary’s biomath curriculum to an afternoon in 1997. She was in her office, working on a grant application to the Howard Hughes Medical Institute when George Rublein appeared in the doorway.

“I have kind of a crazy idea,” he said. Rublein is a member of the mathematics faculty, and his idea was to propose that HHMI fund a special calculus class for students who were good candidates to go on to medical school or graduate study in one of the life sciences. The course would teach calculus using problems drawn from genetics, population dynamics, ecology, cellular biology and similar areas.

“The reviewers at HHMI loved it,” Saha says. “It was a brilliant idea.” HHMI supported hiring a biomathematician in the math department to teach a new pair of courses, Calculus for the Life Sciences I and II. Over the years, more biomath courses were added to the curriculum. Saha says there are now 15 to 20 such courses, for example, Introduction to Mathematical Biology and Cellular Biophysics and Modeling (a mathematics course required for neuroscience majors).

HHMI has been a continual supporter of William & Mary’s Biomath Initiative, funding three successive grants since the first one in the late ’90s that put a biomathematician in the math department. The most recent HHMI grant advances the same interdisciplinary concept—by putting a mathematician in the biology department.

“HHMI likes the fact that the William & Mary biologists can actually talk with the mathematicians, and both departments have been willing to cooperate,” Saha said. “We have this attitude of OK, let’s try it. We’re small enough that the typical administrative battles and hurdles don’t exist to the extent that they do in other places.”

Drew LaMar is the mathematician in the biology department. He was Greg Smith’s post-doc in applied science for three years before emerging at the top of a national search for the HHMI-funded biomath position. He started his new position as assistant professor of in the biology department this fall.

“The idea is to work with the instructors of the introductory biology courses, to infuse more quantitative concepts into these courses, to get the students more comfortable with mathematics and quantitative biology,” LaMar said.

Saha expects having a mathematician among biologists will produce a number of collateral benefits.

“There is a huge social aspect to good science—and good math,” Saha said. “Talking to colleagues informally and having these hallway conversations are really important. It’s going to be wonderful to have this mathematical, quantitative person in our face on a daily basis.”

DETERMINISTIC? STOCHASTIC?

An elementary consideration for any sort of mathematical modeling is whether the problem at hand should be addressed through a deterministic or a stochastic approach. LaMar compares a deterministic model to Newton’s Laws of Motion—each element of each equation is established, and so the model proceeds in an orderly and predictable fashion based on its initial state.

“The stochastic system on the other hand recognizes that biology is messy,” he said. “Probability comes into play. If you get down to the level of the cell, you’re going to have Brownian motion. The end result is not determined by the initial state.”

LaMar will help to introduce both deterministic and stochastic paradigms into the introductory biology curriculum. Leah Shaw’s course, Random Walks in Biology, advances this concept.

“It’s about stochasticity or randomness in biological systems,” Shaw explains. “We start with the idea of a random walk. So, you can go left or right, and after that you can take another step, either left or right, and so on.”

The students then examine statistics that average out many random-walk trials and predict where they might end up.

“We apply this concept to a number of different biological systems and then bring in some elements in math that are good for students to learn,” she said. “These are mostly biology majors. It exposes them to some math that they might not have seen before—but using biological examples.”

A model of both the undergraduate curriculum as well as the research activity of William & Mary would no doubt predict that biomathematics is here to stay. **i**

A BIOMATHEMATICAL MAP OF THE SHORTEST ROUTE TO OBLIVION

Sometimes you want to prevent extinction. In other cases, you want to hurry extinction along. Take, for instance, a cold virus hacking its way through an elementary school. Extinction of the virus within the student



Joel Pattison

Leah Shaw

body is something everyone cheers for. It’s different when the goal is trying to maintain a dwindling population of animals in the wild. Leah Shaw says there are many paths to extinction—no matter if you want to hasten extinction or try to stave it off—but, every system has one route to oblivion that’s most sure and direct.

Shaw works on the mathematical modeling of extinction. She is a co-author of a paper, “Converging Towards the Optimal Path to Extinction,” in the journal *Interface*, a publication of the British Royal Society. The paper outlines a mathematical model of the optimal path to extinction. Understanding the mechanics of extinction is important in many regards, she says.

“If you can understand how a part of a system goes extinct, you know something about the dynamics, you know what factors are important in the extinction,” she explained. “But the major reason for interest, of course, has to do with how you might control the extinction.”

One of the co-authors on the paper was Simone Bianco, who was Shaw’s post-doc at William & Mary and now is at the University of California, San Francisco. The other authors are Ira B. Schwartz of the Naval Research Lab and Eric Forgoston of Montclair University.

DIGGING UP OUR ROOTS

Students join the hunt for historical relics at the Brafferton's base

By Andrea Davis



The archaeology is partially funded by philanthropic support of the Brafferton renovation project, in particular a grant from the Lettie Pate Evans Foundation.

For much of the summer of 2011, William & Mary students in two field schools worked alongside graduate students in anthropology and professional archaeologists. The field schools were a collaborative effort between the College's Department of Anthropology and the Colonial Williamsburg Foundation. Under the direction of Mark Kostro, a William & Mary Ph.D. student in anthropology and a staff archaeologist at Colonial Williamsburg, field school students excavated a two-meter wide trench around the building. When they weren't digging, sifting or processing artifacts, the students attended classes to give context to their field work.

The Brafferton remains an important part of William & Mary's Historic Campus and also occupies a singular place in the history and traditions of many American Indians. Danielle Moretti-Langholtz, director of the College's American Indian Resource Center, gets regular calls from people who have connections to some of the 50 tribes linked to the Indian School who want to chase down a link to an ancestor who might have been an alumnus of the Indian School nearly three centuries ago.

To reforge the Brafferton's connection with the first Americans, Moretti-Langholtz and Ph.D. student Buck Woodard put together the Brafferton Legacy Group, a panel of William & Mary alumni with connections to the tribes linked with the Indian School. Members of the BLG are Paige Archer '78 (Meherrin), Reginald Stewart '86 (Chickahominy), Ashley Atkins '09 (Pamunkey) and Annette Saunooke Clapsaddle '05 (Eastern Band of Cherokee). The Legacy Group joined William & Mary President Taylor Reveley in a traditional tobacco-bundle ceremony in April.

The Legacy Group was set up as an advisory body to the anthropology department, and members remained

Facing page: Pamunkey tribal members Jeff Brown and Ashley Atkins cradle Native American artifacts recovered from the base of the Brafferton. Behind them are (from left) Buck Woodard, Mark Kostro and Danielle Moretti-Langholtz.

active in the excavation throughout the field schools. Atkins is now a grad student in anthropology and participated in the dig. Archer visited the excavation several times, often bringing treats for the archaeologists. She served as an impromptu interpreter, too, talking about the excavation with the curious Williamsburg tourists peering over the brick wall along Jamestown Road.

AT THE BRAFFERTON'S BASE

The field schools excavated around the perimeter of the Brafferton, concentrating within the area to be affected by the pending renovation. The first findings were related to plantings around the foundation of the Brafferton since the Civil War. As the excavations progressed, an assortment of artifacts came to light, representing the 288 years of the Brafferton's existence. Artifacts included fragments of 18th- and 19th-century pottery, glass and tobacco pipes, along with architectural debris such as nails and window glass. The students in the first session of the field school even found a human torso: a fragment of a porcelain doll that bore a "Germany" imprint.

One intriguing find was a stone finial bearing classical details. Edward Chappell, Roberts Director of Architectural and Archaeological Research at Colonial Williamsburg, said that the finial resembles 18th-century ornaments that were used on elaborate gateways. The artifact is probably a remnant of a pre-1776 fence that enclosed the Wren yard, he said.

Chappell speculated that the stone finial recovered from the Brafferton excavation is a relic of Revolutionary-era destruction in

Williamsburg, a time of military occupation, during which the formal landscape of the College was disrupted and the President's House accidentally burned.

