

ideation

Spring 2006

RESEARCH & SCHOLARSHIP AT WILLIAM & MARY



GETTING PAST POCAHONTAS
COMPOSING FOR FILMS
IT'S A VARIABLE WORLD

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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.

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

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WHAT DO YOU THINK?
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COVER PHOTO
Archaeologist Martin Gallivan is leading a team probing the mysteries of Werowocomoco, the capital town of Chief Powhatan (background).

INTEGRATING SCIENCES

By DENNIS MANOS
Vice Provost for Research

We broke ground on Phase One of the Integrated Science Center on Feb. 10, 2006. Members of the departments of chemistry, biology and psychology will populate this new building, as well as the remodeled Rogers Hall. In the 1960s, when these departments were first placed in their existing quarters, most of the things their faculty routinely do today in their research did not yet exist. Even the concepts that are common scientific jargon in their classrooms today had no names then. Discovery, for instance, of the polymerase chain reaction was nearly a decade in the future when the bio faculty moved into Millington in 1968.

Now, let me say a word on how this new facility fits into the liberal arts environment. The College of William and Mary is a liberal arts institution of the first caliber. We recognize the difference between training and education; both are integral parts of what we do. From a practical point of view, if you merely train to a set of disciplinary standards or pre-approved criteria that say, yes, this is what a physicist knows, this is what a mathematician knows, this is what a biologist knows—you can end up with a very highly educated and very well-trained individual who cannot solve the problem at hand. Not coincidentally, you've also stepped away from the tradition of the liberal arts.

The problems at hand today have reached the level of complexity where traditional disciplinary training is inadequate, even—or maybe especially—at the undergraduate level. At the groundbreaking for the ICS, I cited an article titled "125 Questions: What Don't

We Know?" from the July, 2005 issue of *Science*. It was a list of the most important and most pressing problems that need to be addressed over the next 25 years. Now clearly the number of things we don't know in science is immeasurably larger than the number of things we do know, but the problems on this list are real bone-crushers: What is the biological basis of consciousness? What controls organ regeneration? How much can human life be extended?

These are among the questions that our students will be called upon to answer. They're not only beyond the capability of any one person, they also go beyond the borders of our traditional disciplines. Our new science facility must allow our students and faculty to communicate and collaborate in ways we have not yet invented. So, in the best interdisciplinary, liberal-arts tradition, we are "integrating science" at William and Mary. We're building our ISC structure to be flexible and adaptable, with lab space capable of being reconfigured quickly to meet the rapidly shifting demands of the future.

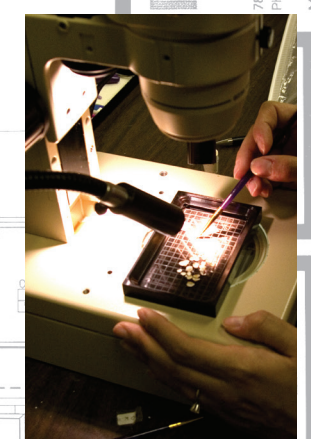
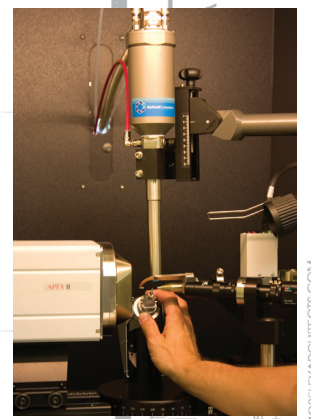
The building is the first step in developing a "science precinct" here at William and Mary, extending the principle of "integrating sciences" to departments in adjacent buildings. It is an ambitious project and we're going to need a lot of help. Some alumni and friends have already stepped forward, particularly Sarah "Sally" Ives Gore ('56) and her husband, Bob.

The Integrated Science Center is not just for faculty labs and offices. Carl Strikwerda, our dean of arts and sciences, often points out that virtually every undergraduate student at William and Mary will use the new building. That's true and we all should be proud of the reason why it's true: we make better scientists by getting them in our labs as early as possible. There's nothing new or startling about it. It's just a variation of the same way we make better scholars, humanists and artists—by getting them involved.

The Raw Data

New construction:	117,000 gross square feet
Renovation, Rogers Hall	45,000 gross square feet
Research, Teaching Laboratory Space	70,000 net square feet
Classroom, Office Space	19,700 net square feet
Anticipated completion, new building	December, 2007
Anticipated completion, Rogers	December, 2008
Design Team	Moseley /Payette Architects
Construction management contractor	Gilbane Building Company

Phase One of the Integrated Science Center will house faculty in departments of chemistry, biology and psychology—and the College's interdisciplinary neurosciences program for undergraduates



THE COLLEGE OF WILLIAM AND MARY
INTEGRATED SCIENCE CENTER: PRELIM. RESUB.
WILLIAMSBURG, VIRGINIA
PROJECT CODE: 204-15296
APPROPRIATION ACT: C-60.30, C-23.10, C-11.15, C11.35

A tale of two citties

2007 WILL BE JAMESTOWN'S
YEAR, BUT 1607 WAS
ALL ABOUT WEROWOCOMOCO

It was the best of times. Wahunsenacawh, also known as Chief Powhatan, had settled into a new capital town on a bay off what is now the York River.

By JOE McCLAIN

The site, known as Werowocomoco, was not a newly created community, but it was a strategic location from which to administer a power base. Powhatan was the mamanatowick, the “great king” of the Virginia Tidewater, ruling an area ranging from just south of the James River north to the Potomac and from the fall line near today’s I-95 eastward to include the Eastern Shore. Martin Gullivan, associate professor of anthropology at the College of William and Mary, points to Purton Bay, site of Werowocomoco, on a large map covering one wall of the facilities of the Werowocomoco Research Group, located in Washington Hall.

“The rivers were the interstate highways of the time,” Gullivan said. “Powhatan moved his home from his birthplace on the James River to the York River. His

chiefdom ranged over the coastal plain of Virginia. If you draw a map of these river highways, you see the York is fairly central and Purton Bay, where Werowocomoco is located, is fairly central on the York. So, my initial interpretation is that Wero is geographically central to this world of Algonquin-speaking Indians on the Coastal Plain.”

Canoes brought a stream of tribute to the great king from his subject people, who were collectively known as Powhatans. Corn and other food, shell beads, copper items and deer skins came to the mamanatowick at his capital city through a stable system of governance administered through sub-chiefs, or weroances, among thirty-odd districts comprising dozens of villages and about 15,000 people.

Meanwhile, down on the James River, times weren’t so good. In late 1607, life in Jamestown (also known as James Cittie), the first tentative toehold of what was to become the first permanent English colony in the New World, was so precarious that 400 years later tourists were attracted to the interpretive exhibits of Jamestown by an advertising campaign asking, “Could you have survived?” Odds aren’t good, considering that nearly half of the original set of colonists were dead by the end of 1607.

While preparations are being finalized for the events of 2007, the 400th anniversary of the founding of the

Jamestown colony, Werowocomoco is emerging into daylight, as archaeological excavations of the site by the Werowocomoco Research Group uncover evidence of life in the onetime capital of the region. Abandoned in 1609 by Powhatan and all but forgotten for centuries, “Wero” is in for its share of the spotlight, as well. A NOVA episode on Werowocomoco is in the works; an advance crew from WGBH-TV has been meeting with Gullivan and others involved, including Bob and Lynn Ripley, whose Gloucester County property includes the Wero archaeological site. The Virginia Department of Historic Resources—a part of the project through the work of Randy Turner, director of its Tidewater Regional Preservation Office—placed Werowocomoco on the Virginia Landmarks Register. In March, Wero also was placed on the National Register of Historic Places.

A PLACE OF POWER

It’s impossible to talk about the early days of Jamestown without mentioning Werowocomoco. Much of the story of the colony either happened at Werowocomoco itself or was influenced by decisions that were made there. The legendary, albeit historically controversial, intervention by Pocahontas in the execution of John Smith happened at Werowocomoco. Smith and Christopher Newport met several times with Powhatan, each time at Werowocomoco. All the decisive action

continued on next page

Background: A reproduction of John Smith’s 1612 map—locations of Jamestown and Werowocomoco have been highlighted.

Facing page: Danielle Moretti-Langholtz works with members of descendant communities interested in the home of their ancestors.

Map courtesy Werowocomoco Research Group

HOW DO WE KNOW IT’S WEROWOCOMOCO?

How do we know that the site of the excavation is the Werowocomoco of history and legend? Researchers point to three lines of evidence.

1. MAPS.

John Smith left them, as did Robert Tyndall. There’s also a third, known as the Pedro Zuniga map. Each one depicts

Werowocomoco on the York River and allows researchers to project the location of Wero in the vicinity of Purton Bay.

2. JOHN SMITH’S NARRATIVE ACCOUNTS.

Capt. Smith described distances between Werowocomoco and Jamestown and other landmarks in the area. He also described the physical layout: On a broad shallow bay fed by three creeks—just like the study site.

3. ARCHAEOLOGICAL FINDS.

The site is clearly a large Contact-era community with ties to Jamestown. For instance, copper recovered at Werowocomoco has been chemically matched to Jamestown copper.



IN 1607, THE POLITICAL, RELIGIOUS AND ECONOMIC AUTHORITY OF THE CHESAPEAKE REGION ALL RESTED IN A SINGLE PLACE: WEROWOCOMOCO.

occurred at Wero because it was the seat of power. In fact, the standing description of Powhatan's capital at the Werowocomoco Research Group is "a place of power." Think of it this way: The White House is

in Washington, the Holy See is at the Vatican and Fort Knox is in Kentucky. In 1607, the political, religious and economic authority of the Chesapeake region all rested in a single place: Werowocomoco.

"When Jamestown was settled in 1607, Wahunsenacawh—Powhatan—is the regional power," Gallivan said. "In the early days of the colony, when the colony struggled to feed itself and to establish its place in the region, Powhatan controlled affairs across the Chesapeake region. It obviously changed in the early 17th Century, but in the early days, it was Powhatan who decided when and how much to feed the English colonists and whether or not they would be allowed to continue to live in the area."

It was inevitable that John Smith would meet the great king. The meeting didn't take long to come about. In December, 1607, just a few months after the colony's founding, Smith was carrying out one of the colony's missions by exploring the Chickahominy River as a possible route to the Pacific Ocean. He had gotten separated from his men and was found—stuck in the mud—by a force led by Opechancanough, brother of Powhatan and a Pamunkey weroance in his own right.

Opechancanough took Smith on a circuitous route through the region, ending up at Werowocomoco. Smith wrote up accounts of his captivity and subsequent encounters with the natives. The parts of the memoirs centering on Smith and Pocahontas have served as the basis for movies, popular literature and countless thousands of grade-school pageants. Taken

as a whole, accounts from Smith and other Jamestown colonists are a primary historical record of the people of Powhatan. It's only in the 21st Century that Werowocomoco began to tell its own long, mysterious and distinguished tale, a story that predates Powhatan and is beginning to offer glimpses of a place that has held significance for centuries.

