College of Arts and Sciences
American University
Washington, D. C.

Spring 2007

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AMERICAN UNIVERSITY SCIENCE

EDITORIAL

SCIENCE ISSUES—Politics in Science

To get anything done nowadays, researchers must master both science and politics. As the public becomes more aware of new research, we also see how politics is working its way into deciding what is researched and judging how proposed research would affect the public. American University, however, has bypassed politics to make scientific advancements available to its students.

In August 2006, Plan B, a form of emergency contraceptive (EC), was approved for over-the-counter sale. To purchase it, however, one must be at least 18 years old, and the approval has stirred up debate. AU's Health Center has been prescribing and distributing Plan B for years.

Sometime this semester, the health center will carry the human papillomavirus vaccine. Human papillomavirus (HPV) is one of the most common sexually transmitted diseases; there are an estimated 6.2 million new cases each year in the United States alone, and it causes 70 percent of cervical cancers. The vaccine's release last spring spurred controversy. While some people asked for its mandatory use on preteen girls, others complained that money had been wasted and that the vaccine would increase promiscuity.

Just three years ago, Rep. Patrick Toomey (R-Pa.) proposed an amendment to control the allocation of the National Institutes of Health's funds. It lost by only two votes. Three months later a list of NIH-approved projects compiled by the lobbyist group Traditional Values Coalition was released. The report singled out any proposed research that used words such as "sex worker," "injection drug use," "harm reduction," or "homosexual." Some researchers have begun to avoid these terms in their abstracts.

Some argue that Congress is working to ensure that taxpayers' money is going toward projects that would do the most good for the most people. NIH would argue that it already has an extensive peer screening process to decide which projects deserve grants. Medical advancements, such as the HPV vaccine and EC, have been withheld from the general public, and research on them has been slowed for years. American University has stepped past the politics of pharmaceutical research to look at the science that supports it and how it can help our students, remembering that, as Albert Einstein once said, "politics is more difficult than physics."

Grenye O'Malley, biochemistry '09

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Catalyst is supported in part through generous donations from alumni and friends of the College of Arts and Sciences.

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Mission Statement:

A catalyst, as defined by scientists, facilitates chemical reactions by bringing together substances that might not interact in its absence. Similarly, *Catalyst* is one place where all the sciences come together to relay exciting scientific developments happening at AU in the AU community and beyond. *Catalyst* is a semiannual magazine created to promote discourse and keep us up to date about how science at AU affects and inspires us all. Our mission is to: serve students and faculty in the sciences as a means to inspire, inform, and promote discourse; share news and accomplishments of students and faculty; inform students of timely and valuable opportunities; raise the profile of the sciences at AU; and expose students outside of CAS to exciting science classes.

Our success will be measured by how useful and informative you find this publication. So we want to hear from you!

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AMERICAN UNIVERSITY
WASHINGTON, DC

"The Hot Spot for Science Education"

Catalyst is published semiannually by the
College of Arts and Sciences
American University
4400 Massachusetts Avenue, NW
Washington, DC 20016
www.american.edu/cas/catalyst

ON THE COVER

Inspired by the film *Ghostbusters,* the cover features AU biology professor Stephen MacAvoy wielding a fish electro-shocker used to help understand pollution in streams in the Washington, D.C., area.

Photo by Jeff Watts.

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SCIENCE STARS:

Student projects affecting you!

ONE MAN'S JUNK . . .