The students also uncovered the underground elements of an early wrought-iron lightning conductor. Chappell noted that it appears similar to the devices that were installed at Bruton Parish Church, the 1770 Courthouse and the Public Hospital in Williamsburg.

The archaeologists uncovered a set of post holes, extending eastward from the northeast corner of the Brafferton. Kostro points out that the holes correspond with a fence shown on the 1782 "Frenchman's Map," a sketch of Williamsburg that's part of the holdings of Swem Library's Special Collections Research Center. Many of the most important artifacts, including the finial and the quartzite piece, were found in postholes, he added.

Other artifacts render associations that are less Euro-centric. Early in the first field school, archaeologists uncovered two glass beads and an item known as a "jingling cone" or "tinkling cone."

"They're related to adornment," Kostro said, "They're known from both African American as well as Native American contexts." The two blue glass beads are around three millimeters in diameter—Kostro says they're likely Venetian or Dutch in origin. The cone is a thumbnail-sized, thin, triangular piece of trade copper folded to form a cone-shaped object—not a common archaeological find in Virginia, he added.

The beads and copper cone could have been associated with students of the Indian

continued on page 12

A PIECE OF STONE AND A SCANT DOUBLE-HANDFUL OF BROKEN GLASS.

It doesn't look like much to the uninitiated, but the team of archaeologists working this summer at the base of the Brafferton knows that these artifacts are the richest kind of pay dirt. The stone is quartzite, flaked on two faces to make what might have been a scraping tool or a projectile point. The pieces of glass have been knapped—made into cutting or scraping implements by working their edges into sharp serrated cutting surfaces.

The quartzite and the knapped glass are the only artifacts found so far with unambiguous connections to students of William & Mary's Indian School, which operated out of the Brafferton from 1723 to its closure during the Revolutionary War. Today, the Brafferton serves as William & Mary's central administration building, housing the offices of the president and provost.

The Brafferton is scheduled to undergo a \$4.5 million renovation, a project that prompted the archaeological examination of the site before construction work begins.



Field school participant Thomas Geddy Cross '12 takes a turn at the sifter.

Photos by Stephen Salpukas

A SURPRISE FROM THE 18TH CENTURY

A ‘massive outbuilding’ was likely associated with slaves

More steps away from the Brafferton, College archaeologists were unearthing a set of undocumented brick building foundations—“a little island of preservation” hidden for centuries.

“It is wonderful that our colonial campus, about which so much is known, still can surprise us after all these centuries,” said Louise Kale, director of William & Mary’s Historic Campus. The discovery gained national attention and coverage by the Associated Press and *The Washington Post*.

College archaeologists say the partially unearthed foundation looks to be the remains of “a fairly massive outbuilding,” almost certainly associated with slaves who worked at William & Mary in the early 18th century. The foundation runs 20 feet east-west and more than 16 feet north-south. The remains extend underneath a sidewalk south of the Wren Building. The discovery prompted postponement of repairs to the sidewalk.

The precise location of the foundation has been recorded and the areas exposed for examination have been filled in. The College is already making plans for a complete archaeological excavation of the site.

Joe Jones, director of the William and Mary Center for Archaeological Research (WMCAR), said that the foundation could reliably be dated to the 18th century by the type of mortar used. Other contextual clues led him to believe that construction of the foundation may date as early as the second quarter of the century. Such a figure would put the foundation as somewhat more recent than the Wren Building, which was constructed between 1695 and 1700.

“It’s a substantial outbuilding or dependency,” Jones said. “Based on the time period, where it’s located and the dimensions, it’s probably a specific-function building like a kitchen building or maybe quarters for slaves.”

Neil Norman, ACLS/Mellon Foundation New Faculty Fellow in the Department of Anthropology, says the foundation is relatively substantial—three brick courses wide—a finding that tends to eliminate some functions from discussion of the building’s purpose.

“It’s probably not a privy, probably not a stable, probably not a smokehouse,” he said. “Those kinds of structures are usually

wooden and relatively ephemeral. If you are going to invest money into durable materials and energy into creating what, back then, was a relatively massive structure, then it’s something intended to endure.”

Norman is a specialist in the archaeology of Africa and the African diaspora. He is a participant in the College’s Lemon Project, an ongoing initiative that examines the relationship of the College with slavery.

Norman says that artifacts still in the ground might show that the building had served several different functions over the years.

“If it was associated with laundry, you might find buttons that were worn and discarded after they were replaced,” he explained. “It would be a real boon to find a kitchen area. That would give us a window into cuisine and food preparation. Given that elite young colonial men were educated at the College, Native Americans at the Brafferton, and Africans and African Americans at the Bray School, it would be interesting to see what types of artifacts and food remains are represented.”

Both Jones and Norman agree on the need for a thorough archaeological examination of what Jones believes will be the important strata below the foundation brickwork. Jones rates the site “a solid 10” in terms of archaeological potential, as indications show that it’s relatively undisturbed.

“This site is like a little island of preservation,” Jones said. “In every direction, if you go more than three, four or five feet out, you get into areas of massive ground disturbance. You can take five steps, and it’s a jumble.”

—Joseph M. McClain



After examination, the opened areas were backfilled, to rest undisturbed until a comprehensive excavation can be done.

Digging up the roots

continued from page 11

School, Kostro said, but the quartzite tool and knapped glass certainly were.

“I’ve seen many of these. I would say it’s Native American,” Jeff Brown said, turning the quartzite tool in his hands. Brown, a member of the Pamunkey tribe, is a veteran of the 2003-10 excavations at Werowocomoco, the capital of Chief Powhatan. He was a mentor to the students throughout both field schools and part of the crew that continued the excavations after the field schools ended in August.

The knapped glass pieces are evidence of how Native American’s adapted to the availability of new types of material introduced by European colonists, Kostro says. Pieces of broken bottles are among the most common Colonial-era artifacts found, he added, and the shards were a readily available raw material for toolmaking.

“They’re pieces of glass that’s been fashioned into some kind of tool—a cutting tool, a projectile point or a scraper,” he explained. “They used the same manufacturing process that Native Americans used for making stone tools for millennia. All they’re doing is changing materials.”

Kostro added that the glass might have been preferable to the area’s native stone traditionally used for making tools. “Quartzite is really a very difficult material to make stone tools out of,” he said. “It doesn’t have a very predictable fracture pattern. Glass, by comparison, is much easier.”

LEARNING HOW TO DIG

The Brafferton field schools centered around two concepts: archaeological technique and historical relevance. In the field, students learned using a shovel meant more than randomly pushing it into the ground. “It’s not just mindless digging,” remarked Morgan Dyson ’13.

Students in the first session of the field school, held from May 31 to July 1, went into the field with different expectations. Some, like Danny Mosier ’12, knew the basics beforehand but otherwise were surprised by the requirements of the field school.

“I was introduced to some basic concepts in my anthropology classes, but nothing actually like field work,” he said.

Evan Rutherford ’13 shared a similar experience. Like Mosier, he took Intro to Archaeology. Still, he feared the field school would prove full of tedious work. However,

the class excited him enough to make him return for the second session.

“Since I learned so much this semester, why not come back and see what else I can learn in the second half?” he said.

Working around the base of the Brafferton with graduate students and professional archaeologists, students learned the techniques for excavating features around the building. For example, when digging around the foundation, students used a trowel. Rather than simply plunging the tool into the ground, students had to learn the correct techniques to minimize damage to fragile artifacts. Correct trowelling, they learned, is done holding the tool with the point slightly elevated, keeping the bottom edge at an angle of 35 degrees from the ground.

Another technique students learned was triangulation. The purpose of triangulation in the field school was to set up mapping grids, to keep track of where artifacts and features were discovered. Joshua Anish ’13 was excited when he learned how to do it around the Brafferton.