Wero occupies a peculiar place among ancient native town sites: we've known about it long before it was rediscovered. And, as Danielle Moretti-Langholtz, a cultural anthropologist at William and Mary and a specialist in Native American communities, points out, "We actually have the name for the place in the Powhatan language."

"That's right," Gallivan seconded. "The folks that lived at Cahokia didn't call it Cahokia. The folks that lived at Pueblo Bonita in Chaco Canyon didn't speak Spanish."

GETTING PAST POCAHONTAS

Werowocomoco began to come out of hiding in 2001. Lynn Ripley had collected an impressive amount of artifacts on her farm, which led to a survey of the property by archaeologists from the Fairfield Foundation. As the Purton Bay site became an increasingly likely candidate for the location of the legendary capital city of the mamanatowick, Gallivan consulted Moretti-Langholtz on how to involve the native community, many of whom are descendants of the Powhatans.

"We decided that instead of having the native community wake up to a newspaper story that said Dr. Gallivan is going to be working on this site that we think is Werowocomoco, let's bring them in before we begin work," Moretti-Langholtz said.

Representatives of the eight state-recognized tribes were invited to a meeting at William and Mary during which Gallivan and others explained their intentions and asked for reactions. As a follow-up, Moretti-Lang-

holtz arranged with Bob and Lynn Ripley for the tribal representatives to visit the site in February, 2003.

"We learned a lot that day, as archaeologists, about what the Powhatans were intrigued by, what they were interested in, what they wanted to know. There were some directions they pushed us in that were different from where we might have headed on our own," Gallivan said. "For example, they expressed an interest in the long-term history of place, the history of that location. Not just the events of 1607, 1608 and 1609 involving personalities such as Pocahontas and John Smith—they're intrigued by that history, as are we all. But they are just as interested in the decades and centuries leading up to 1607—what happened in the years prior to 1607 to make this place Werowocomoco, to make it the place of the king, the place of the chief.

"I took that to heart," Gallivan said. "That was not at the top of our list going into that meeting, but it was at the top of our list coming out. It shaped the direction of our research in a positive way."

Work began in earnest in June, 2003, as a project of the College's Archaeological Field School, consisting largely of students from the Archaeological Field Methods class. Excavations soon revealed that Werowocomoco was an old place. In comparison with Jamestown and other sites in the history-laden Tidewater, Werowocomoco, Moretti-Langholtz notes, is "fully a native story." If the history of the town were compressed into a 24-hour day, Pocahontas would come along in the final reverberations of the last stroke of the clock sounding midnight.

"The location of Werowocomoco has been occupied for several millennia," Gallivan said, "but there's an abrupt change around A.D. 1200 where we start to see evidence of a large, fairly permanent community in the location. We see evidence of houses, pits, pottery, stone

tools and these sorts of things in fairly large numbers starting around A.D. 1200."

These relics of everyday life came from stratified deposits near the river, and are typical, Gallivan says, of other native communities of the time—"a fairly large community of corn, beans and squash farmers." The researchers have unearthed similar evidence of a residential community up to about 1,000 feet back from the riverbank, where the findings stop and an empty space begins. Where the empty space ends, things get very interesting.

THE PUZZLE OF THE PASTURES

"Behind that empty space, we found an area that we refer to as the Pastures," Gallivan said. "It is demarcated by a set of ditch features, earthworks. We haven't exposed them in their entirety, but they seem to form a kind of enclosure a thousand feet back from the riverfront—away from the residential community."

There are two parallel earthworks, each about two and a half feet wide and two feet deep. The field team has exposed over 600 feet of the front side and they're still going. Gallivan said that ditchworks are not uncommon in native communities in Tidewater. In some places the ditches surrounded palisades, other times not, but the Werowocomoco ditches are unusual.

"Something like this that's 600 feet on one side is unheard of," he said. "It's gigantic. It's unique in the area. It's incredibly large—and also separated from the core of the community."

Work in the Pastures has also uncovered the remains of post-hole architecture, with at least one hole that dates from 1600. Even the pottery found in the Pastures is different from the riverfront residential area. There is pottery from the Potomac River; from the James River—pottery from all over the coastal region, a strong

continued on next page

Werowocomoco Research Group

- DAVID BROWN DATA Investigations
- MARTIN GALLIVAN William and Mary
- THANE HARPOLE DATA Investigations
- DANIELLE MORETTI-LANGHOLTZ William and Mary
- RANDOLPH TURNER Virginia Department of Historic Resources

Virginia Indian Advisory Board

- JEFF BROWN Pamunkey
- KERRY CANADAY Chickahominy
- ASSISTANT CHIEF MARK CUSTALOW Mattaponi
- LEE LOCKAMY Nansemond
- CHIEF ANNE RICHARDSON Rappahannock
- REGGIE TUPPONCE Upper Mattaponi
- CHIEF STEVE ADKINS Chickahominy (ex officio)

From left: Aerial view of work in the Pastures; Jeff Brown (in cap), a member of the Pamunkey Tribal Council, works on the site with William and Mary student Brendan Burke. Brown was one of two members of Powhatan-descendant communities who worked at Werowocomoco.



A TRULY ALGONQUIN ROUND TABLE

There are eight state-recognized native tribes in Virginia. Of those eight, seven are descendant from the Powhatans. Six of the seven are represented in the Virginia Indian Advisory Board, which works with the Werowocomoco Research Group.

Members of the descendant communities are more interested in Werowocomoco as a place important within their own heritage than as an archaeological site, Danielle Moretti-Langholtz said.

"Their interest is more focused on the time period before the English arrived," she said. "This excavation is the one thing going on in the Powhatan world for which everyone has agreed to leave their differences at the door because everyone wants this project to go forward."

FINAL MARSHALL VOLUME IS PUBLISHED

They begin with the entry of a 20-year-old freedom fighter stopping in Williamsburg. They end, fittingly, with his epitaph.

The 12th and final volume of the *Papers of John Marshall*—a comprehensive edition of the chief justice's papers and correspondence—has been published, bringing to conclusion a project that started nearly half a century ago to document the life of one of the country's most famous jurists.

The 600-page concluding volume, which captures four years of Marshall's life until his death in July, 1835, is the last installment of a project that began in 1960 under the direction of Stephen G. Kurtz. Charles Hobson has served as editor of the Marshall Papers since 1979 and Joan S. Lovelace has been managing editor since 2000. The entire 12-volume collection will be housed at the William and Mary Law School Library, a fitting location since John Marshall attended the first law lectures given at the school by Professor George Wythe. The project has been housed in the law school for the past three years.

"There is a consensus among historians, with which I heartily agree, that the modern documentary editions constitute one of the great intellectual legacies of our time," said Ron Hoffman, director of William and Mary's Omohundro Institute of Early American History and Culture, which has co-sponsored the project with the College. "Within this tradition, the magnificent work accomplished by Chuck Hobson and his predecessors and associates in editing the *Papers of John Marshall* makes possible an informed understanding of how, under Marshall's leadership, the Supreme Court became an equal partner with Congress and the president in the government of the United States."

The 12 volumes, which have all been published for the Omohundro Institute by the University of North Carolina Press, include a comprehensive look at Marshall's correspondence and selected judicial and miscellaneous papers through his life.

The opening volume begins with Marshall's early life and the collection tracks Marshall's papers, correspondence and selected legal decisions over the course of his life. For example, the first document of the first volume is an entry Marshall made in a Williamsburg store in November 1775. At the time, Marshall was a 20-year-old member of the Culpeper Minute Men Battalion and had stopped in Williamsburg on his way to fight in the Battle of Great Bridge.

The final document of the most recent volume is a simple epitaph Marshall wrote for himself two days before he died on July 6, 1835.

"Two days before he died, on July 4th, he drew up his epitaph, which is a very brief and humble document," Hobson said. "It shows the simplicity of John Marshall. It gives the facts of his birth, the date of his marriage to his wife, Mary Willis Ambler, and that he was the son of Thomas and Mary Marshall.

Hobson added. "He left blank the date of his death, naturally."

The project began 46 years ago with a comprehensive search for Marshall's documents and papers. Historians explored documents, biographies and books that led them to holdings of manuscripts at institutions or libraries, such as the U.S. Library of Congress, the National Archives, the Virginia Historical Society, the Library of Virginia and the historical societies of Pennsylvania, New York and Massachusetts. Foreign archives, such as the British Public Record Office, were also searched. The Earl Gregg Swem Library at William and Mary also provided a small collection of original Marshall documents that were either donated to the College by the family or purchased over the years.

"There was a systematic search undertaken in all of the major libraries," Hobson said. "There's also a

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By BRIAN WHITSON

Charles Hobson, editor of the Papers of John Marshall since 1979, stands in front of Marshall's portrait at the William and Mary Law School.



Randy Searle

THE JUSTICE ON EBAY

As technology improved over the past several decades, obtaining copies of documents related to John Marshall became easier with the assistance of the Internet and online auction Web sites such as eBay. In fact, project editor Charles Hobson said publication of the final volume was delayed because more and more documents were turning up online. Sometimes, Hobson would only have to go to the eBay link that included an image of the document and print off a copy. Other times, he said, the auctioneer would gladly send a copy for the Marshall project.

"There are a number of documents in volume 12 that were obtained in just that way," he said. "Sometimes, it was literally 'Hold the presses,' because we would get wind of another document becoming available online."

Copper pieces, worked by the Powhatans into ornaments, have been chemically linked to Jamestown trade copper.



Tim Jones



Top: Working carefully below the plow line.

Center: Gallivan and Moretti-Langholtz examine some of the thousands of artifacts yielded by the site.

Lower: Sifting tons of dirt is a tedious, but necessary, task of archaeology.

indication, Gallivan says, that goods were being moved into the site. There is also copper, a much rarer find down near the river:

"We found 20 pieces of copper that have been chemically matched with Jamestown copper," Gallivan said. "Eighteen of the pieces come from the Pasture. Two come from the riverfront. So there's a pretty big imbalance there. Copper is, of course, a key trade item between the Jamestown colonists and the Indians. Copper has enormous significance for the Powhatans. It's a high-status item. Those who wear it and those who control it have elite status in the Powhatan world."

Gallivan refers to the documentary accounts of John Smith and to the practices of other native cultures to make a preliminary interpretation of the findings in the Pastures. There were the narratives of meetings with Powhatan, of course, and Smith also had described the physical layout of Oropacks, the village near the Chickahominy headwaters where Powhatan made his home after abandoning Wvero.

Smith's description of Werowocomoco has Powhatan's house separated from the rest of the community and was situated "thirty score" from the riverfront. "A score is twenty," Gallivan said. "Twenty what? Is he referring to paces? To feet? It's unclear in the text, but that reference to the layout of the community emphasizes that Powhatan's house was separated from the rest of the community and we're seeing something in the archaeological record that parallels that."

Smith was a little more detailed in his description of Oropacks, placing Powhatan's house in the woods, a mile from the rest of the community. In this house Powhatan kept his copper, shell beads and deer skins that he was given as tribute.