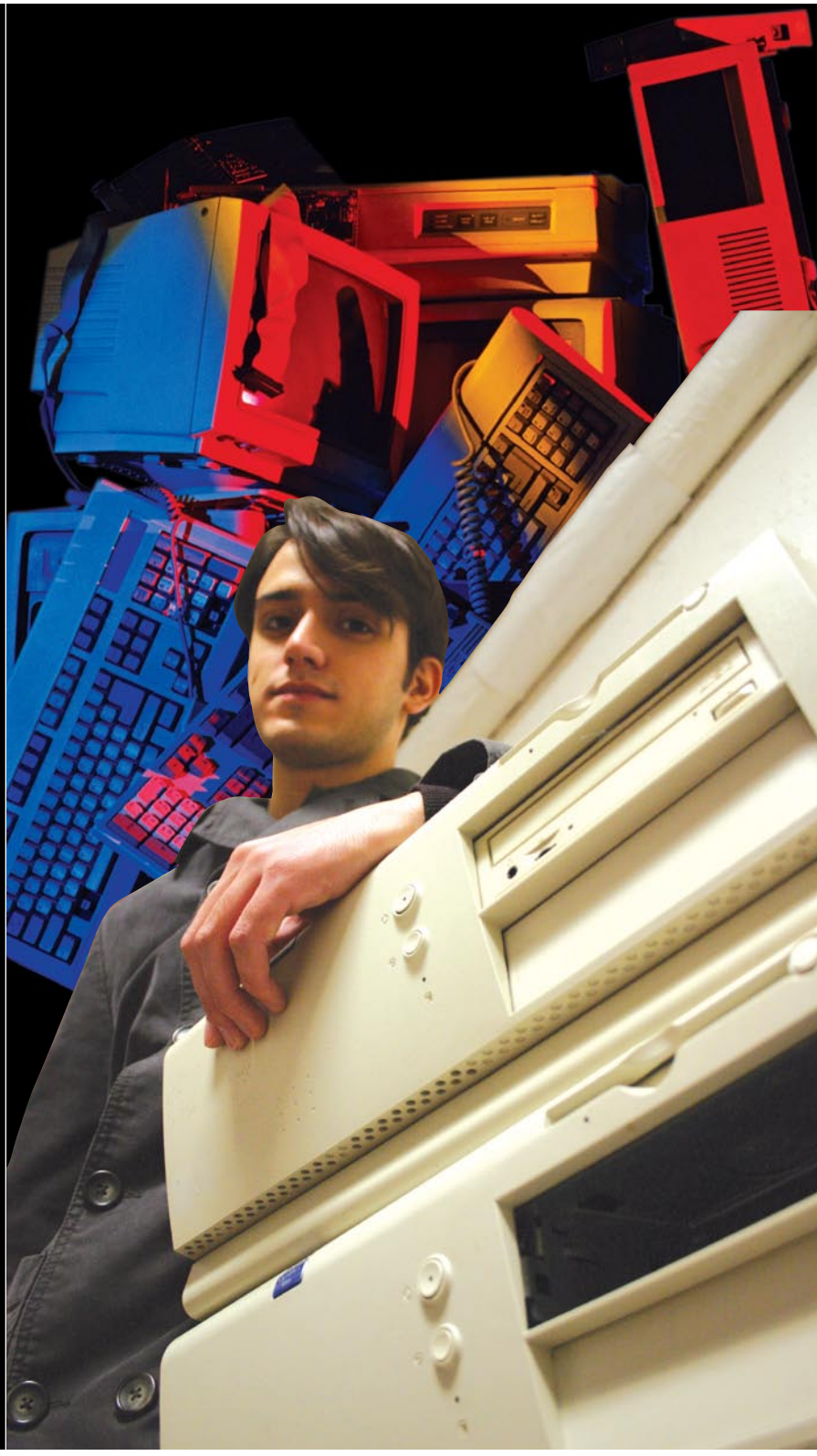
By Emma Kerr, journalism '10

MENTION SCIENTIFIC RESEARCH AND MOST people envision a room full of high-tech equipment, gleaming machinery, and lab-coated technicians. This is not the case for **Claudio Leite (MATH '07),** who created his own lab in the McKinley Building's basement from out-of-date computers and free software. These "junk computers," as Leite called them, were obtained from offices where they were not used because they were considered obsolete. Leite, however, saw value in them as an educational tool for his project. Using only $150 for networking supplies, he was able to create a computer cluster that breaks down and solves computational problems.

The computers operate by dividing complex problems into multiple pieces and then processing those pieces on four computers simultaneously. The individual pieces are reassembled on a fifth computer. This method reduces the time it takes to solve problems by up to four times. The lab is run by three students—**Tim Clem (MATH '07);** grad student **Meghan Emilio (MATH, '10)**, who works on her own problems there; and Leite. The students also had a faculty advisor who helped to secure the room, but as Leite said, "the actual setup was done by students." Now that the lab has been established, the students use it to work on their own problems independently. This involves the difficult task of "analyzing a problem and figuring out what can be broken down,"

Even though the students made a well-received presentation to the dean of the College of Arts and Sciences and received a grant from the school, their project has entailed only minimal expenses. Leite says his group has no plans to create a more expensive lab of newer computers. Leite and his colleagues use the older computers because their research is not focused on state-of-the-art technology or what can be done by the fastest computers. Leite and the other students use the computer cluster as an "educational tool" that teaches them "how to think in parallel."