“You take two points, then you take two measuring tapes, and you bring them together at a certain point,” he explained. “That was amazing. I wouldn’t have thought about it.”

MORE THAN DIGGING AND SIFTING

There is more to a field school than digging and sifting. Once a week, the students attended lectures on artifact identification, archaeological conservation, environmental archaeology and zooarchaeology at Colonial Williamsburg’s archaeology lab. In one lecture, Buck Woodard, a Ph.D. student at the College and director of the American Indian Initiative at Colonial Williamsburg, gave an

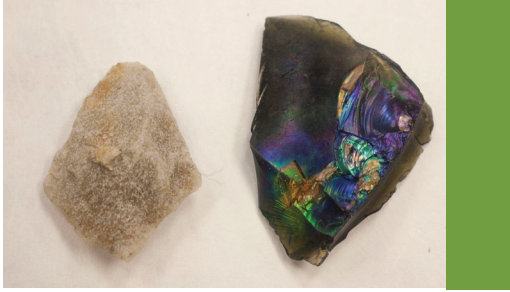
overview of the history of Native Americans in the Tidewater region. Woodard said that local Indian communities were recruited to help the British during the French and Indian War. One native soldier, educated at the Brafferton, was Capt. Tom Step, who, under the command of George Washington, rallied natives to the British cause.

Woodard also discussed the history of the Indian School and the Brafferton. He told the students that the school predates the Brafferton, having been started around 1700. Woodard said the first students were Virginia Siouan captives—perhaps Saponi or Catawba—from what was then the Virginia frontier. In 1713-14, treaties with the Virginia colony encouraged Native American leaders to send their sons to the school, he said.

By the end of the school in the 18th century, Native American boys were being educated in Christianity and the basics of reading and writing. The enrollment numbers have been lost over time. As historical records are scarce, archaeology has emerged as the best connection to the life of Native Americans in the early days of Virginia.

“It’s striking how little historical archaeology has been conducted on American Indian sites in Virginia,” said Martin Gallivan, an anthropology professor at the College. “The Brafferton project is a prime example of several recent William & Mary projects shedding light on the post-1607 native experience in the Chesapeake.”

Involvement of William & Mary students in the Brafferton archaeology, through the field schools, was a conscious decision, says Kathleen Bragdon, chair of the anthropology department. “This is the second-oldest building at the second-oldest university in America,” she said. “It’s important that our undergraduates



Pay dirt: Tools made from stone and glass.

have a part in this project at a place that is so important to three cultures in America.”

The third culture Bragdon referred to is African American. Eighteenth-century Williamsburg was virtually built by African Americans, Kostro explained.

“Almost every building that was built was done so by enslaved Africans,” he said. “They made up 50 percent of Williamsburg’s 18th-century population, and certainly as laborers, they made up the lion’s share of the workforce.”

Examination of the artifacts removed from around the Brafferton’s base will be of interest to faculty participating in William & Mary’s Lemon Project, an ongoing initiative that examines the role of slavery in the College’s early years.

“We are interested in knowing more about how enslaved people lived and worked here, and any archaeological evidence of their material culture,” said Robert Vinson, Lemon Project co-chair. “We are also looking for clues about where enslaved people might have been buried. We still do not know the location of the cemetery for enslaved people, if indeed there was one.”

Many of the anthropologists, and members of the Brafferton Legacy Group, hope the project will provide an opportunity for the College to re-engage with Native American communities that have William & Mary roots that predate even Thomas Jefferson’s.

“Our hope is to reach out to the many, many other communities that had members who went to the Brafferton,” Ashley Atkins said.

Faculty, students and members of the Brafferton Legacy group first came together at the April prayer ceremony. The event allowed native people an opportunity to reconnect with the Brafferton and sing honor songs in remembrance of William & Mary’s Indian students. The focal point of the ceremony, the tobacco bundle, will be respectfully interred at the Brafferton at the conclusion of the excavations. **i**



Anthropology Ph.D. student Alexandra Martin records findings and progress on the dig.

SACRED DIVORCE

UNTYING THE KNOT

Religious communities step in when wedding rings come off

by Erin Zagursky

FOR THE FAITHFUL OF EVERY CREED, the beginning of marriage is a religious and spiritual event. But what about when the marriage ends?

“I’m interested in how someone seeks meaning through their religious community when they’re divorcing,” said William & Mary sociologist Kathleen Jenkins, “but there are plenty of religious people who may not turn to religion to make divorce meaningful.”

Numerous quantitative studies have looked at the numbers of people within religious communities who divorce, but Jenkins, associate professor and chair of William & Mary’s Department of Sociology, says there’s been very little qualitative study of the set of religious experiences that make up the end of a marriage.

Jenkins is one of the scholars breaking ground in that territory. Researching a book, to be titled *Sacred Divorce*, she observed support groups and workshops for divorced people and interviewed more than 100 self-described religious people as well as clergy from seven religious traditions.

She found that people engaged in religious communities experience divorce in unique—yet similar—ways. At the same time, religious groups are responding to the country’s divorce culture with techniques and ideas from another of the nation’s prevalent social forces: the therapeutic culture.

The establishment of formal support for people who divorce is a relatively new trend in many religious communities. For instance, a

group of Catholics started a divorce ministry in the 1970s after Vatican II, when the church was adopting broad changes and dealing with concerns about the high divorce rate.

Although having dedicated programs or support groups for the divorced appears to be a recent change, “I think that people have probably been using religion for dealing with ending relationships for a long time,” said Jenkins.

BEGINNINGS AND ENDINGS

She acknowledges that it may seem counterintuitive for religious communities to offer divorce support, especially in religious traditions that have long discouraged or even condemned divorce. The larger American culture promotes the desirability of long-term, companionate marriages. At the same time, we Americans often embrace the concept of divorce as a gift, an opportunity for new beginnings, said Jenkins.

She also noted that even as the divorce rate has decreased slightly in America over the last several decades, many American religious groups have begun to acknowledge the reality of divorce among their members.

“We live in a society where more than any other Western nation, we begin and end relationships at high rates,” Jenkins said. “American religious groups and institutions are part of that larger culture.”

Jenkins spoke with people in different stages of divorce from seven communities: black

Baptist (mostly National Baptist Convention, USA, Inc.), black Pentecostal (Church of God in Christ), Jewish (Reform Reconstructionist, Conservative and Jewish Renewal), evangelical (primarily non-denominational), mainline Protestant (United Methodist, Presbyterian), Unitarian Universalist and Catholic (primarily Roman Catholic).

She also interviewed lesbian congregants from some of the Jewish and Unitarian communities who had dissolved committed life partnerships. Jenkins noted that her sample was not representative, and described it as “purposive,” meaning that she sought out a specific group of people—those who were involved in their religious communities as their relationships were ending.

Each religious tradition has its own approach for caring for their divorced or divorcing congregants, ranging from support groups to pastoral counseling. Jenkins found a common thread in that all incorporated therapeutic techniques. This makes sense, Jenkins said, considering the pervasiveness of therapeutic culture in our society.

“Religion and the therapeutic are so connected in our culture that it’s very hard to separate them,” said Jenkins.

The divorced/divorcing participants in these ministries are expected to do what Jenkins calls “divorce work,” a combination of the common psychological models of grief work and marriage work. She explained that grief work provides strategies for dealing with the typical emotional components of loss,

such as anger and disbelief. Marriage work promotes self-improvement and the learning of relationship-building abilities such as communication skills in order to prepare people for new relationships.

“All of these communities—to different degrees—value life partnership. Even when they are talking about helping the divorced, it’s helping them figure out what went wrong last time and how to do marriage better,” Jenkins said. “But they also talk about divorce as a gift. Divorce becomes an opportunity, an opportunity to grow closer to God, an opportunity to become a better individual.”