"It was a place that could be described as a storehouse, a sacred space, a treasury—all those words could apply to that. It was a place where only Powhatan and his priests could attend to," Gallivan said.

Were the Pastures the site of another, maybe larger, storehouse-treasury-sacred space? For Martin Gallivan—who is, after all, a scientist—there's not enough evidence to say definitively.

"We've got different kinds of pottery, different kinds of space, and documentary references that

those kind of spaces were associated with leaders and with sacred activity," he said. "So it's kind of a circumstantial case."

There is a certain amount of evidence pointing to Werowocomoco's role in the spiritual life of the Powhatans, as well. Smith underwent an examination ceremony conducted by a Powhatan priest, whom he described as a "great, grim fellow," before being allowed into the presence of the great king. Historical documents also tell of the huskanaw, a male rite of passage ceremony among the Powhatans for which members of many communities would travel to the chief's house. A similar practice exists among another Algonquin group.

"The Delaware Indians had a Big House ceremony annually in the chief's village in which members of a number of different communities would get together," Gallivan said. "They would feast, they would dance, they would pray and hold a series of rites over a series of days in this special location. The archaeology we're seeing at Werowocomoco matches those sorts of activities."

WITHER WEROWOCOMOCO?

As an archaeological site, Werowocomoco is not only huge, but also disbursed, with dwelling sites spread across 50 acres. Gallivan and Moretti-Langholtz concur that excavation and cataloging of evidence still buried in the riverfront community and the Pastures represent a lifetime of archaeological work.

"We really have a tremendous opportunity here," Gallivan said. "The site is intact. It is in great shape archaeologically. It is owned by one family, Bob and Lynn Ripley, who have been very amenable to the archaeological research. They've opened their door to the Virginia Indian community. They've been really fantastic."

As the site is worked, conversations turn to the future of Werowocomoco, when the focus shifts from excavation to interpretation of the site and what it has revealed.

"It's not yet clear what the site and its post-excavation profile could be in terms of presenting the complexity of native culture," Moretti-Langholtz said. "I don't know if we're close to the day where we can see Werowocomoco as an interpretive site rather than an archaeological site, but I would love to see that happen. But that can't happen without the archaeological work and it can't happen without our native partners. I think that day will come and the landowners seem to know that that is a key future component of the site."

COMPOSE, YOURSELF

COMPUTERS CAN REMOVE THE DRUDGERY, BUT CAN'T REPLACE MUSICAL CREATIVITY

Cindy Baker

By KATHERINE HOVING

Strange bedfellows? Sometimes, but it's better to think of technology and music as dancing partners—the kind of dancing partners that take turns leading.

Consider, for instance, the case of Beethoven's piano sonatas, which not only evolved as the instrument changed, but which also served as significant agents themselves in driving the evolution of the modern piano-forte. There's even a report of Beethoven cracking in half a piano that was insufficiently evolved to stand the strain of his chords.

A similar co-evolutionary dynamic has been developing since the advent of MIDI in the 1980s. MIDI, an acronym for musical instrument digital interface, is a communications protocol that allows electronic musical instruments and computers to communicate. MIDI has increased the tempo of the technology-music dance to allegro or presto. For those who know computers—Sophia Serghi or her music, it should come as no surprise that this native of Cyprus, who thrives on musical and physical challenges, is pushing the envelope in using the latest technology in her teaching and composing.

Serghi, the Robert F. and Sarah M. Boyd Distinguished Associate Professor of Music at William and Mary, hasn't broken any pianos, but her compositions often have an intense physical element. Her chamber work has been performed in biking gear, the performers keeping Gatorade nearby to maintain their stamina. Compositions such as "X-Games," for piano and orchestra, which is based on extreme sports, and "Jet-Skis" for flute, clarinet, violin and cello, are among Serghi's numerous award-winning works, which display a tendency to be visceral and rhythmically complex, often combining multiple media.

SCORE ONE FOR FILMS

Lately, Serghi has been using the new Swem Media Center to teach Introduction to Film Scoring. She and her students are some of the most regular customers of the center's largest studio since it opened in January.

"I've always been interested in writing music for films and I've done documentaries in the past and lots of theatrical plays in Greece and Cyprus and Europe in general," Serghi said.

Last summer she attended the prestigious NYU/ASCAP Foundation Film Scoring Workshop; only 10 applicants are selected each year. Serghi spent two weeks using the latest technologies and being coached by the top film scorers in the country. She came back to Williamsburg determined to do something similar here.

"The timing could not have been more perfect, actually, because of the new media lab and the director, Troy Davis," she said. "He has really pushed and brought this into existence and, lo and behold, we have a state-of-the-art studio."

Music and technology stepped out on the dance floor when Serghi met Davis, who came to William and Mary from the University of Tennessee. She drew up a list of software needed for her new class on film scoring and then was shown what Davis had already ordered. "And I'm checking every single thing on my list, and it's exactly the same things he had," Serghi recalls. "And I said, 'Good. You're hiring the right person.'"

Most of the students come to the film scoring course with some experience. Serghi accepted only 10 students in the first semester the course was offered.

Some of the students come from film studies and some from music. Four are freshmen.

"It's a very competitive course to get into because you obviously have to have previous musical experience and have some compositional skills and orchestration craft and so forth," Serghi says. "These students came in with a lot of skills. Nowadays there is so much software available to them that they can pretty much do everything in their rooms. It's just wonderful, though, to have the media lab for them to experiment with new high-end applications that would cost a lot of money and they otherwise wouldn't have."

FROM MIDI TO FULL ORCHESTRATION

The students have assignments each week to compose short pieces for film clips—ranging from blockbusters to avant garde works, such as Fernand Léger's 1924 "Le Ballet Mécanique." By the end of the semester, each student should have six small clips from various movies, with two- to three-minute orchestrations for each.

"We do a MIDI realization, in that what we hear in the classroom is all electronic, but they can generate a full orchestra score that's all written out," Serghi said. "So, if an orchestra comes and says we want to do your music, they can just generate the parts and it can go to the hands of real musicians."

continued on next page

Sophia Serghi might use three different keyboards to compose, but the end result is the same—talented students with more than a single creative point of view.

Click! An 8th note becomes a dotted 16th

Each student will choose a favorite to be played live—in a reading situation, not a finished performance—by the William and Mary Orchestra or the Wind Symphony. This opportunity will give the students the rare experience of cuing up a film to a live orchestra and conducting it, as Serghi did in New York.

Students composing pieces for the class can begin at one of three keyboards. There's the QWERTY one attached to their computer or there's the MIDI piano-type keyboard, which also can be plugged into the PC. There's always the standard 88-key hammer-and-wire piano that would be familiar to Beethoven. One student, Chris Cowan, doesn't use any keyboard, plugging a guitar into the computer instead. Many of her students are comfortable initiating their compositions at a computer; but Serghi notes that "when I first started it was pen, pencil and paper."

"Usually I sit at the piano," she said. "I know plenty of composers in the younger generation who just start at the MIDI, using a keyboard right at the computer. For me I'm very much a person who likes to sing to my music and play to my music, so I usually have a lot of sketches, handwritten sketches. The big architecture of the piece may happen on the keyboard, but the initial kernels happen on the piano."

Bay McLaughlin, a member of the class of 2006, is an example of one of the students in Serghi's class who has

mostly worked directly on a computer keyboard. He likes to "bend sound," using a professional program like Logic 7. He plays a few measures, which are immediately scored and ready for playback. Then with a touch of a key, a drag of the mouse, he can add notes, transpose or alter just about anything. Change a flute to a drum? Click—it's done. Make an eighth note into a dotted sixteenth? Click, drag—no problem.

"You can take any noise that's in your head and make it happen," he said. "You have just endless possibilities of the sounds you create; anything you want. A program like this goes so far past anything you can ever imagine in your mind. You can't get to a point where the computer won't do something. For me, that's about as cool as it gets."

In an atmosphere filled with powerful software and other high-tech whistles and bells, Serghi continues to emphasize the creative process and writing scores that support the visual message of the film. Additionally, there are still some issues in music on which technological advances have very little impact.

"I get frantic calls from parents occasionally—how is he going to make a living?," she says. "Out of the 10 folks that I have in my class, at least five are going to go to grad school in film scoring, and that's really what they want to do. Three of my current students are thinking of going on to grad school for concert composition."



Left: Troy Davis, director of the Swem Media Center, and Lord Botetourt. Center: Bay McLaughlin likes to use computer capabilities to "bend sound." Right: Sophia Serghi shows freshman Kate Buss how to add texture to her orchestration.



A NEW MEDIA CENTER

The Media Center, housed in the basement of Swem Library, just off the Botetourt Gallery offers the kind of set-up found in professional studios. There are five Macintosh stations with dual processors loaded with industry standard software. This is a place in which words like Finale and Allegro refer more often to notation programs than movements and tempi. GarageBand and Logic, Macromedia Studio and Final Cut

Studio are other powerful software are also available. The center opened in January 2006 and consists of 5 fully-equipped, acoustically isolated (Wenger V-Ready) Rooms and the Cox Viewing Room. The center can support a wide range of multimedia projects from pre-production through distribution. The center is open six days a week, and faculty, staff and students can book studios and rent equipment at no cost. Staff are also available to assist and give training on equipment.

Lessons from hurricanes

Hurricane Katrina wreaked havoc on the Gulf Coast of the United States when it made landfall in late August, 2005.

According to the National Oceanic and Atmospheric Administration's National Weather Service, the storm was the third largest to hit the United States in 100 years. Sustained winds of more than 140 mph brought catastrophic damage.

Two years before Katrina hit the Gulf, Hurricane Isabel blew its way across much of coastal Virginia and North Carolina. Isabel was no Katrina in terms of property destruction or strength—but she might have been much worse. Isabel was Category 2 storm at landfall but reached Category 5, the top of the Saffir-Simpson Scale, three times during her life out in the Atlantic Ocean. A Category 5 hurricane has winds in excess of 156 miles per hour and produces storm surge approaching 20 feet.

"Hurricane Isabel was a wake-up call for me," Harry Wang said. He points to a picture of a destroyed dock near his office at the Virginia Institute of Marine Science at Gloucester; a facility hit hard by Isabel's winds and storm surge. "That's my icon. That dock was standing there for a long time, but this one hurricane completely destroyed it."

Wang is an associate professor of marine science at VIMS. He studies coastal and estuarine physical process – in short, the way that water moves. Wang, along with other members of his Estuarine and Coastal Modeling Group (ECMG), studies the way water moves through the use of computational models. He estimates not only the ways water moves but also the quantity that moves and what the water takes with it when it flows—docks, for instance.

After Katrina, Wang and his colleagues wondered what Isabel might have been like if it had made landfall as a Katrina-strength storm. Much of the Katrina-related damage along the Gulf Coast was from flooding from storm surge. Wang said scientists haven't been focused on predicting storm surge and, he emphasizes, they should be.

"Ironically, from a scientific point of view we don't pay much attention to storm surge predictions," he said. "We think we know what would happen with a lot of water and a lot of wind, but we don't."