Leite's basic research goal is to gain "hands-on experience with something that's actually applicable and being done." As he described it, clustering is either being used or investigated by many large organizations today, and so what Leite and the other students are doing is developing a "real skill" that is "not theoretic at all." Computer clusters are useful because they are a time- and cost-effective alternative to super computers. Leite and his team were able to demonstrate this fact as they recognized the value of an educational tool in someone else's junk.



HEALING THE WHOLE BODY

By Cristin Strining, CAS/SOC '07

AFTER GRADUATING IN 1999 FROM THE UNIVERSITY OF IOWA WITH A COMMUNICATIONS degree, Marla Mead has recently finished AU's Postbaccalaureate Premedical Certificate program to pursue a new career in osteopathic medicine.

The certificate program is designed to help students meet basic requirements for admission to schools of medicine, dentistry, veterinary medicine, podiatry, optometry, and oral surgery, as well as for training in other health professions.

Mead said she became involved with osteopathic medicine because of its holistic approach to healing. She originally looked into acupuncture schools but became frustrated that acupuncturists have limited authority in the United States because their field is considered complementary to conventional medicine. "I don't want to be tied to a physician," she said.

According to the National Center for Complementary and Alternative Medicine, osteopathic medicine is a form of conventional medicine that focuses on diseases arising in the musculo-skeletal system. Overall it stems from a fundamental belief that all of the body's systems work together and a disturbance in one system may affect functions elsewhere in the body.

Mead chose this form of medicine because she wants to receive the additional training that osteopathic doctors (DOs) receive in osteopathic manipulation, a full-body system of hands-on techniques to alleviate pain, restore function, and promote health and well-being.

Mead is currently interning with Dr. Stephen Blood, formerly a team physician for the Washington Redskins who now has a family practice in Alexandria, Virginia. Mead assists him on "Baby" Sunday, when she helps calm and entertain Blood's young patients during treatments.

Mead said that Blood "realigns" newborn babies after the trauma of delivery, which he believes has been exacerbated by the newest labor-inducing drugs and the use of a suction device, as opposed to forceps.

"This is more than just giving them a pill," Mead said, explaining that she has seen Blood's treatments give some patients with genetic conditions—such as Down's syndrome and cerebral palsy—an increased range of movement and more verbal skills.

Mead was in AU's premedical certificate program for two years. She graduated from the University of Iowa in 1999 with a bachelor's degree in communications studies.

"Some people only have to take a few courses to complete the prerequisites required for med school, but with my communications degree, I had a lot more holes and had to take almost everything," she said.

Mead has always been interested in science. With her undergraduate degree, she had worked for National Geographic and had aspired to become involved with film production for the PBS science series *Nova*.

Mead is applying to medical schools for fall 2007. So far, she has been accepted to the West Virginia School of Osteopathic Medicine, the Edward Via Virginia College of Osteopathic Medicine, and the University of Medicine and Dentistry of New Jersey, School of Osteopathic Medicine.

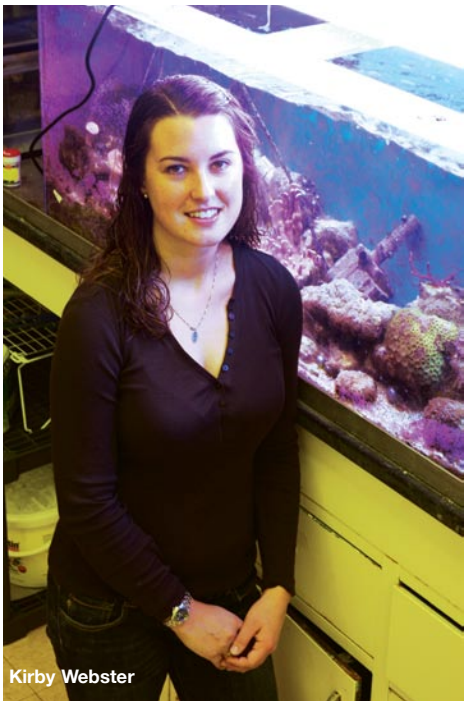
SAVING THE RAINFORESTS OF THE SEA

By Genny Ramos, SOC '06

IT'S A FACT: CORAL REEFS ARE ON THE decline. Called the "Rainforests of the Sea," coral reefs are some of the world's oldest and most diverse ecosystems. But external factors like disease, pollution, and rising water temperatures threaten their survival.