ADAPTING SYMBOLS

Although they all follow a similar therapeutic script, each religious group also draws on its own symbols, traditions and messages. For instance, the black churches, more so than in other traditions, talk about God as an “imminent provider,” Jenkins said. The imminent provider concept means God provides not only for the faithful’s spiritual needs, but their material ones as well.

By contrast, Unitarian Universalists focus on ethical reflection and creating rituals. “That’s in line with a lot of therapeutic models of being a creative self and working your way through,” said Jenkins.

In the Jewish community, different versions of the *get*—the traditional Jewish divorce ceremony—or the *mikvah*—a traditional bath for conversion—are sometimes conducted.

“The differences among these religious traditions basically comes down to how they would use their own religious symbols and how those would fit with the therapeutic process,” said Jenkins.

Jenkins found that the experiences of divorced and divorcing individuals did not necessarily follow any script.

For instance, people going through divorces are often portrayed in therapeutic literature as being very emotionally vulnerable and even potentially dangerous, but Jenkins found that some of her subjects were anything but. In fact, one woman Jenkins interviewed talked about feeling quite happy about her divorce. At the same time, she was concerned by the financial implications of ending her marriage and reached out to her religious tradition for help in dealing with the stress of facing a new and uncertain fiscal future.

Additionally, in many of the ministries, the newly divorced are asked to refrain from dating, to focus on the divorce work they are engaged in. However, Jenkins found that many of her interviewees dated anyway; some of them even got married to new partners they had met through divorce groups.

Jenkins also found that many people sought creative outlets, such as music and art, to help them through their divorces. She noted that some drew on a number of resources—often across religious divides.

“One woman used Divorce Care (an evangelical Christian video-based ministry), a Catholic group, yoga, her own private prayer, music, painting,” Jenkins said. “There were all these different ways she talked about for getting in touch with God, while in the center there was her mainline Protestant church that she went to.”

It didn’t surprise Jenkins, who said a plural divorce-therapy approach is, again, reflective of the larger culture.

“One of the things that sociologists write about now is that religion is pluralistic,” she said. “Very rarely are we on one institutional path. We are pulling from lots of different sources.”

A few of the people whom Jenkins interviewed engaged in divorce rituals, including the Jewish *get*, with members of their congregation—sometimes even with their children involved in the ceremonies.

“Those were emotional, very emotional,” said Jenkins. “In one case, I interviewed the clergy who helped put one together, and he said he wouldn’t do it again. It was too painful.”

‘LIKE A FUNERAL, ONLY WORSE’

Jenkins said her interviewees reported that smaller, more private ceremonies worked better. “People said rituals were helpful, but they also understood that it felt harsh,” she said. “They would describe it like a funeral but only worse in some ways.”

Jenkins said that divorce is still seen as a very private, solitary process, even within religious congregations. Though resources and support are now more readily available to divorced people in religious communities, many of the people whom Jenkins interviewed still reported experiencing a twinned sense of silence and shame within their congregations.

Interestingly, that sense of shame was reported more or less equally by members of both conservative and liberal religious traditions. The shame is the result of the culture, which sees marriage as an enterprise and divorce as something that occurs because of a lack of effort and skill, said Jenkins.

But she adds that the silence also comes from a lack of ways to talk about divorce—both in religious settings and within society in general.

“We live in a divorce culture,” Jenkins said, “but we still have limited ways of saying, ‘I’m so sorry to hear about your divorce.’ Even that doesn’t sound right. What do you say?” **1**

Sociologist Kathleen Jenkins examines the myriad strands of American religious life, looking at how people are reconciling faith and divorce.



Photos and photo illustration by Joel Pattison

THE CHEMIST AND THE CONSERVATOR

They work together to trace molecular ‘fingerprints’ of rare pigments

by Joseph McClain

Kristin Wustholz (left) and Shelley Svoboda examine some period pigments in Svoboda’s laboratory at the Colonial Williamsburg Foundation.



Stephen Saipukas

SHELLEY SVOBODA USES A FINE SURGICAL BLADE to take pigment samples from 18th-century paintings. She used to tell visitors to her lab at the Colonial Williamsburg Foundation that she only needed to remove a piece smaller than the period at the end of this sentence.

She doesn’t say that now. You can see the period at the end of this sentence, but you can’t see anything as small as the amount now needed to do scientific analysis of pigment—at least not with the naked eye.

“The idea, especially with these historic paintings, has always been to remove a minimal amount of paint,” explains Svoboda, a Colonial Williamsburg conservator specializing in paintings. A collaboration with Kristin Wustholz, assistant professor of chemistry at William & Mary, has produced a new technique that allows precise chemical analysis from a single near-microscopic particle excised from the painting.

The technique uses a laser microscopy method known as surface enhanced Raman scattering (SERS). Much like the objects

of their study, 18th-century portraitists who prepared their own paints, Wustholz and the students in her lab begin their work by mixing a paste of silver-colloid nanoparticles.

“You place the silver nanoparticles on the paint sample you want to analyze,” Wustholz explained. Then the sample goes onto a glass slide and into the SERS laser. The molecules in the sample react to the laser, vibrating and scattering the light. The pattern of the scattered light is diagnostic for the substance being analyzed.

LOOKING FOR FINGERPRINTS

“The silver nanoparticles act as an antenna, essentially. It gives you a very strong signal, like a fingerprint, almost,” she said.

That “fingerprint” is the vibrational spectra unique to the molecules in the paint. Wustholz can compare the fingerprint of the sample to a database of known vibrational spectra of pigments.

Wustholz’s SERS laser approach is a great improvement over conventional Raman spectroscopy, until now the go-to protocol

for paint analysis. “Raman spectroscopy is great. It provides you with the vibrational fingerprint. The problem is that it’s incredibly insensitive; only about one in a million photons will be Raman scattered,” she explained—thus the need for the larger sample to be taken from the painting.

The chemists correlate SERS work with a second examination of the paint, using fluorescence microscopy. The two-pronged approach, Wustholz says, gives a superbly accurate and detailed fingerprint of paints.

Wustholz describes the SERS process as “minimally invasive,” while fluorescence is completely nondestructive; it even can be done at a distance. These attributes are a godsend to a conservator of paintings such as Svoboda. The two—along with two of Wustholz’s undergraduates—collaborated on a study of pigments used in two 18th-century portraits that were in Svoboda’s lab. The collaboration led to a paper in the scientific journal *Analytical Chemistry*, with Wustholz’s students Stephen Dinehart ’12 and Lindsay Oakley ’12 as co-authors.

“Both of those paintings are from about the same era, but one is by Sir Joshua Reynolds—the biggest name in painting in London at the time. Robert Feke is an American, the first American-born painter,” Svoboda explained. “Feke is actually a little earlier than the Reynolds, 1748— but we found that they both were using the same materials, most probably British.”

In their examination of Reynolds’ *Portrait of Isaac Barré* and Feke’s *Portrait of William Nelson*, the team was searching for the molecular fingerprints of colorants known as lake pigments. They were especially interested in finding evidence of a prized—and quite expensive—red pigment known as carmine lake.

RED PIGMENT = RED FLAG

Svoboda explains that lake pigments are organic dyes compounded into a mineral carrier. In the case of carmine lake, the dye comes from the scales of a particular insect. She said that lake pigments, much valued by 18th-century painters for their “beautiful, luminous colors,” raise a luminous red flag when today’s art professionals suspect their presence.

“They are more prone to damage from light fading,” she said, “and we can’t share the paintings with the visitor without light.” Svoboda says museums have developed exhibition techniques for protecting light-vulnerable works by displaying them with minimal illumination.

Both carmine lake and another red pigment, madder lake, present fading concerns, Svoboda said. Red colorants weren’t only used to paint red coats and the like; they were commonly mixed with—or used on top of—other colorants to produce flesh tones. “It gives a vitality and translucency that the artists found nothing else could contribute,” she said, but it’s often been difficult to do more than suspect the presence of carmine lake, especially if you allow for three centuries of potential sun damage.