ECMG's research on coastal and estuarine physical processes includes studies on the effect of storm surge on low-lying coastal regions—how ocean waves interact with wetlands and barrier islands and man-made structures, such as levees and buildings. Wang said he was struck with how much of a difference even an inch—let alone a foot—of additional storm surge made in terms of damage.

"It's the difference between water at the front step versus flooding in your living room," he added. "That's one foot."

After witnessing Isabel's destruction first hand, the ECMG team began using their computer models to chart the impact of the storm's surge on areas around the Chesapeake Bay.

Through complex mathematics and state-of-the-art computer processing, they turned raw water level, velocity, salinity and water temperature data into graphic storm surge calculations. Wang is hopeful they can increase the accuracy of storm surge predictions from 3, 4 and 5 feet to 3.5 and 3.3—the more accurate the better.

Wang, along with his colleagues Jian Shen, a research assistant professor; and Wenping Gong, a visiting scientist, used the computational model to demonstrate the impact of a Category 4 hurricane on the Bay region, using the Isabel model as a platform. In essence the scientists put together a model with Hurricane Katrina on Isabel's path. The model showed that a storm the size and strength of Katrina would

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By SUZANNE SEURATTAN

Working with industry partners

To help fund research like Harry Wang's on hurricane storm surge effects and to identify where VIMS research may be the most useful, William and Mary's Office of Economic Development is working with local industry to pinpoint the most beneficial fields and research for industry goals.

The VIMS Industry Partners Group includes VIMS/SMS researchers and representatives from the corporate community. John Wells, VIMS director and dean, chairs the committee. Jim Golden, director of economic development, facilitates the meetings.

Through the Office of Economic Development, William and Mary actively supports collaborations not only with industry, but with non-profit organizations and government entities that serve the university's mission of teaching, research, and public service.

Professor Harry Wang



and they wintered *happily* ever after

RESEARCH, COUPLED WITH ADVOCACY, HELPS TO CREATE A PANAMANIAN SHOREBIRD PRESERVE

They come from all over North America. Buff-breasted sandpipers from the high arctic. Whimbrels and oystercatchers from Virginia's Eastern Shore.

Killdeer from Midwestern prairies. Red knots. Willets. Stilts, snipes and godwits. Greater and lesser yellowlegs. Wilson's phalaropes. More than 40 species in all.

Millions of migrating shorebirds use the rich, mangrove-fringed Bay of Panama as wintering grounds. For millions more the bay serves as a kind of Chicago O'Hare or Dallas/Fort Worth—an international air hub for refueling and maintenance en route to a further destination. Refueling, for many of the species studied,

means grazing for marine worms on the abundant mudflats. Others are sandflat specialists or like to forage in adjacent grasslands. Maintenance consists of replacement of worn flight feathers on the bay's molting grounds.

"This location is one of the more important areas for migrant shorebirds in the western hemisphere," said Bryan Watts, director of the Center for Conservation Biology at the College of William and Mary. "There are only a few places in the world that offer enough available energy to

support these huge congregations of shorebirds."

The wintering grounds and the birds they support have avoided a triple threat to their future, at least for now. In October, 2005, the Bay of Panama joined the Western Hemisphere Shorebird Reserve Network as a "Hemispheric Site." Research work and grass-roots education efforts by the Center for Conservation Biology helped to generate interest in the birds and their habitat among the local people, resulting in the Panamanian government's support of the shorebird reserve.

A PLAN, A CANAL, A BIRD MAGNET

The Bay of Panama is not only a shorebird magnet, it's also the Pacific entrance to the Panama Canal and the location of the nation's rapidly growing capital, Pan-

ama City. Watts and his colleagues began surveying the Bay's wintering grounds in 1997 at the request of the U.S. Department of Defense. The DOD was preparing for the 1999 turnover of the Panama Canal mandated by the 1977 treaty signed by President Jimmy Carter. Along with the canal itself, the Panamanians were to gain substantial DOD-administered lands and infrastructure on the Bay of Panama, including vast expanses of shorebird habitat.

"The Canal Zone was actually military land—and that was most of what was being transferred," Watts said. "The DOD was concerned that these lands might be vulnerable to fragmentation and all the development that's going on in central Panama, and so they felt like they had a bit of responsibility to make recommendations to the Panamanian government before they turned those lands over."

William and Mary's Center for Conservation Biology has earned a reputation over the years for excellence in conducting bird surveys, making it a natural choice to join the Smithsonian Tropical Research Institute and the Legacy Program of the Department of Defense to do a rapid ecological assessment of DOD lands before they change hands. Watts was joined by Dana Bradshaw and Bart Paxton, senior biologists at the CCB. Researchers sought to inventory numbers of birds and bird species and to get a handle on their distribution, specific habitat and ecological requirements. Studies by the CCB and others revealed that much of the relevant habitat was based on mangrove trees.

IT STARTS WITH MANGROVES

"Mangrove forests line these coastal areas. The trees drop leaves, the tide comes in and pulls those leaves out into the mudflat," Watts said. "The decaying leaves form the basis of the marine food chain. Without the mangrove forest you lose the engine that's driving the forage availability for the shorebirds."

The vast expanses of mangrove forests controlled by the Department of Defense had long been left undisturbed, but as the date approached on which the Panama Canal would become Panama's canal, the fate of the mangrove-driven wintering grounds seemed increasingly precarious. The mangroves were immediately vulnerable to development pressures from nearby Panama City as well as from shrimp farming operations.

GENERATING SUPPORT

"Throughout Central America, these companies—U.S. companies included—will come in and clear the mangrove forest," he said. "They'll dig out these large lakes, which they will use for shrimp farming. They last for about four or five years and then they just leave them. There's plenty of places on the coast of Panama where you see these huge routed-out places that are just abandoned now."

Grass-roots support among the citizens of Panama was necessary to keep the mangrove forests—and the birds they ultimately support—from becoming lost to bayfront condos and gouged-out shrimp farms. Funded by the Department of Defense, the Center for Conservation Biology produced a pair of brochures, "Migrant Shorebirds Within the Upper Bay of Panama." The brochures are identical twins, one in English and another in Spanish.

The Spanish-language brochure, distributed heavily in the Panamanian schools, was a huge success. Suddenly, everyone was interested in the shorebirds, having read about those chorlos, vuelvepiedras, zarapitos, agujetas, patiamarillos and others that visit their region each year.

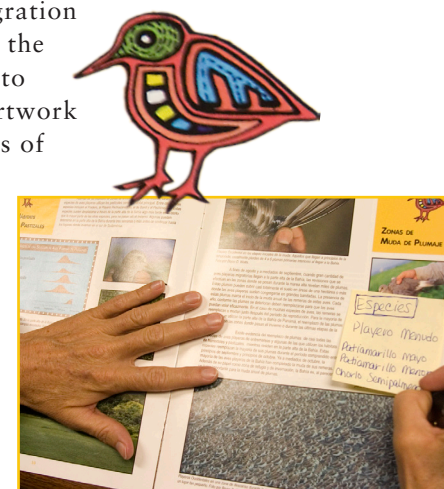
"The Panamanians have used that brochure to develop a lot of programs. That's what led eventually to enough popular support to encourage the government to sponsor the area's designation as a hemispheric site," Watts said. "It was important to get the government to sign on. If this international organization had just come down drawing lines on a map and saying we declare this to be a site of international importance for shorebirds and wetlands and other things, that by itself wouldn't have carried much protection within the country."



¡MIRA! ¡Un playero semipalmeado!

Center for Conservation Biology researchers told their story through booklets, printed in both English and Spanish. The publications were designed by Marian Urbi Watts featuring artwork inspired by "molas," traditional needlework panels sewn into their blouses by Panamanian Indian women. The western sandpiper (inset) is the dominant species passing through at the Bay of Panama, migrating from coastal Alaska down into South America.

People all along the sandpiper's migration route have told CCB personnel that the booklet's drawings are very similar to bird forms seen in the indigenous artwork of their own area. Several thousands of the Spanish-language brochures were circulated and Panamanian schoolteachers readily used the brochure in their classrooms. The colorful and informative pieces kindled widespread local interest in the birds and helped to generate support for the shorebird preserve.



Not all data collection was done "on the fly"—Bart Paxton collects birds from a mist net at dawn with the Panama City skyline in the background.



Dana Bradshaw, senior biologist at William and Mary's Center for Conservation Biology, speaks at the October, 2005, dedication of large expanses of the Bay of Panama as a hemispheric shorebird preserve.

By JOE McCLAIN

and they wintered *happily* ever after

BRYAN WATTS SPEAKS —

"We were flying surveys on an outgoing tide over a mudflat in Panama that is two kilometers wide, about 50 feet off the deck to flush birds up so that I can count and try to identify them. I've done a lot of that over on the Eastern Shore and you get up flocks that are maybe in the thousands over there. These were flocks that were in the tens of thousands, with birds getting up in front of the plane for an hour solid.

We're not only counting birds, but also mapping flocks. The way it goes down is that we have a flight map and it's broken up into segments and I have somebody in the back. So you're blowing through these birds at a hundred miles per hour and there's just waves of them getting up in front of you. It's not like you can just pull over and stop. You gotta keep the information out in front of you because if you get behind everything just falls apart. I tell the person in the back I want a site map here. He maps the site, and I give an assessment into a tape recorder. The guy in the back watches the map and tells me when we reach the end of the segment. It's difficult because we were counting not only shorebirds but also marine

birds. There are just thousands and thousands of pelicans down there and gulls and herons and all of these different groups. It's real intense business and you just have to stay completely focused in the moment to do it.

Most pilots don't like to fly down low like that, particularly out in the middle of nowhere where if you crash you are pretty much done. We had a really great pilot, Krish Persaud. Krish ran a little flight school. He had an instructor there—every time we'd come in, this instructor keeps asking to fly us. We didn't want to fly with him because it takes a while to break in a pilot, but one day Krish was going to be gone. So we fly with this new guy and I kept telling him to get down—fly lower, fly lower. We finally got down to about 50 feet and we turned up into one of these coves.

When you turn that plane, the wing tip is almost in the mud, you know, and all of a sudden—pop!—we took a whimbrel down the left side. We counted nearly three million birds and that was the only one we ever hit, but that pilot turned white as a sheet. After that, every time we'd come into the place, this instructor would go in the back and hide. He didn't want to have anything to do with us again.

Then we did a lot of hands-on stuff where we were catching birds, working with headlamps over tropical marsh at night. And you're getting covered with mosquitoes and you're trying to work the birds out and not think of all the fever and everything else that's going around. It was some real hard-earned stuff but we did it."

METHODOLOGY—FLY LOW, COUNT FAST



The pectoral sandpiper is a denizen of the upper Bay of Panama, where it feeds on insects and worms in mowed fields.



Wattled jacana



Wilson's phalarope

Photos by Bryan Watts, except where noted



Marian Ubbi Watts

Top: Wintering shorebirds in the Bay of Panama use habitat dangerously close to Panama City.

Bottom: Back on the ground, safe and sound, from left, Bryan Watts, Krish Persaud, Dana Bradshaw at Persaud's flight school.