KIRBY WEBSTER (BIO '07), a second-year graduate student in the master's of biology program, is doing research to understand the causes of their rapid decline. Since the start of her first semester, Webster has been tracking human nutrients, "one of the factors contributing to the decline of corals," she says.

Corals naturally occur in oligotrophic, or nutrient-poor, water. Living under such conditions, corals depend on a symbiotic relationship with photosynthetic microscopic algae, called zooxanthellae, to maintain a healthy ecosystem. Additional nutrients are problematic for the coral because they cause organisms such as large algae (seaweed) to grow faster than they would have been able to without the extra nutrients.



Kirby Webster

"When the algae grow faster, they can very easily overgrow the coral, making the coral unable to reach any light to photosynthesize. So, it kills the coral," she says.

Most of the root of the problem is attributed to humans.

"Humans add wastewater into the ocean. That's what increases nutrients in coastal waters, which is what allows the algae to grow much faster than it used to be able to grow," says Webster.

Webster's research involves measuring the ratio of two types of nitrogen isotopes, ^{14}N and ^{15}N, in coral. By comparing the ratio of isotopes of nitrogen in coral to that normally found in human waste and air, for example, one can trace the source of the nitrogen.

"Human waste is enriched with ^{15}N. So, if you measure the amount of ^{15}N in the coral, you can figure out how much human influence there is based on the amount of ^{15}N in the coral itself," explains Webster.

Last summer, Webster collected samples from San Salvador, the Bahamas, and the Florida Keys. She wanted to study the difference in nitrogen isotopes between the coral reefs in the Florida Keys, which humans impact greatly, and San Salvador, coral reefs that humans influence only minimally.

"We're trying to determine specifically where nutrients are coming from and then trying to figure out how to decrease the nutrient influence through regulations and policies. It's one way to combat the death of a lot of the corals," says Webster.

WEBSTER'S RESEARCH INVOLVES MEASURING THE RATIO OF TWO TYPES OF NITROGEN ISOTOPES IN CORAL. BY COMPARING THE RATIO OF ISOTOPES OF NITROGEN IN CORAL TO THAT NORMALLY FOUND IN HUMAN WASTE AND AIR, FOR EXAMPLE, ONE CAN TRACE THE SOURCE OF THE NITROGEN.

Webster's interest in coral reefs stems from her admiration of their beauty and rich diversity and an appreciation of their potential medical application.

"There are a lot of possible medications that are within these ecosystems, and as we destroy them we have no idea what's there," says Webster. "You lose a lot of opportunity when you destroy the coral reef before you've even finished researching it to figure out what could be there. It's a pretty amazing ecosystem."

SCREENING FOR ANXIETY

By Courtney Albon, journalism '08

ALMOST 30 PERCENT OF WOMEN FACE anxiety disorders, according to **Victoria Coleman (PSYC '08),** a fifth-year PhD student. For her dissertation, Coleman researched the knowledge, screening-patterns, and decision-making strategies of obstetrician gynecologists (ob-gyns), focusing on anxiety during pregnancy. She said that previous research reveals the detrimental effect of maternal anxiety on both the pregnant woman and the fetus.

"I was interested in how many ob-gyns are screening for anxiety disorders during pregnancy, what factors are associated with screening, whether or not ob-gyns are using certain cognitive biases and heuristics in their decision making about screening and diagnosis, and how knowledgeable ob-gyns are about anxiety diagnoses as outlined by the *Diagnostic and Statistical Manual of Mental Disorders,"* Coleman said.

According to Coleman, who was awarded a three-year predoctoral fellowship from the Ford Foundation in 2004, many women, especially those from low-income households, rely solely on ob-gyns for medical care, making it crucial that ob-gyns have the tools and training to deal with issues of mental health.

"Screening," Coleman said, "is the first step in getting appropriate treatment for women affected by anxiety."