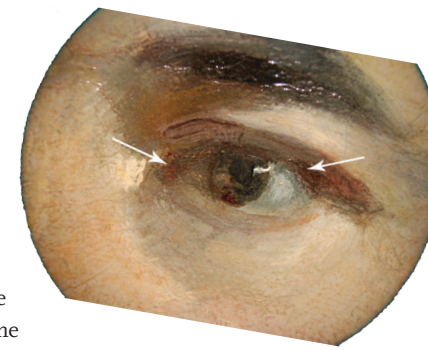
Isaac Barré’s portrait was put to the new minimally invasive SERS protocol. Viewing the painting’s surface underneath the floor microscope in her lab, Svoboda plied her surgical blade in two areas, taking tiny samples. Feke’s *William Nelson* got the same treatment.

“I just break through the varnish with a very small action of the blade,” Svoboda says. “With a good blade you can slice through a single large pigment grain, and the naked eye can’t even see the cut in the varnish.”

SERS microscopy can find the molecular fingerprint of even faded pigments. Wustholz and Svoboda had good reason to suspect carmine lake in the *Portrait of Isaac Barré*; Sir Joshua Reynolds maintained detailed notes on his technique and paint preparation. The paints Feke used represented more of an unknown quantity.

Wustholz took the samples to her lab in William & Mary’s Integrated Science Center, where she got Dinehart and Oakley started on the nanoparticle prep and the microscopy.

“When we first looked at the sample, we just saw some kind of red pigment,” Oakley said. “We suspected it was



probably either carmine lake or madder lake.”

It was a while before the students caught onto the feel of the SERS laser microscope (“It’s like learning to drive,” Wustholz says.)

“We have to move the sample around and try to find the best spot that will give a high intensity spectrum,” Dinehart explained. “It takes a lot of luck and a lot of maneuvering. We’ve spent hours

back there just moving one tiny sample around trying to find the perfect fingerprint.”

The fingerprints—verified by fluorescence microscopy—verified presence of carmine lake in the flesh of the Reynolds portrait, as Svoboda suspected. “The art history record shows that Reynolds’ flesh has faded in many paintings that we know of, sometimes very early,” she said. “But it’s been very hard to definitively identify the lake, because many analytical techniques require a fairly good sized sample. Until now.”

A SURPRISING FIND

The analysis also showed that Feke used carmine lake in his Nelson portrait, a bit of a surprise in a work by a Colonial painter. Svoboda said that a Colonial apothecary could have been a source of the high-priced colorant.

The ability to identify positively a pigment provides a number of benefits. Curators can take appropriate measures when hanging especially vulnerable works. Svoboda and other conservators can work with more assurance when they know the pedigree of the pigments on their canvasses.

The chemist and the conservator are now working together to identify colorants in Colonial Williamsburg’s Carolina Room, a relocated 1830s parlor that’s a conservation treatment in progress.

“SERS, to me, is a magical thing,” Svoboda said. “It just opens up a whole avenue of study in these faces of history.” In turn, the chemists take pleasure in working on a project that generates interest outside of the lab.

“If I tell my family that I’m synthesizing silver nanoparticles, they don’t really care,” Dinehart said, “but if I can tell them that I’m working with the Colonial Williamsburg Foundation on a three-hundred-year-old painting, then people get a little more excited about it.” **i**



Undergraduates Stephen Dinehart and Lindsay Oakley observe as Kristin Wustholz adjusts the optics of the SERS laser.

Detail from *Portrait of Isaac Barré* shows suspected (but yet unsampled) areas of carmine lake use.

Photo courtesy of Colonial Williamsburg Foundation



Hello Conqueror

Culture of ‘cute’ scores an international victory over samurai and ninja

By Megan Shearin

SHE’S AN INTERNATIONALLY ACCLAIMED SUPERSTAR WHO accessorizes with a colorful bow clipped near her left ear. Her image appears on more than 10,000 items.

She and her equally darling companions are responsible for taking down the samurai, ninja and Godzilla-era movie monsters that ruled Japanese popular culture for decades.

She’s Hello Kitty.

First introduced in 1974 by the Japanese company Sanrio, Hello Kitty is one of global pop’s most successful brands. The outpouring of cute-cat merchandise rakes in billions of dollars in revenue, and is primarily consumed by girls ranging from age six up to females in their 30s.

Rachel DiNitto, co-director of the Asian and Middle Eastern Studies Program at William & Mary, studies the influence of Hello Kitty and other avatars of Japanese popular culture.

She explains that over the past three decades, Japan’s cultural, economic and political dynamics have shifted. Those changes have made Japanese pop culture a global phenomenon, influencing markets, entrepreneurs and other cultures.

Traditional American popular culture celebrates the cowboy, athletes and real-life drama, while contemporary Japanese pop culture embraces a youthfulness and playfulness.

“There’s a cuteness aesthetic in Japan that is very appealing to people globally,” said DiNitto, associate professor of Japanese studies. The Japanese term is *kawaii*, literally meaning cute and lovable. In societal terms, cuteness is accepted and desired by Japanese adults of all ages and genders, she added.

DiNitto says the rise of cuteness in Japanese culture began in the 1970s, when Hello Kitty was launched. Cute Japanese pop stars were heavily marketed, and a magazine culture

emerged, targeting young girls as consumers. Hello Kitty and her associated girl culture fueled popular culture in the 1980s, harnessing the economic power of the nation’s young females.

IT’S ALL ABOUT THE KAWAII

Kawaii permeates Japanese anime, manga (comics), fashion and advertising. For example, Pikachu, a character from *Pokémon*, decorates the side of Japanese trains and airplanes. Even Japanese police departments employ lovable mascots.

According to DiNitto, the cute factor has become such an enormous corporate success that non-Japanese companies are attempting to cash in on the craze. Cartoon Network, Nickelodeon, Funimation and Warner Bros. are a few of the many American corporations emulating the Japanese.

But when other cultures incorporate the Japanese-cute aesthetic, there’s an evident trade off, said DiNitto.

She cites Italian artist Simone Legno’s Japan-influenced lifestyle brand Tokidoki. Legno’s designs have been incorporated into lines of toys, cosmetics, clothing and accessories—even cell phones.

A student working on a project in DiNitto’s Japan’s Gross National Cool course, conducted research on Tokidoki designs. She found that the women in Legno’s illustrations were leggier, bustier, more likely to be at least partially nude—together more sexualized—than the innocent *kawaii* images found in Japanese comics and anime, said DiNitto.

More sex may sell globally, DiNitto says, “but it’s more of an innocent cuteness that defines the Japanese culture.” Which is not to say that there is no overtly sexual imagery in Japan, she adds.

The influence of Japanese pop culture can be found everywhere in America—from manga comics filling the racks of mainstream bookstores to skyrocketing sales of the Wii video game. Japanese anime-style cartoons play on Nickelodeon. Sushi is even challenging burgers as the go-to U.S. convenience food.

CULTURALLY ODORLESS

These Japanese-origin products may be all the rage, but scholars continue to debate the reasons for their wide popularity, says DiNitto. Pop-culture scholars have coined the term “culturally odorless,” or *mukokuseki*, to identify this singular aspect of Japanese popular culture, she said.

“‘Culturally odorless’ means these products are not marketed as Japanese; they’re not marketed as anything,” explained DiNitto. “By eliminating a level of exoticism and national branding, the products become easy to consume because they’re not targeted toward any specific culture, gender or age group.”

Some critics feel the “culturally odorless” phenomenon is responsible for the global popularity of Japanese culture. Legno’s overtly sexual Tokidoki women are also very Asian in appearance—the antithesis of culturally odorless. Hello Kitty, by comparison, was created with no origin or background story, says DiNitto. Unlike Godzilla, who was born in Japan of nuclear testing and spawned a succession of Japanese monster movies, Hello Kitty technically has no national ties to Japan. It was only later, DiNitto says, that Sanrio gave Hello Kitty a character profile and a British nationality.