The name comes from the Latin word for fortress. It's the Suda, a medieval compendium of information about the classical Mediterranean world, a reference used for centuries by scholars.

The most recent print edition of the Suda was published in Greek more than 70 years ago, but now the fortress is becoming more accessible, thanks to efforts led by a William and Mary professor to develop an Internet community devoted to Suda translation, annotation and discussion.

"The Suda itself is an attempt in the 10th Century A.D. by Byzantine scholars to gather as much information as they could about classical history and literature," William Hutton, associate professor of classical studies, explained. "There's also some Byzantine history and literature and some church-related or New Testament-related history—anything that they thought would be useful for somebody trying to become an educated person at that time. In that period the mark of education was to be able to write and speak as if you were from classical Greece, which in the 10th Century would have been 1,400 years in the past."

This 10th Century compilation of more than 30,000 entries was collected by educated people, and therefore, was written in classic Greek. Much of the Suda consists of scholia, explanatory notes or annotations added to the original ancient texts by ancient and Byzantine compilers. The modern definitive edition of the Suda, the one that sits on Hutton's desk, was compiled and edited by Ada Adler, a Danish scholar. Adler's five-volume work, published in installments between 1928 and 1938, is in classic Greek, of course. There's no comprehensive English translation of the Suda.

The Suda On Line grew from a series of discussions initiated by Hutton in 1998 on an e-mail list of classical scholars. There was immediate interest in the possibilities of a dynamic World Wide Web version of the Suda, a kind of never-ending virtual seminar in which translations are continually discussed and new information and interpretations introduced. A number of classics scholars were eager to join on. Hutton and several other organizers became managing editors of the project.

Currently, more than 100 people participate in the Suda On Line. Through the enthusiastic participation of Ross Scaife, editor of the Stoa Consortium for Electronic Publication in the Humanities, the project was able to get funding for some computer hardware and software experts to bring the Suda into the 21st Century, Hutton said.

"Our goal was to create a database of translation that's not fixed," he said. "The one disadvantage to the print version is that it's always going to be written just as it's printed. Nobody can change it unless they produce a completely new version. The Suda On Line entries are designed to be revisable and now our contributors are going to have that capability."

When it comes to scholarly translation, ancient texts are moving targets, subject to revision based on numerous factors such as new scholarship, fresh contexts and the discovery of previously unknown material. Therefore, scholars will never be "finished" with the Suda.

"Sometimes ideas change about how you should understand certain texts, certain literatures, and so forth," Hutton said. "Changing and revision is part of scholarship and should be reflected. On a regular basis, people will put the text in and translate it. Somebody else will come along and say, 'wait a minute—consider updating the text.'"

HOW IT WORKS

One day in early 2006, a handful of William and Mary undergraduates gathered in Professor Hutton's office to discuss progress on their Suda translations. Hutton logged into the Suda On Line and checked the assignment of Emily Rossow.

Emily was to translate the word "ἑθω," which became the "headword" in the Suda On Line entry. The entry also contains the Adler number, pinpointing the location of the passage in the Suda. It also gave the original sentence that contains the headword and translations for both. Emily's headword translation was "I am accustomed." The full translation adds a bit of context: "I do something out of habit. For example, '...being accustomed to Oineus' threshing-floor.'"

"It's an explanation of a mythological story that's featured in the Iliad," Emily said of her first Suda translation. "It's a little intimidating. This is the first time that any of our work is being published, albeit on line. It's still pretty exciting."

A note tells the origin of the entry (Homer's Iliad) and indi-

continued on next page

A fortress under siege

AN INTERNET
COMMUNITY
OF SCHOLARS
CHIPS AWAY
AT A
MAMMOTH
PROJECT

By JOE McCLAIN

A laptop and a place to sit allow William Hutton to work on translations of classic Greek text just about anywhere there is wireless access.

IT'S NO LONGER ALL GREEK

www.stoa.org/sol/

For all the seriousness of purpose, there is little marble-pillar solemnity in the Suda On Line, as is evident by taking a quick glance at the home page. The introductory text carries a sense of fun. References to Chrysippus, “the philosopher who left ‘em laughing” appear along with an impeccably correct, yet unostentatious, use of *hoi polloi* (not *the hoi polloi*, of course). And who could resist clicking on a hypertext link to learn why Akesia is a particularly bad name for a proctologist?

cates that there was a scholia associated with it. The name of the translator and date are listed, as well, as are keywords for reference.

Once a translation is submitted, vetting—an instant peer-review and annotation process—begins. Emily submitted her translation shortly before 5 p.m. on Feb. 6. As a new entry, it was assigned a status of “draft.” Within a few hours, her entry had been vetted by two managing editors of the Suda On Line, Catharine Roth and David Whitehead, who reviewed her work for accuracy, added notes and keywords and raised the vetting status to “low.” As additional editors review the translation, the vetting status is raised.

“A status of low usually means it’s been looked over and the editor can’t see anything wrong with it,” Hutton said, “but we only raise an entry to ‘high’ status after review by a scholar who is expert in the field.”

Not all Suda translations, even those assigned to undergraduates, are quite so straightforward. Kenny Bumbaco, another of Hutton’s students, submitted an entry of a word that could be translated as “was lacking,” or “was soaking,” or that in another sense could mean “was satisfied,” “was gladdened” or “got wet.” If that’s not enough freight for a single word to carry, a note from one of the vetting editors pointed out, among other learned things, that the word “occurs seven times in Homer (always in the formulaic phrase ‘did not lack an equal feasting-share’)”—and also cautioned that “got wet” glosses a different verb.

A DEMOCRACY AND AN ARISTOCRACY

As a community, the Suda On Line is at once a democracy and an aristocracy. The number of classic Greek scholars is small enough to meet the definition of an elite group, while the vetting process serves a

winnnowing function for translations (and translators) that is at least as thorough as the one found on Oineus’ threshing floor. The Suda On Line’s democratic qualities become evident in a glance at the list of contributors. There are Americans and Europeans. The Ivies are well represented, of course, but so are community colleges and even public school districts. Grad students contribute, as do holders of ancient distinguished chairs.

Of course, there is room for undergraduates, especially at William and Mary. In fact, Jennifer Benedict, one of the project’s most prolific translators, began her work as an undergraduate at William and Mary. She is now a graduate student at the University of Virginia and has more than 4,000 Suda On Line translations to her credit.

Like Bumbaco and Rossow, most of Hutton’s student contributors to the Suda On Line had taken Latin in high school, but received their introduction to the language of Socrates here in Williamsburg. Classic Greek, of course, differs at least as much from what is spoken today on the streets of Athens as modern English differs from the vernacular of the age of Beowulf. (Hutton, in fact, said he had to learn Greek all over again in preparation for a trip to the Aegean.) The Byzantine scholars who compiled the Suda couldn’t use their everyday Greek in their work, either.

MAKING PROGRESS

The Suda On Line’s home page bears a counter that shows progress of the translations, but it only includes passages that have been assigned. Hutton says that about 60 percent of the full body of Ada Adler’s five-volume opus has been translated and he expects all the entries to be translated in three or four years, given the present rate of work. Once the initial translation is complete, the logical next step might seem to be to print an English-language version of the Suda.

“That idea has been brought up but the general response to most of us involved is, why? One of the main benefits of the Suda On Line is that anyone with access to the Internet can use it. That’s not the case with *this*, and not the case with *this*,” Hutton said, hefting two of Ada Adler’s five volumes.

Undergraduates working on translations of the Suda (from left) Kenny Bumbaco, William Travis Hall and Emily Rossow discuss their progress with Professor William Hutton.

two ways of looking at things

JOSHUA ERlich USES AN EXTRA DIMENSION TO EXAMINE THE FORCE THAT BINDS ATOMIC NUCLEI

Let’s start at the beginning.

Traditional physics has long identified four forces. Everyone is familiar with gravity and electromagnetism. Less well known (except among physicists) are nuclear interactions known as the strong force and the weak force, which is seen in particle decay.

This is a story about the strong force, but ends up involving all four fundamental forces. The strong force is what binds protons and neutrons together in the nuclei of atoms. A theory called quantum chromodynamics (QCD) describes how the strong force operates.

Joshua Erlich, assistant professor of physics at William and Mary, is one of the authors of an article, “QCD and a Holographic Model of Hadrons,” which outlines a proposal for modeling certain aspects of quantum chromodynamics in five dimensions. The paper, published in the journal *Physical Review Letters*, bolsters physicist Juan Maldacena’s connection of QCD with string theory. String theory, in effect, holds that the four forces—gravity, electromagnetism and the strong and weak interactions—are manifestations of the same thing.

“What Maldacena showed was that if you have a theory which looks in many ways like quantum chromodynamics, but not quite, that there’s another way of looking at it which is exactly equivalent,” Erlich said. This dualistic way of looking at things is called holography.

“It’s the idea that a surface with a smaller number of dimensions might contain all of the information to describe another kind of world which has more dimensions in it,” he explained. String theory, Erlich said, works in ten dimensions: nine spatial dimensions, plus time, although for his work only four spatial dimensions (plus time) are important. Our day-to-day existence takes place in a world of three spatial dimensions. Add time, and ours is a four-dimensional world.

In their paper, Erlich and his co-authors outline a way to construct a holographic twin of quantum chromodynamics. The proposed holographic twin is a five-dimensional description of the same strong-force interactions illustrated by quantum chromodynamics in our everyday four-dimensional world. The five-dimensional twin is, essentially, another window through which to view the strong interactions, although holographic duality also has implications for string theory.

The strong and weak interactions and electromagnetism all are governed by the same set of principles under what physicists know as the Standard Model—but gravity doesn’t fit.

“Gravity is the strangest of all the forces, meaning we understand it the least,” Erlich said. “The only quantum theory which seems to work that includes gravity together with other interactions is string theory.” He explained the higher dimensional gravity of string theory makes itself known through holographic duality, in the form of particles that exist in its four-dimensional twin.

“The holograph is a completely different world which has gravity in it and it has more dimensions than the three spatial dimensions in our world,” he said, “and they’re exactly equivalent.

“It’s just not obvious that these two worlds are the same,” he continued. “Anything you can calculate in one you can calculate in another. There’s a dictionary between how to calculate things in one world and things in the other.”

This dictionary, or map, between the two worlds has allowed physicists to make a number of discoveries regarding the nature of the strong force, Erlich said, through a property known as chiral symmetry.

“This symmetry maps onto a set of interactions in the extra-dimensional world which is dual to the strong interactions,” Erlich said. “So now we input the physics and we ask what comes out.”

What has come out, at least so far, is that predictions of the mass of certain particles made in the five-dimensional world are accurate to “real world” measurements within 10 to 20 percent.

“If you tell a string theorist that you predicted something in the real world to 10 percent accuracy, he’ll get very excited because it’s very difficult to make physical predictions from string theory,” he said.

Erlich explained that tests of the accuracy of the model make it a good candidate for work such as calculating masses of mesons and predicting the interaction between particles.