Coleman conducted her research through the American College of Obstetricians and Gynecologists (ACOG), where she is a research assistant and has helped publish several papers. Her other projects there include a study of patient perceptions of HIV testing in ob-gyn clinics and another study of primary care training during ob-gyn residency. For her current research she developed surveys that were sent to ob-gyns, some belonging to the Collaborative Ambulatory Research Network, a group of ACOG members who volunteer to participate in research.

With a 44 percent response rate, Coleman found that only 20 percent of ob-gyns who responded were currently screening for anxiety. However, she observed that when an ob-gyn had a close friend who had been diagnosed with an anxiety disorder or reported a high level of interest in anxiety disorders, he or she was more willing and likely to practice screening. According to Coleman, this represents an instance of the affect heuristic in that doctors are more likely to practice screening when they connect with the purpose in a personal way.

Coleman's study also revealed that many ob-gyns have minimal knowledge about anxiety disorders, a large percent reporting that they have received barely adequate to inadequate training in the area. The survey found that most, in fact, are more familiar with depression.

Coleman—who is also an extern at Catholic University Counseling Center, providing psychotherapy, and a psychometrician at Children's National Medical Center, researching sleep and ADHD—defended her dissertation on October 5 and is optimistic about the application of her research.

"I hope that these findings will influence obstetrics and gynecology residency programs to incorporate additional training on anxiety disorders into their curriculum, will make physicians more aware of the negative implications of untreated maternal anxiety, and will encourage ACOG to design educational pamphlets on anxiety for patients in obstetric clinics," Coleman said. "I hope that my results will raise awareness of anxiety disorders in primary care settings and drive further research."

ACCORDING TO COLEMAN, MANY WOMEN, ESPECIALLY THOSE FROM LOW-INCOME HOUSEHOLDS, RELY SOLELY ON OB-GYNS FOR MEDICAL CARE, MAKING IT CRUCIAL THAT OB-GYNS HAVE THE TOOLS AND TRAINING TO DEAL WITH ISSUES OF MENTAL HEALTH.

Victoria Coleman

HEAD OVER SEALS

By Michael Lucibella, journalism '08

IN A SMALL CORNER LAB OVERLOOKING THE main quad, **Lisa Rothman (BIO, '07)** goes about her task of meticulously measuring the skulls of dozens of sea lions. Out of a big black bin full of skulls she picks a new sample, fresh from the Smithsonian Institution, and sets about her task, recording 11 different measurements on each skull. She carefully measures each of the dimensions with her calipers, recording them so they can be used later to help determine the health of California's sea lion population.

Each skull Rothman measures comes from a sea lion that has died from domoic acid poisoning, which results from an algae-produced neurotoxin. When sea lions are young, their bones can develop asymmetrically as the result of physiological or environmental factors. Rothman is looking for any lack of symmetry in the skulls of sea lions that have died from domoic acid to see whether they were any more or less susceptible to the toxin.

Her measurements must be exact, and the differences are easy to overlook with the naked eye. The variation between the right and left eye sockets of a sea lion could be as little as a few one-hundredths of a millimeter. While the differences are minute, the implications are very important. The large size of the population seems to show that the California sea lions are healthy, but looks can be deceiving. Helping to understand the effects of domoic acid on sea lions will give naturalists a better idea, a baseline essentially, for what to look for in the wild population, and a more complete picture of the species' health will emerge.

Rothman received a grant from the College of Arts and Sciences to continue her work over part of the summer. Also during the summer she traveled to Boston, Massachusetts, to take part in a project put together by the National Society of Collegiate Scholars. She helped assemble teaching curricula about the environment for local schools and led guided tours for schoolchildren through some of the area ecosystems.

Rothman has long been interested in environmental science. Growing up in Schenectady, New York, she had the opportunity to take part in a special research class offered at her high school. Though the program lasted only two years, Rothman found it helped her understand the importance of research to science.

"I love science; I think I'll end up sharing that love rather than research," she said. With a minor in peace and conflict resolution nearly complete and graduation approaching, Rothman has already started planning her next step. She hopes to be accepted into the Peace Corps so she can travel abroad and work with environmental issues around the world.

THE VARIATION BETWEEN THE RIGHT AND LEFT EYE SOCKETS OF A SEA LION COULD BE AS LITTLE AS A FEW ONE-HUNDREDTHS OF A MILLIMETER. WHILE THE DIFFERENCES ARE MINUTE, THE IMPLICATIONS ARE VERY IMPORTANT.