A KITTY FOR EVERYONE

Hello Kitty’s simplistic and malleable facial features also make her appealing to everyone. Her white cartoonish face, button eyes and absent mouth make her visage as versatile as it is enigmatic, says DiNitto.

“There’s nothing foreign about Kitty. She can become kind of anything,” said DiNitto, adding, “There’s no real national identity to her.” You can find Hello Kitty speaking Spanish or Chinese. There is even a Hello Kitty dressed as the revolutionary Che Guevara.

The second argument for Japan’s cultural globalization is a bit more subjective: For many, Japanese pop culture is just more interesting than American popular culture.

“Students tell me all the time they feel American popular culture is kind of tired and worn,” says DiNitto. “Japanese popular culture is offering them possibilities and alternatives that they find more appealing. It’s a way for them to reject or resist American popular culture they feel really isn’t speaking to them anymore.”

One example is video games, says DiNitto. She explained that American video games tend to be very masculine and often military-oriented.



Rachel DiNitto’s students actually do call her “sensei.”

By comparison, Japanese video games have more intricate plot lines that incorporate more fully developed characters, attracting more female gamers.

WORKING ON A NEW BOOK

DiNitto is currently working on a new book project. Tentatively titled *Consuming Cultural Politics*, the book examines political expression found in the culture of contemporary Japan from the 1990s to 2000s.

Inspiration to write the book came from student class projects, says DiNitto. She challenges students to think beyond their blind consumption of these cultural products to consider deeper issues. Students in the Japan’s Gross National Cool class analyze scholarly articles on Japan’s music, movies, anime, video games and cuisine. Those in her Popular Culture and Nationalism in Millennial Japan: 1980s-2000s, study popular culture alongside the rise of nationalism in contemporary Japan.

DiNitto says Hello Kitty’s reign over Japanese popular culture may be coming to an end. She cites one piece of evidence, a recent exhibit in New York titled, *Bye Bye Kitty!!! Between Heaven and Hell in Contemporary Japanese Art*.

The real question is not what will happen to Hello Kitty, but what will emerge from Japan in the upcoming decade as it recovers from the Fukushima disaster. DiNitto hopes to look at this question in the epilogue to her new book. **i**

RELIGION, HISTORY, CULTURE

TRANSLATING DEVOTION



Photos by Joel Pattison

The size, scope and poetical power of the *Bhagavata Purana* create a triple set of challenges in creating an English-language translation from the original Hindu script. Ravi Gupta is determined that his English version will embrace the full literary and artistic glory of the original Sanskrit.

Ravi Gupta works to share joy of a ninth-century Sanskrit holy text

by Lillian Stevens

THE *BHAGAVATA PURANA* IS TO SOME HINDUS WHAT THE BIBLE IS TO SOME CHRISTIANS. IT IS A WORK OF LITERATURE encompassing a rich tradition of poetry and drama, as well as a scientific, technical, philosophical and Hindu religious text. There is only one English translation of the pure Sanskrit work and it's a technical, bare-bones translation. That is about to change.

Ravi M. Gupta, associate professor of religious studies at William & Mary, is working on an abridged English translation of the *Bhagavata Purana*. Fluent in Hindi, English and Sanskrit, Gupta grew up in Boise, Idaho, and is an initiated brahmana priest of the International Society for Krishna Consciousness. He is a major figure in the U.S. Hindu community; he was selected to meet with Pope Benedict XVI in 2008 as a representative of American Hindus.

Gupta's goal is to produce a translation that will include the artistic and literary elements of the sacred work, which most scholars date to the 9th century. He is working with Kenneth R. Valpey, a colleague from the Oxford Center for Hindu Studies. Their translation will also include a companion volume of scholarly articles which examine the *Bhagavata Purana* from multiple disciplinary perspectives.

AN ANCIENT TEXT IN AN ANCIENT LANGUAGE

A "Purana" is a class of Hindu sacred writings comprising popular myths and legends and other traditional lore. Most of the major Puranas are written in Sanskrit which, like Latin and ancient Greek, is considered an archaic language. Again like Latin and ancient Greek, Sanskrit continues to be widely used as a ceremonial language in Hindu religious rituals. Gupta notes that some 10,000 people in India still speak it as their native tongue.

"The *Bhagavata Purana* is one of the most sophisticated philosophical works of its time, spawning multiple religious traditions for which it serves as the primary sacred text," Gupta says.

The *Bhagavata Purana* has long served as the ultimate religious text for Vaishnavas, who focus on Bhakti Yoga, or devotion to the supreme lord expressed through love, with Krishna understood to be the supreme lord. Gupta notes that the work is an important cultural

source as well, its verses inspiring countless works of art. Stories of Lord Krishna from his childhood to the Kurukshetra battle in Mahabharata figure in one form or another in Vaishnava temple sculptures, while important Hindu dance types have themes taken from the *Bhagavata Purana*.

"It stands out as an important piece of world literature, with some of the most beautiful poetry you'll find in any language," says Gupta. "It's an excellent literary piece in terms of poetic ornamentation, alliteration and all kinds of innovative Sanskrit verse meters. And it stands out aesthetically in terms of the imagery and stories that are used."

Hinduism is not a "religion of the book" where there is a single text held up as sacred, and Gupta explains that there are three texts which have had a shaping influence on India's history, and specifically on the development of Hinduism.

The first of the three works—the one perhaps most famous in the west—is an epic called the *Rāmāyana* which depicts the duties of relationships, including the legendary love story of Ram and Sita. The second text, the *Mahabharata*, an epic of life, remains the longest epic in world literature. It contains the *Bhagavad Gītā*, often regarded as the central text of their religion by Hindus today. The third work is the *Bhagavata Purana*.

LAST—BUT NOT LEAST

Interestingly, the first two texts—the *Rāmāyana* and the *Mahabharata*—have been read and studied thoroughly in English scholarship whereas the *Bhagavata Purana* has—according to Gupta—practically been ignored.

"So we decided to open up this treasure trove of Indian lore—of history—of religious culture, knowledge and theology," he said.

The two-part work—translated verses and companion articles—is slated for publication by Columbia University Press in late 2012. The books are intended to work as a primary and secondary reading, each keyed into the other.

"There will be an abridged translation covering approximately 10-12 percent of the *Bhagavata Purana*'s 18,000-verse text and the accompanying volume of articles written by different scholars but edited by us," Gupta said. "Some of those are being written by us too."

The articles will study the *Bhagavata Purana* from multiple disciplinary

perspectives—from its influence on Indian music and classical Indian dance to its view of cosmology and the concept of time. The translation will include notes drawn from a number of commentaries which Gupta says provide a wealth of all kinds of historical knowledge.

"Each commentary reflects the dominant themes and problems of that era. You get a good sense of what were people struggling with at that particular period in history," he explains.

TRUE TO THE ORIGINAL

Gupta and Valpey want their abridged translation to remain as true to the original text as possible. They run into the typical challenges of translators faced with nuanced meanings in the original language that must necessarily lose something in the translation.

"Sometimes a verse can be pregnant with different layers of meaning," Gupta explains. He adds that just as a Sanskrit word may carry different meanings, "the word in English may have three meanings as well. When you do a translation you often have to choose one layer of meaning."

Gupta is employing a number of strategies to incorporate into his translation as much of the original subtleties of meaning that make up much of the artistic and literary elements of the *Bhagavata Purana*. His goal, he says, is "to help the reader enter these various layers through the translation, notes and introduction."

Sometimes it means translating the verse once for the main text. Then, completely retranslating the verse in a footnote in order to capture the multiple layers of meaning that elude a single translation.

Gupta envisions his translation as a point of entry for other scholars who are interested in the *Bhagavata Purana* but don't have the time or the tools to attempt a translation

themselves. What's more, he sees this project as the tip of the iceberg—a much larger project being planned under the auspices of the Oxford Center for Hindu Studies.