“The physics of this is difficult to study from the perspective of quantum chromodynamics but easy to study from the perspective of this higher dimension,” he said. “It’s really a great tool. It would be even greater if we could understand why it works so well. If we trust it and then just follow our noses it makes really nice predictions.”

By JOE McCLAIN

A SURFACE WITH A SMALLER NUMBER OF DIMENSIONS MIGHT CONTAIN ALL OF THE INFORMATION TO DESCRIBE ANOTHER KIND OF WORLD WHICH HAS MORE DIMENSIONS IN IT.

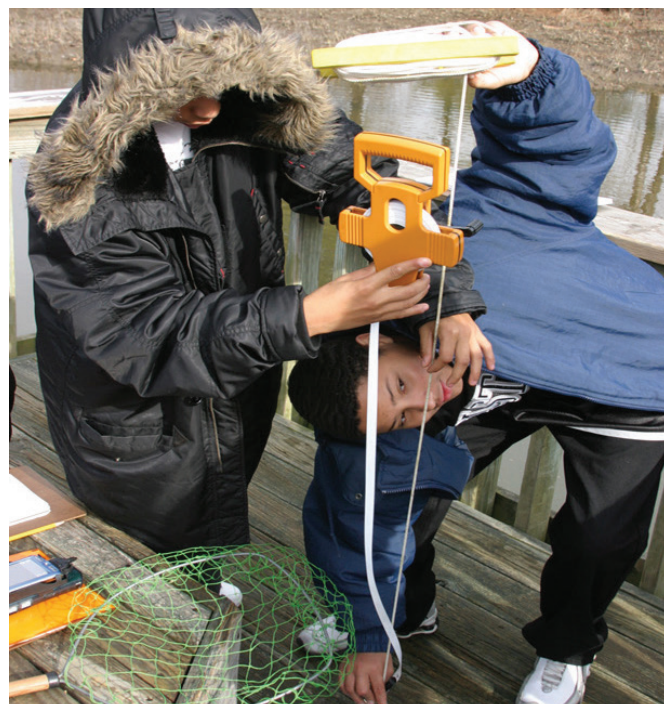


Joe McClain



Joe McClain

William & Mary physicist Joshua Erlich is helping to unravel the knotty intricacies of string theory using a holographic twin model of quantum chromodynamics in four spatial dimensions—plus time.



doing what scientists do

By BRIAN WHITSON

Alex Jimmerson and Marquise Wilson, students at Williamsburg-James City County's Center for Educational Opportunities, prepare a Secchi disk before dropping it over the pier at College Creek.

photos: Brian Whitson

It was a chilly December morning at College Landing Park as Devon Sabb and his classmate Alex Turner worked together to lob a large black-and-white disk over the pier railing.

Attached to a rope, the disk— called a Secchi disk— is a standard research tool used to determine water clarity. You lower the disk until you can't see it, then record the depth of the rope from the surface. Devon and Alex were among a group middle-school students studying the waters that are part of College Creek.

Later, the students collected water using a device called a Secchi tube, fishing up water samples from bottom of the creek. Using electronic probes, the team collected data such as water temperature and pH balance and plotted the information on spreadsheets in their hand-held personal digital assistants.

"It's like a little puzzle," said Devon, who is a middle-school student at Williamsburg-James City County School's Center for Educational Opportunities, the school district's alternative education program. On this day, Devon and his classmates were deciding who was going to be first to use the cool stuff that allowed them to learn more about the Chesapeake watershed, which includes College Creek and Lake Matoaka.

"We've got all these gadgets and I think the point of this field trip is to have fun," said Devon, who was one of a dozen or so middle-school students who took part

in the field trip. "It's also work out here, but if you put your mind to it you can do a lot."

The field trip may have been fun, but the point of the morning spent at College Landing Park was for the middle schoolers to discover the rudiments of aquatic research while William and Mary's graduate students in education gain insight into how to incorporate field work into a science curriculum. This program is part of a partnership with the School of Education and the Keck Environmental Lab at the College of William & Mary.

"I think this gives a student a real taste of what being a scientist is all about," said Tim Jones, a William and Mary graduate education student who plans to teach science. Jones spent the morning with the students and is doing his graduate thesis on the project.

"This gives them a learning environment they may be more suited to," Jones added. "I know I love the outdoors and I hope when I'm teaching I'll be able to take my students outside into the field as much as possible."

The project – called Lake Matoaka Studies– was initially developed by Nancy West, who is the science education coordinator for WJCC Public Schools. West

A PARTNERSHIP WITH PUBLIC SCHOOLS CREATES A SORT OF LAB WITHIN A LAB




From left: Tim Jones, a graduate student at William and Mary's School of Education, works with CEO student Daron Faltz (right) as part of a project to study the water conditions of College Creek; CEO student Devon Sabb lobs the Secchi disk off the pier; CEO students Sedrick Jackson and Tony Peters sample the waters of College Creek using a Secchi tube as Nancy West (right) science curriculum coordinator for Williamsburg-James City Schools, observes.

said the project represents the ultimate collaboration among colleagues in different disciplines.

The project provides the students a unique opportunity to combine several subjects – science, technology, math and language arts. Using the electronic probes and the hand-held computer devices, the students examined a number of aspects of College Creek such as water temperature, water depth, current flow and cloudiness.

The students are documenting their work with digital cameras and also are writing papers on their experiences in the field. Later this spring, West said, the students will spend a few days at William and Mary's Keck Environmental Field Lab so that they can compare the data collected on College Creek to conditions at Lake Matoaka.

"We always try to keep the students engaged in what they are learning," said Trisha Farinholt, a middle-school reading specialist at CEO who received her master's in education from William and Mary in 1989. "We're combining so many subjects with this project and it gives the students an unusual opportunity to work in the field." 

Unusual project; unusual opportunity

"This project is pretty unusual," said Nancy West, science education coordinator for Williamsburg-James City County Public Schools. "That's one of the reasons why I wanted to invite William and Mary graduate students to participate."

Most of the equipment was purchased with a \$4,000 Dominion Education Partnership grant. Other equipment for the project was loaned by William and Mary's School of Education. The goal is to bring CEO students to William and Mary's Keck Environmental Lab four times a year.

"While our students get an opportunity to learn using this cool technology, future teachers at William and Mary get an opportunity to see how it can be integrated into the classroom," West said. "We have very close connections to the College and I think that benefits our students as well as their students."

A Microscope



Cindy Baker

MATHEMATICAL
MODELING
IS A POWERFUL
WAY TO DESCRIBE
AND PREDICT
NATURE

When Sebastian Schreiber talks about his work, he uses quite a few references to rock lyrics.

He has a PowerPoint presentation titled “Living in the variable world,” a nod to a hit by Madonna. Schreiber, distinguished associate professor of arts and sciences at William and Mary, uses quantitative methods to explain and to predict many complex interactions observed in nature.

Seen through the lens of Schreiber’s mathematical models, our world is a mosh pit of variability. For instance, consider just a single variable factor; tempera-

ture. “If you want to know how temperature affects a certain organism, you’d ask, ‘Well, where is the organism?’—because its temperature varies across space,” Schreiber said. “And when were you looking at the organism?—because its temperature varies across time. Of course, there’s variation among individuals, as

well.”

If you study enough individuals or record enough temperature readings, you end up with a reliable data set from which to base a model. The concept of “variability” would seem to imply “unpredictability,” but not to a mathematical biologist. Schreiber uses different forms of variation to reveal insights about the way diseases spread through human populations or the interactions of predator and prey species. The rock lyrics help to frame some of his findings.

“When I talk about populations persisting and evolving in a variable environment, I use a Clash song because the basic question that every organism is facing is, Should I Stay or Should I Go?,” he said. “After all, one might be better or worse. Moving across space influences how fit the population is. For example, if there’s variability only in space, individuals that move less displace those that move more—in other words, the tortoise beats the hare.”

LOOKING AT SUPERSPREADERS

Schreiber says he is still looking for a lyric to illustrate his work on disease outbreak. The journal *Nature* evidently didn’t care; Schreiber was a co-author of

a Numbers

By JOE McCLAIN



Illustrations by Lillian C. S. Selby’06

Counterintuitive like a fox: Schreiber’s models predict instances (left) in which prey aggregate in low-quality habitats, finding less food, but also fewer predators.

a paper published in 2005. It proposed a new way of looking at contagious disease outbreaks based on variations in infection rates among individuals, and especially the role of “superspreaders.”

The *Nature* paper examines the phenomenon of superspreading from data collected during eight disease outbreaks, such as the Asian severe acute respiratory syndrome (SARS) incidents of 2003, which made “superspreader” a household word. The diseases studied included pneumonic plague, measles, smallpox and monkeypox, all passed from human to human with no vector in between.

Variability turns out to be a crucial epidemiological concept, Schreiber said, because mathematical modeling shows that the degree of variability can predict how the disease is likely to spread.

“Data sets on SARS and Ebola illustrate that diseases can exhibit different degrees of variability in infectiousness,” he said. “For SARS, the average infectiousness is achieved by many individuals infecting no one and a handful of people infecting many others. In contrast, for Ebola, the average infectiousness was achieved by most infected individuals infecting the same number of people.

Diseases that exhibit more variability are less likely to give rise to an outbreak, Schreiber explained. “However, when an outbreak does occur in a disease with more variability, it tends to spread like wildfire through the population.”

High-variability diseases, therefore, tend to erupt in surges, he said. SARS, for example, probably appeared in many locations but did not always progress to an outbreak, because it is one of the more variable diseases.

“But in the places where it did outbreak, it did so very quickly, very explosively, with a lot of people getting infected very quickly,” he said. The principles outlined by Schreiber and his co-authors could apply in the case of an outbreak of avian flu among humans or, indeed, any variety of flu.

“Our article is relevant to influenza,” Schreiber said. “It’s relevant for any disease that’s transmitted easily

from individual to individual—what we term diseases of casual contact—including the common cold.”

HIGH RELEVANCE

This versatility is one of the prime benefits of mathematical modeling. Just as one size never fits all, one formula won’t cover each and every situation, but, as in the casual-contact disease studies, a model can be tweaked to suit circumstances reasonably similar to those presented in the data set.

Another example of the versatility of variability comes from Schrieber’s examination of the co-evolution of predator-prey-habitat relationships, which he said are applicable to a range of predators that includes—but is by no means limited to—parasitic wasps, wolves, even herbivores “preying” on plants.

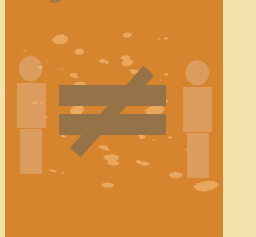
Schreiber addressed the effects of predator “handling time”—the time from which the predator catches prey until it begins looking for another meal—in another paper published in 2005 in the *Proceedings of the Royal Society*. The paper investigates how handling time causes the aggregation of predator and prey species in patchy habitats.

“The song on that is Running with the Devil by Van Halen,” he said. “If you think of the predator as the devil, there are some conditions in which the prey actually will go to places preferred by the predator—so they’re running with the devil.”