"Kenneth Valpey and I envision a consortium of scholars from around the world who will take up different commentaries from different periods of history and work with them—maybe not to translate all of the commentaries, but to study important areas," he explains.

Over time, Gupta hopes to undertake an historical analysis of these various periods of Indian history and study how the *Bhagavata Purana* has interacted with other texts and other cultures—exploring ways in which it has migrated to different parts of the world. **1**



Ravi Gupta is one of the leading members of the U.S. Hindu community. An initiated brahmana priest of the International Society for Krishna Consciousness, he was selected to represent American Hindus in a 2008 meeting with Pope Benedict XVI.

TEACHING THROUGH RESEARCH

Original investigation is woven into the undergraduate curriculum



Caitlin Oakley '12 and Monika Bernotas '12 interview Sergei Kovalsky about his art and the contemporary art center «Pushkinskaya-10» in St. Petersburg, Russia.

‘WE’VE DETERMINED AS A FACULTY THAT OUR UNDERGRADUATE STUDENTS should comprehend the tools of research as an essential part of their future problem-solving and decision-making,” says Joel Schwartz, director of the Charles Center and dean of honors and interdisciplinary studies.

Ordinarily, students would wait until graduate school or until they begin their careers before taking the next step: posing an original question, designing a method of investigation and then devising a way to share their conclusions. William & Mary students get involved in research early—often as early as the freshman year.

“Our students are ready, our faculty are capable, and upping our game raises the intellectual level and provides competitive advantages across the board.”

Each academic field, from mathematics and physics to English and the performing arts, has its own definition of research, and the teaching/research effort acknowledges and builds on those individual approaches.

Freshman Seminars are the first “book-end” of the College’s undergraduate research program. All first-year students take small, focused seminars (offered across all the disciplines), learn research methods and complete a significant project.

At the other end, about 10 percent of graduating seniors complete and defend a supervised Honors thesis in their major. Some departments require their majors to complete a capstone senior project.

“The real challenge comes between the end of the freshman

year and the start of the senior year,” says Schwartz. “A successful student research experience requires faculty supervision at a very individual level. It might also involve travel to conduct research on site or in a library or archive. How can we implement such resource-intensive learning across the board?”

In some cases, faculty have involved students in their own research. The curriculum makes room for “independent study” and “independent research” courses, where students earn credits conducting research or scholarship alongside a faculty member.

RESEARCH PATHWAYS

Many faculty now also integrate elements of research into their classroom teaching, or design research pathways that flow naturally from one course to the next.

For example, Assistant Professor of Physics Seth Aubin has added a challenging circuit design project to his course on digital electronics. In the Sharpe Community Scholars Program, students complete coursework and conduct research over two semesters while working with partner organizations in the community.

Summer has proven a fertile time for offering new teaching/research opportunities. The classical studies department, for example, offers an intensive three-week summer program in ancient Roman studies. A faculty member leads students to sites and relates what they are seeing and experiencing to the classroom knowledge they already have. The insights that

result can be key to informing a student’s research.

“I could not have performed my research adequately without visiting the actual sites,” says Brent Bickings ’11, whose project focused on archaeological and architectural evidence. “I was able to explore each room of the compound and literally photographed every inch of the site for my research paper.” In spring 2011, Bickings was awarded honors from the religious studies department for his subsequent thesis, “Was the Western Diaspora Cut Off from Israel? A Case Study of Sardis and Hamath Tiberias.”

Another summer research program is the interdisciplinary Bosnia Project, where students follow a preparatory spring course with five weeks on site. They engage with community partners, integrate academic and experiential knowledge and produce documentaries about identity and life in Bosnia.

“We’re seeing an interesting shift toward ‘research abroad’ programs,” says Schwartz, “taking coursework out into the world and applying a hands-on research orientation.”

The College has also expanded opportunities for students to present their research. Along with traditional publishing venues, students participate in presentation fairs and poster sessions on campus and attend and present at professional conferences. Students can also help organize research conferences and edit journals.

In spring 2011, for example, undergraduate students worked with a faculty advisor, Assistant Professor of Philosophy Christopher Freiman, to host the department’s first undergraduate philosophy conference. A dozen students from William & Mary and other universities submitted original philosophy papers for blind review by the W&M Philosophy Club. Eight papers were chosen for presentation at the conference.

Each student presenter had 20 minutes to share her or his work, and then the floor was opened for comments and general discussion between the faculty and students. “Giving a presentation and responding to feedback on the fly is a really valuable skill and not something a student would get to do in a typical undergraduate course,” says Freiman. “The conference also gave students the unique opportunity to evaluate each other’s work. Learning to both get and give comments can give students a good head start should they decide to continue with advanced study.”

W&M students in the honor society Pi Sigma Alpha can sign up for a course and serve on the student editorial board of the *Pi Sigma Alpha Undergraduate Journal of Politics*, published twice a year at the College by the American Political Science Association. Papers are submitted from undergraduates across the country. Students vet the methodology and quality of papers, and advisory faculty members at various universities review and

comment on the papers students move forward. The student editors decide which papers are published.

Associate Professor of Government Christine Nemacheck, one of two professors teaching the course, notes that journal submissions cut across the entire field of political science, so participating students gain exposure to subfields they might not have studied yet. They also get a feel for what students at other universities are doing and how they’re setting up their research. “This improves our own students’ writing and research skills, and sharpens their critical thinking,” says Nemacheck.

PROCESS IS KEY

Attention to the *processes* of research is key, says Schwartz. “Of course it is important that students and their faculty mentors are discovering and presenting research that expands our knowledge of the world,” he said. “But research at the undergraduate level has benefits quite independent of these research products: it helps develop the student’s capacity to solve problems, think critically, work productively both alone and in teams, and communicate persuasively. These are all traditional goals of a liberal arts education.”

As the teaching/research effort gains momentum, the College has attracted national attention as a possible model for other universities. In October 2010 the College co-hosted with the Council of Colleges of Arts and Sciences a two-day conference titled, “Creating a Culture of Research on Campus”—and registered about three times the expected number of participants.

The Andrew W. Mellon Foundation, whose 2007 grant to the College helped fund about 90 projects to incorporate research into the curriculum, has awarded additional funding to expand undergraduate research across the entire Global Studies curriculum. And as private donors learn more about how the research experience benefits students, the College is attracting more support to its Faculty-Student Research funding initiative.

“Some institutions have emphasized faculty research at the expense of their commitment to the education of undergraduates,” Schwartz says. “William & Mary has invested in undergraduate research as a way to expand its commitment to undergraduates, and integrate its research and teaching missions. Currently about 75 percent of our undergraduate students have at least one significant research experience before graduation. We’d like every student to have this kind of opportunity.”

A LABORATORY FOR CULTURAL HISTORIANS

The Russian city of St. Petersburg offers an excellent laboratory for cultural historians. Conjured up from reclaimed marshland as Czar Peter the Great’s “window to the West,” the city bears witness to its various historical identities as imperial capital and cultural showcase, heroic survivor of a 872-day siege in World War II, and strategic Soviet naval center. Today those identities co-exist alongside post-Soviet democracy and capitalism, and residents are grappling with their cultural memories as they shape a new urban environment.

“Cultural historians believe that communities construct their sense of the past through memory vehicles such as books, films, museums and commemorations,” says Associate Professor of Russian Studies Alexander Prokhorov. “In post-Soviet Russia, historians and social activists have urged a re-evaluation of the cultural memory in a contemporary context.”

Prokhorov and other W&M faculty have teamed up to offer students the year-long program, “Visualizing St. Petersburg: Urban Environment in Transition.” In spring 2011, students took a one-credit preparatory course to learn various methodological approaches to conducting research, choose their summer sites for individual research projects and become familiar with media-production techniques and equipment. Teaching continued during the six-week summer session in St. Petersburg, where the students carried out their exploratory research. In a final one-credit fall course, the students will use written, audio, and visual media to produce cohesive narratives of the urban environments they studied in St. Petersburg.