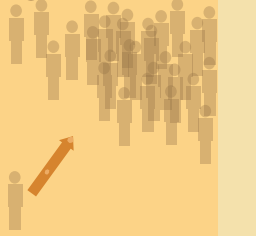
Not all prey choose to run with the devil. Sometimes prey will avoid high-quality patches where there’s a lot of food and/or better conditions for breeding, choosing patches with a lower quality of life—but fewer predators, he said.

“And the predator will spend most of its time searching for the prey in the high-quality patches despite the fact that most of the prey are in the low-quality patches,” Schreiber explained. “So they’re doing things that sound quite counter-intuitive at first glance, but not really, because the prey in the low-quality patches are effectively trying to escape the predator and the predator in the high-quality patches are hunting a few prey items, but they’re of higher quality.”

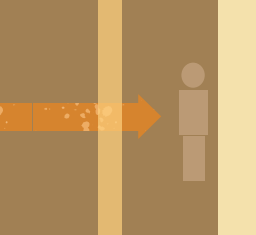
diagnostic error



high contact rates



co-infection



Three of the most common causes for superspreading: Misdiagnosing the illness was instrumental in the SARS outbreak. An infected person in a crowded room can be bad news, while a second, less-contagious illness can increase coughing and sneezing.

Zero variability (top): Ten people get a disease and each infects two other people. There’s no variability in that case because everyone’s infecting two other people. Variability ≠ zero (below): Ten people get a disease. Eight of them infect no one else but the other two infect ten people each. The average infection rate is the same, but the variability is different.

College shows moderate growth in sponsored research dollars

Research funding at the College of William and Mary is on a moderate increase, according to the 2004-2005 Annual Report of Sponsored Programs released by the Office of Grants and Research Administration.

Grants received for fiscal '04-'05 totaled \$43.2 million, up from \$41.2 million posted the previous period. The figures represent external funding for research by faculty at both the Williamsburg campus and at the Virginia Institute of Marine Science.

"The overall trends continue upward," said Michael Ludwick, director of sponsored programs in the grants office. "We had a one-year bump with a couple of big awards in 2003, then we went down to something like normal in the next year."

Ludwick pointed out other funding trends revealed in the report. Research expenditures, for example, followed the same upward path as the awards, totaling \$43.9 million in '04-'05, up from \$41.5 the previous year. Also increasing are the numbers of grant proposals, requests for financing, handled by the grants office.

"The grant proposal trend line is going up; that doesn't mean that we'll necessarily get all those awards, but pro-

School/department funding breakdown

	FY 2005	FY 2004
Faculty of Arts and Sciences	\$12,341,053	\$15,068,111
Arts & Sciences	N/A	2,000
American Studies	45,000	203,650
Anthropology*	138,143	843,848
Applied Science	1,622,953	4,654,810
Biology	1,043,911	1,708,514
Center for Archaeological Research*	543,998	N/A
Center for Conservation Biology	382,048	486,411
Chemistry	660,687	580,788
Classical Studies	N/A	30,000
Computer Science	1,334,874	574,290
Economics	N/A	275,016
English	N/A	100,000
Geology	816,876	598,881
Government	328,764	163,648
History	110,523	65,350
Kinesiology	328,593	108,100
Mathematics	425,422	257,523
Physics	3,439,863	4,232,346
Psychology	517,919	356,936
Religious Studies	10,000	N/A
Sociology	15,000	33,200
Theatre, Speech and Dance	15,400	13,627
Thomas Jefferson Program in Public Policy	545,771	266,403
W.M. Keck Environmental Field Lab	15,308	N/A
School of Business Administration	19,983	1,900,150
School of Education	5,058,248	4,893,860
School of Law	583,139	70,950
VIMS	23,317,061	16,829,787

* 2004 figures for the Department of Anthropology include the Center for Archaeological Research, which has its own category in 2005.

posals and awards do tend to follow one another," Ludwick said. Funding sources in FY '05, he said, were led by federal "stalwarts," such as the National Science Foundation, and departments of commerce, education and defense.

"We have been getting some more National Institutes of Health funding," he said. "I hope that trend continues."

—Joe McClain

Three students named Goldwater Scholars

Three William and Mary undergraduates were named 2006 Goldwater Scholars by the Barry M. Goldwater Scholarship and Excellence in Education Foundation. The three students join 320 other juniors and seniors selected on the basis of academic merit from a field of 1,081 mathematics, science and engineering students who were nominated by the faculties of colleges and universities nationwide. The students are:

- Blair S. Ashley, class of 2008, a neuroscience/kinesiology major from Upper St. Clair Township, Pa
- Kendra L. Letchworth, class of 2007, a mathematics/physics major from Williamsburg
- Evan Saltzman, class of 2008, a mathematics/public policy major from Reston, Va.

Asked to name a professor who was particularly helpful or inspirational, Ashley and Saltzman both cited Sebastian Schreiber of the math department. In fact, in completing their applications to the Goldwater Foundation, both listed work done through the Biomath Project, in which Schreiber is a participant. Saltzman also thanked Lawrence Leemis of the math department and Ronald Rapoport of government. Ashley mentioned Robin Looft-Wilson of kinesiology.

Letchworth said she was inspired by Vice Provost for Research and Graduate Studies Dennis Manos, who taught her Honors Physics class for freshmen. "He challenged me to work harder in class and provided me with my first opportunity to do research," she said.

The Goldwater Foundation said that among this year's class of scholars, 32 are mathematics majors, 234 are science majors, 47 are majoring in engineering and 10 are computer science-related majors. Many of the scholars, including William and Mary's three winners, have dual majors in a variety of mathematics, science, engineering and computer disciplines.

The one- and two-year scholarships will cover the cost of tuition, fees, books, and room and board up to a maximum of \$7,500 per year.

—Joe McClain



William and Mary's Goldwater Scholars for 2006 are, from left, Blair Ashley, Kendra Letchworth and Evan Saltzman.

Taylor is NHC fellow

Talbot J. Taylor, the Louise G. T. Cooley Professor of English and director of William and Mary's linguistics program, is among next year's crop of fellows at the National Humanities Center.

Each year, the center draws together faculty in the humanities to its facilities in the Research Triangle Park of North Carolina to work on individual projects and share

ideas in seminars, lectures and conferences. Taylor's project, sponsored by the Delmas Foundation Fellowship, is titled "Agency, Reflexivity, and the Problem of Linguistic Order."

He will be one of 39 fellows who competed successfully from among more than 500 applications in its fellowship competition for 2006-07.



History Channel tapes at W&M
Dennis Manos, William and Mary's vice provost for research and graduate studies (left), prepares for taping a segment for an upcoming episode of the series Modern Marvels for the History Channel. Manos answered questions about metals and metallurgy to be used in a show titled "Heavy Metals," tentatively scheduled to be shown in mid-June. The taping took place outside the Swem Library board room.

Paul Smith wins Thomas Jefferson Prize

Paul A. Smith, a senior math major from Blacksburg, Va, is the recipient of the 2006 Thomas Jefferson Prize in Natural Philosophy at the College of William and Mary.

Attention of individual faculty members in the math department brought Smith to William and Mary, he said, while individual professors also contributed to his achievements.

“In high school, I called some of the math professors here at William and Mary and asked them if they would be willing to meet with me,” he said. “They were. I met with five faculty members. I left with a really good impression. That contributed more than anything else to my coming here.”

As a freshman, Paul was admitted to a summer Research for Undergraduates (REU) program, usually restricted to upper-class students. In a letter supporting Paul’s nomination for the Jefferson Prize, Associate Professor Vladimir Bolotnikov noted that Paul continued working with him after the REU on an advanced topic. He eventually became a co-author on a paper



Paul Smith

published in the journal *Linear Algebra and Applications*. Additional research work with math faculty could lead to two additional papers published in peer-reviewed journals.

After his sophomore year, Paul joined about 20 other high-performing math students in the Director’s Summer Program at the U.S. Department of Defense, an endeavor at Fort Meade, which required security clearance.

“They had a great group of students up there,” Paul said. “Many of them had taken graduate-level classes, but I think together we were able to make progress on a number of problems.”

He studied math with Russian mathematicians for a semester as a participant in the Mathematics in Moscow program, supported by the National Science Foundation. The classes, though taught in English, were rigorous, he said. Negotiating day-to-day life on the streets of Moscow while learning Russian was challenging as well, but he says back in Williamsburg he has had plenty of support.

“Every math professor I’ve had has been really good,” he said. “Four really stand out, though. I’ve had a lot of classes with professors (David) Lutzer and (Nahum) Zobin. Professor Lutzer was my undergraduate academic advisor and Professor Zobin was the one who really recommended I apply to the Math in Moscow program. I’ve done research with Professor (Charles) Johnson starting my freshman year. And Professor Bolotnikov—I got my first publishable results working with him and right now he’s my honors advisor.”

—Joe McClain

Secretary of Energy learns about G0 project

Stephanie Bailey, a Ph.D. student in physics at the College of William and Mary, gave a presentation on nuclear physics research to U.S. Secretary of Energy Samuel W. Bodman during his visit to the Jefferson Lab in Newport News on Feb. 22, 2006.

Secretary Bodman and his entourage heard a short explanation of the G0 (pronounced G-zero) project, an ambitious investigation of the subatomic particles known as quarks under way in Hall C of the Jefferson Lab. Specifically, G0 is examining the contribution of the strange quark—one of the six known varieties of quarks—to the electric and magnetic properties of the proton.



W&M graduate student Stephanie Bailey explains her work with strange quarks to a group including Secretary of Energy Samuel W. Bodman (at right, in red tie). To Secretary Bodman’s right is U.S. Rep. Robert C. “Bobby” Scott of Virginia’s Third Congressional District.

Research: College’s economic impact adds up to \$539 million

“Communities think of businesses as economic drivers, but they often don’t think of universities in that light,” said James R. Golden, director of economic development and corporate affairs at William and Mary. “This study shows universities can and do play that role.”

Research conducted by the Wessex Group, Ltd. revealed that the College of William and Mary is a potent economic factor—and not just in the Peninsula. The study shows that the College contributes more than \$539 million and some 7,100 jobs to Virginia’s economy.

The Wessex Group examined the school’s economic impact on the Greater Williamsburg community, the Hampton Roads region and the Commonwealth of Virginia. The study found that William and Mary contributed more than \$343 million to the local economy, \$491 million regionally and \$539 million to the state in FY 2005.

Completed in January, 2006, the study notes that William and Mary is not only a major employer in the area, but also attracts approximately 120,000 visitors to Williamsburg each year for various campus activities including admission visits and College-sponsored confer-

ences. These visitors spend some \$19 million in the local area and \$26 million in Virginia each year.

For the study Wessex examined both the direct and indirect economic impacts of the campus community, including the Virginia Institute of Marine Science. The study began by gathering information about direct expenditures on payroll, procurement and construction by William and Mary and related organizations.

The analysts then surveyed the student body to estimate the degree of their off-campus spending, finding that the 7,500 students pump more than \$11 million into the Greater Williamsburg economy annually.