The St. Petersburg project has been awarded two faculty fellowships in student-faculty research by the College’s Reves Center for International Studies.

GOOD NEWS/BAD NEWS

Rare woodpeckers have a ‘chick boom,’ but they’re outgrowing their habitat

By Andrea Davis



It's a boy: After fledging, this bird shows the eponymous head markings of the red-cockaded woodpecker. He's one of the “chick boom” generation of this endangered species, now in danger of outgrowing its Virginia habitat. Only males have the “cockade.”

VIRGINIA'S BREEDING POPULATION OF RED-COCKADED WOODPECKERS REACHED A NEW high this year, with nine breeding pairs documented in late May.

The population reached an all-time low in 2002—only two breeding pairs. However, due to the work of a group of preservationists including Bryan D. Watts and the Center for Conservation Biology, this endangered species is starting to make a comeback in Virginia.

During the 2011 breeding season, CCB scientists not only

recorded the highest number of breeding pairs in three decades, but they also banded 26 chicks. That's the good news. The bad news is that Virginia's recovering population is beginning to outgrow its limited habitat.

Watts, the director of the CCB, takes his team out to The Nature Conservancy's Piney Grove Preserve each spring to record a variety of information about the population. They record the number of eggs in each cluster, or group, of birds. These birds are cooperative breeders, so a cluster may contain a “helper” bird, as well as the breeding pair.

When the eggs hatch, they record the number of chicks per cluster. In May, the team recorded 26 chicks among the nine breeding pairs of woodpeckers. Five to ten days after hatching, Watts and his team place bands on the chick's legs.

“They receive three color bands on one leg, and a color band and a U.S. Fish and Wildlife Service band on the other leg,” Watts explained, adding that the pattern of the color bands is unique to each chick. “The reason for doing that is so we know individual birds when we see them again.”

The team made another trip to the preserve after the birds fledged. According to Mike Wilson, a senior biologist at the CCB, the birds fledge when they leave the nest tree and begin to roost in their own tree cavity. The CCB researchers recorded the number of males and females, using the red “cockade,” or crown patch, of the fledgling males to distinguish the sexes, and the colored leg bands to distinguish individuals.

They came back with some more good news: “All the fledged birds were doing fine,” Watts said.

The Piney Woods group constitutes the only red-cockaded woodpeckers breeding in Virginia. The recovering population is nearly outgrowing the nesting habitat, presenting the CCB with another problem.

“What will happen is that we'll reach saturation of that patch, and so all the available areas will be consumed,” Watts said. “There's no prospect for further population growth until other patches come of age, and so we're looking at probably a forty-year lag.”

NOT JUST ANY TREE WILL DO

He explained that red-cockaded woodpeckers are extremely particular about their nesting trees, and the destruction of suitable habitat is the main reason for the species' decline. The Piney Woods patch is the only one in Virginia with pine

trees at least 80 to 100 years old, representing a limited space for the woodpeckers to build cavities and breed. Some of the birds may try to breed in other places across Virginia, Wilson said, but CCB research indicates migration is likely to prove unsuccessful for the woodpeckers: There are just no other suitable locations.

CHICK BOOM PROMPTS BUILDING BOOM

To combat the shrinking habitat, the team has taken a variety of measures to help the woodpeckers. One involves giving the woodpeckers artificial cavities: a special bird box that is plastered over and painted to look as though it is a part of the tree. Watts said, however, that the woodpeckers abandon certain cavities after a period of time, for reasons that the team has yet to understand.

Long-term measures are still being worked out. Efforts have been put into place to plant other pine trees in Virginia for the birds, but there is no way to speed up the aging of the pine trees. So during this 40-year lag, Watts and his team will continue to monitor and manage the woodpecker population in a holding pattern.

The Center for Conservation Biology has been working with the red-cockaded woodpeckers in conjunction with the Nature Conservancy and the U.S. Fish and Wildlife Service since the 1970s, when the Endangered Species Act was passed and the woodpeckers were placed on the list. Efforts started by Mitchell A. Byrd, former Chancellor Professor of Biology and co-founder of the CCB, and Dana Bradshaw, also of the CCB, have continued for the past 30 years to maintain a population of the species in Virginia.

The CCB is a joint program supported by the College of William and Mary and Virginia Commonwealth University. **i**



Hunting for red-cockaded woodpecker chicks (clockwise, from left) requires Bryan Watts to use Swedish ladders to climb several stories up the mature pine trees that the birds use for nesting. His goal is the oval shaped opening to the nesting cavity. Pine sap congeals around the opening, creating a sticky deterrent for egg-hungry snakes. His reward is a handful of chicks, carefully returned to their nest after banding.

Photos courtesy of the Center for Conservation Biology



The College Of
WILLIAM & MARY

P.O. Box 8795
Williamsburg, VA 23187-8795



ideation

RESEARCH & SCHOLARSHIP AT WILLIAM & MARY

an advance look...

Call it the Panic of 2008

by Joseph McClain

Scott Nelson's forthcoming book looks at strangely familiar financial landscapes. Junk bonds and unbacked, ineptly bundled mortgages trigger financial crises that prompt competing economic stimulus proposals in Washington, D.C. Proposed government regulations prove to be controversial. Debate on how to react paralyzes Congress.

It sounds like a recap of the 2008 meltdown, but these events happened more than a century ago; many happened more than once. *Crash: An Uncommon History of America's Financial Disasters* takes a look at the seven American financial panics from 1792 to 1929 from the context of the 2008 crash, which Nelson says should be referred to as the Panic of 2008, even though "Great Recession" is a more popular term.

Nelson is the Legum Professor in the Lyon Gardiner Tyler Department of History at William & Mary. He expects *Crash*, being published by Knopf, to hit the stands in November. In August, Nelson was working on manuscript revisions on the book, which stemmed from reaction to a article he wrote for *The Chronicle of Higher Education*, just as the U.S. economy was starting to crumble.

"Everyone was talking about 1929, but I said in this article that the depression following the Panic of 1873 was much more like our current crash than 1929," Nelson said.

His phone started to ring after his *Chronicle* story was reprinted in major newspapers. Bankers and managers of large investment funds were asking Nelson to recommend a good economic history of the nation's panics, crashes and depressions: "They were saying 'What should I read?' 'Someone told me that the Panic of 1837 was important.' 'How about 1819?'"

Nelson realized that there wasn't a good history of American financial panics and decided to fill the void by addressing material largely neglected by historians and economists alike.

During his research, Nelson found that older economics textbooks usually had a chapter on the nation's panics—up until the 1964 neoclassical revolution in economics. At that time, he

said, Milton Friedman's *A Monetary History of the United States* convinced large numbers of economists that "all you have to do is look at the money supply and that's all you need to know."

"All of this accumulated knowledge about the other financial panics has just disappeared," Nelson said. "It used to be taught by economists, sometimes by historians. Nobody teaches it now. Nobody *knows* it now."

Nelson is a social historian, and so *Crash* deals more with the effects of panics than their causes. For instance, he tells how the Panic of 1819 advanced the study of alcoholism. So many merchants and bankers tried to drown their troubles that Philadelphia's charity wards filled up with once-respectable men exhibiting the full range of alcohol withdrawal symptoms.

Nelson demurs when asked to offer words of wisdom relevant to the Panic of 2008. "Historians hate to make predictions," he says. However, he points out that greater transparency has helped to reduce symbolic doubt and restore public confidence.

"That did happen in 1857—probably the quickest recovery of all the panics," he said. "Reforms created transparency. Once investors can actually see the document and compare one to another, it makes all the difference in confidence."

Read more about Scott Nelson's new book at www.wm.edu/crash 



Stephen Salpukas

Scott Nelson combines history and economics to examine America's financial hard times.