The study also pointed out that William and Mary has other significant economic impacts beyond the spending researchers could measure. The College generates large benefits for the region and the Commonwealth through its preparation of students for professional careers, creation of knowledge, technology transfer, community outreach, assistance to businesses and support of economic development agencies.

— Suzanne Seurattan

Israeli-Palestinian violence studied

Violence between Palestinians and Israelis in the Middle East has a deep and long history, but the popular notion that both sides are engaged in a never-ending cycle of attacks and counter-attacks may be wrong, according to a recent report co-authored by David A. Jaeger, associate professor of economics and public policy at the College and M. Daniele Paserman from Hebrew University in Jerusalem.

“The Cycle of Violence: An Empirical Analysis of Fatalities in the Palestinian-Israeli Conflict” demonstrates that while Israel responds in a predictable way to Palestinian violence, the opposite is not the case.

“Our results suggest that the overall number of fatalities on both sides might be reduced if the Palestinians reduced their attacks against

Israelis,” Jaeger said, but the factors determining the timing and magnitudes of the Palestinians’ actions are still an open question that requires further research.”

The authors found that Israel responds to with force quickly after Israeli deaths but did not find a significant response by the Palestinians to Palestinian deaths. While the overall level of violence on either side appears to have a deterrent effect, the authors did find that Israeli attacks that resulted in the death of one of the leaders of a Palestinian faction reduced subsequent violence against Israelis.

Jaeger and Paserman examined more than 3,300 Palestinian and 1,000 Israeli fatalities between September 2000 and January 2005.

— Suzanne Seurattan



George H. Miller

Alumnus to lead Livermore

George H. Miller, a triple alumnus of the College of William and Mary, was named interim director of the Lawrence Livermore National Laboratory at the University of California in March, 2006.

Miller received his B.S. with high honors in physics in 1967, his M.S. in physics in 1969 and his Ph.D. in physics in 1972— all from the College of William and Mary. He is a nuclear weapons and national security expert and a leader in large facilities management.

Miller has been an associate director since 1985 and associate director at large for the laboratory since June 2005. He joined Lawrence Livermore in 1972 as a physicist.

A RARE LOOK
INTO
CHIEF
JUSTICE
MARSHALL'S
PERSONAL
LIFE

continued from page 7

flourishing trade in autograph documents and whenever a document came up for sale we always tried to get a copy of it."

The first volume of the Marshall papers was published in 1974 and the 11th volume was published in 2002. Over the years, Hobson and his staff put together a comprehensive look at the life of one of the country's most famous jurists. The largest find of new documents came in 1985 when the project obtained nine letters Marshall wrote to his friend and colleague on the Supreme Court, Bushrod Washington. The letters, written between 1814 and 1821, were sold at auction by Sotheby's of London, Hobson said.

"These letters had somehow made their way from Washington's home at Mount Vernon, which he inherited from his uncle, George Washington, across the ocean to England," Hobson said. "An English family had married into the Washington family in the mid-19th century and they put the letters up for sale."

The 12th volume provides an insider's look to Marshall's final years. For example, Hobson said, the volume includes Marshall's trip to Philadelphia in October 1831 for an operation to remove stones in his bladder.

"There was a well-known surgeon in Philadelphia who came out of retirement to perform this operation," Hobson said. "We've got letters that Marshall wrote just before the operation and while he was recuperating."

continued from page 11

PREDICTING THE BIG ONE

put some areas along the Bay under meters of water while sucking others dry. With a minimum central pressure of 920 mb, a storm Katrina's size would produce storm surge levels from 50 to 200% higher than those seen during Isabel - storm surge could swell as high as 6.5 meters, or more than 20 feet, in some locations.

Wang noted that computer models used by federal and emergency management agencies have evolved in their accuracy

in predicting hurricane paths and landfall locations in recent years. Yet he says there is less accuracy predicting the evolution of hurricane strength and the storm's ultimate impact on wave and surge effects.

Not long after Marshall returned to Richmond following his surgery in Philadelphia, Hobson said, his wife, Mary Ambler, died on Christmas Day in 1831. They had been married 49 years and the following Christmas in 1832, Hobson said, Marshall wrote about their life together.

"Marshall wrote this very beautiful memoir about his wife and their life together," Hobson said. "It's one of the wonderful documents in this volume."

Hobson said the 12th volume also includes a lot of correspondence between Marshall and his family.

"There are letters to his sons, who were farmers in Fauquier County, and letters to his grandchildren where he is admonishing them to study," he said.

Over the past half century, Hobson said, historians examined more than 8,500 documents to complete the project, which has been funded by William and Mary and two federal agencies, the National Endowment for the Humanities and the National Historical Publications and Records Commission, as well as through private donations from individuals and foundations. In total, the 12-volume set of papers includes nearly 6,700 pages and the project published approximately 2,700 Marshall documents.

"This is a collection that, as much as you can, documents someone's life," Hobson said. "His judicial opinions are accessible in various forms but as for his private papers, this is the first and only edition that we have."

To make ECMG's models more accurate, Wang notes, better terrestrial elevation data as well as wind speed and rainfall predictions during the storm are necessary. This type of information could be used to make more informed evacuation decisions. Money, and more importantly to Wang, lives could be saved.

Good data is the key. A consistently updated data stream is the heart of a good predictive model, he says. Real-time data allows the scientist to verify and monitor a model's output.

In the future, Wang notes, there has to be a focus on low-lying areas to accurately predict storm surge. He sees high accuracy in these predictions as vital because that's where people live.

"With all the best minds in science, I don't think we are there," said Wang.

PUT ON YOUR THINKING CAP

Christopher Ball sits at a table in a small, gray-painted room. The monitor of a laptop computer in front of him flashes a series of single solid green dots and red circles.

"You can see that the red ones outnumber the green ones, probably about three or four to one," Ball says. "You're to press the mouse button when you see the red and you don't press for the green. People who have trouble maintaining attention will press at the green because they can't inhibit their response."

Ball, an associate professor in the psychology department, was demonstrating new instrumentation that allows experimenters to observe the activity of the cerebral cortex—the surface of the brain—as the subject responds to stimuli. Researchers have begun tests involving the repeated presentation of a stimulus event that requires a specific behavioral response.

Depending on the experiment, a procedure might be as simple as the flashing symbol stimulus/mouse-click response demonstrated by Ball. Or, the stimulus might be the presentation of two words and the response deciding whether the words are semantically related. New instrumentation allows experimenters to observe the activity of the cerebral cortex—the surface of the brain—as the subject responds to stimuli.

Measurement of the brain's electrophysiological response to stimuli, known as event-related potential (ERP), is made possible by NeuroScan equipment, purchased with assistance from a Science Recapitalization Equipment Award provided by Dean of Arts and Sciences Carl Strikwerda.

In an initiative led by Ball, members of the psychology and neurosciences faculty have developed an ERP lab located in the Bell Building. A participant in ERP experiments wears a skullcap studded with electrodes placed to correspond with distinct locations of the cerebral cortex. Actual ERP recording is connected to the presentation of stimulus events, but the electrodes also detect extraneous "noise"—eye movements, for example. Experimenters factor out noise by running the tests multiple times.

"You can't do it once; you have to do it a couple hundred times," Ball said. "That's the disadvantage of it: you've got to do a lot of trials and get an average."

Ball said he will be using the instrument in his studies of autobiographical memory retrieval and focusing on the role of the frontal cortex for retrieving these personal experiences.

"This equipment will also be used for teaching, particularly in our neuroscience concentration," Ball said. "We have a class called Cognitive Neuroscience and I

teach an advanced research class in human cognition that will provide our undergraduates with hands-on experience with this cutting-edge technology."

Assistant Professor Jennifer Stevens will further her investigations about the human "potentiated state," a term she uses to describe how the body is always ready to do something and that the mind always knows what the body has the ability to do. She describes a paradigm beginning with subjects visualizing swinging their arms.

"So in a simple case, they're doing actual arm swings. Then they're just standing at rest and imagining doing twenty arm swings. But then we change their posture," Stevens said. "One of the things I do is just have them standing against the wall. They're at rest but they can feel that they're against the wall." The experiment continues, with subjects sitting on a small wooden bench with their arms unencumbered, then sitting against the wall, then lying down. The instructions are always the same—imagine swinging your arms.

"As the posture gets less and less optimal for doing something like an arm swing, it takes the mind longer to imagine doing so," she said. "It's interesting, because in all of the conditions the body is never doing anything actively, it's always at rest. The question is: Why would a change in posture translate to an increased time frame for completing an imagined movement?"

The new equipment's ability to pinpoint the area of the brain's response to stimuli will help decide the answer. One theory, she said, is that the wall constitutes a constant interference in the mind's continual computation of its potentiated state. The other possibility is that the subject first has to take a mental step away from the wall, and this movement into a secondary state accounts for the extra time.

"The ERP will show us this, because if you are taking a step away, then essentially you're going to visualize yourself doing it. Visual imagery is always going to activate the occipital lobe, in the back of the brain," she said. "Whereas, if you're not visualizing taking a step away, and there's a motor signal constantly interfering, then you're going to have something like motor cortex or pre-motor cortex activated and showing that delayed response."



Joe McClain

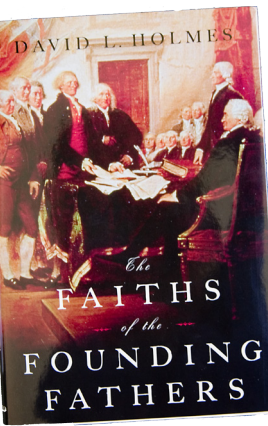
Fitted with a skullcap, Jennifer Stevens prepares for an ERP trial, as her colleague Christopher Ball fastens an electrode near her eye.

By JOE MCCLAIN

BEGINNINGS TAKES A LOOK AT PARTICULARLY INTRIGUING AND/OR PROMISING WORK AT AN EARLY STAGE.

If Hurricane Isabel had packed the wallop of Katrina, storm surges in Hampton Roads and Baltimore would have reached approximately nine feet.

THIS JUST IN...
GREAT REVIEWS
FOR FAITHS OF THE
FOUNDING FATHERS



As *Ideation* goes to press, reviews have started to come in for *The Faiths of the Founding Fathers*, a book by David L. Holmes, Mason Professor of Religion at the College of William and Mary.

Holmes' book outlines the religious atmosphere of the Revolutionary era and has chapters devoted to the religious views of Franklin, Washington, Adams, Jefferson, Madison and Monroe. Another chapter is dedicated to the religious thought among various wives and daughters of the era, such as Martha Custis Washington, Dolley Madison, Abigail Adams and Jefferson's daughters.

A substantial portion of the book is an exploration of the beliefs and influences of Deism—the center of which, Holmes says, was at the College of William and Mary at the end of the 18th Century.



SELF STUDY

Undergraduate anthropology students in the foyer of Phi Beta Kappa Memorial Hall take notes on academic regalia, ranging from the subfusc black garb of undergraduates to the faculty's dizzying array of robes, hoods and tams. The students were assigned to observe the rituals of Charter Day, the annual observance of the 1693 founding of the College.

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COMMENTS, IDEATIONS, SUGGESTIONS?

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