Lisa Rothman

YOUR MORNING CUP OF NEUROPHARMACOLOGY

By Asha Tamirisa, international studies '10

PETE KARDEL IS A 2003 WAKE FOREST University graduate who is currently working on his PhD at AU in the psychology department's behavior, cognition, and neuroscience program. His current research focuses on the effects of expectancies of caffeine and nicotine use in humans. This research endeavor complements past projects he has worked on that involve the role of environment and context in drug use and research on dopamine receptor subtypes in the reward pathway of the brain.

His inspiration for taking on these projects finds its source in a neuropharmacology class he completed while an undergraduate. He felt that this field of science was much more innovative and progressive than his original interest, general biology. He began working with Professor Terry Blumenthal, studying the effects of caffeine on humans. He hit his stride in this area and decided to look for graduate programs that would accommodate his desire to pursue studies in caffeine and nicotine effects. After finding that his interests closely aligned with those of Professor Laura Juliano, he decided to participate in the psychology program at AU. It was here that he was introduced to "expectancy" phenomena and their effects on the drug experience.

In the lab, Kardel works closely with people. He begins by giving the human subject the drug (either caffeine or nicotine) and then monitors the person for various amounts of time. Kardel says, "We assess the drug's effect on mood, reaction time, attention, sleep, etc., as well as what the participants expect the drug to do or not do to them." He then compares that data to either the same person or others who have gone the same amount of time without their usual drug consumption.

Kardel says that his findings from these studies will help determine what aspect of caffeine and nicotine use is the most influential in the

drug experience. This knowledge can be used in treating drug users by focusing therapy to combat the ideas that are most significant. It is hoped that one day these results could be applied to treat the abuse of illicit drugs.

Kardel's past projects were funded from grants Juliano obtained from the National Institute of Drug Abuse. His current work is being funded by Mellon Grants.

ENTANGLED IN QUANTUM INFO THEORY

By Anneke Mulder, literature '09

GREG HUTTON (CAP MATH '07) POSSESSES a rare ability to converse affectionately about proofs and Gaussian functions. Currently, he devotes much time and many pencils to researching quantum information theory with physics professor Nathan Harshman. Asked to describe his research, Hutton pulled several pages of integrals and other equations from a thick folder. After a few aborted attempts to express the meaning of his innumerable calculations, he interrupted himself triumphantly with, "Dynamic entanglement—that sounds fancy!" In his elaboration, his genuine enthusiasm became more and more apparent.

Hutton examines the interaction of two subatomic particles. To determine the purity of the system, he puts wave functions, the representations of the particles' state, into a density operator and measures the resulting entanglement of the particles. Entanglement is a term that refers to the extent that the particles influence one another's state. This measurement is referred to as the system's purity. Purity, measured on a scale from zero to one, is the focus of Hutton's research so far.

Hutton's calculations deal largely with matrices, rectangular arrays of numbers representing systems of linear equations. In this case, the equations represent information about the motion of the particles. He works with a very important calculation in matrix mathematics called the determinant, from which can be ascertained information about the behavior of the system. The set of real matrices that have determinants equal to one is the focus of his attention. To understand the "general form of their purity," as Hutton says, he thinks of them as linear transformations. He listed the names of these two-by-two matrices—"the flipper, the squasher, the rotator, and the quasher"—with a grin and a light dose of drollery. These linear transformations change the coordinate system in which the equations are mapped, which in layperson's terms is essentially to express the equations in different terms, which allows Hutton to explore their behavior still further.

The "main interest" of the project, Hutton explained, is in describing center of mass and relative coordinates. The research is currently "completely theoretical." But the goal, he went on, is to create a "mathematical framework to pave the way for further research."

A conversation with Hutton about his research reveals a candid fervor for both math and physics. His eyes take on the distinctive polish of those who willingly immerse themselves in calculations, but he is careful not to leave his listener wandering lost in the fog of variables and hypothetical wave functions. He demanded that his listener explain his own research back to him, just to be sure his lesson was comprehensible.

After he graduates, Hutton, this self-proclaimed "advocate of TI-89," aims to get his PhD in either physics or math. As for what comes after graduate school, Hutton willingly admits that he "really [has] no idea," but that he is interested in extensive further research and that he is "really excited about fusion."

GETTING OUT OF DODGE

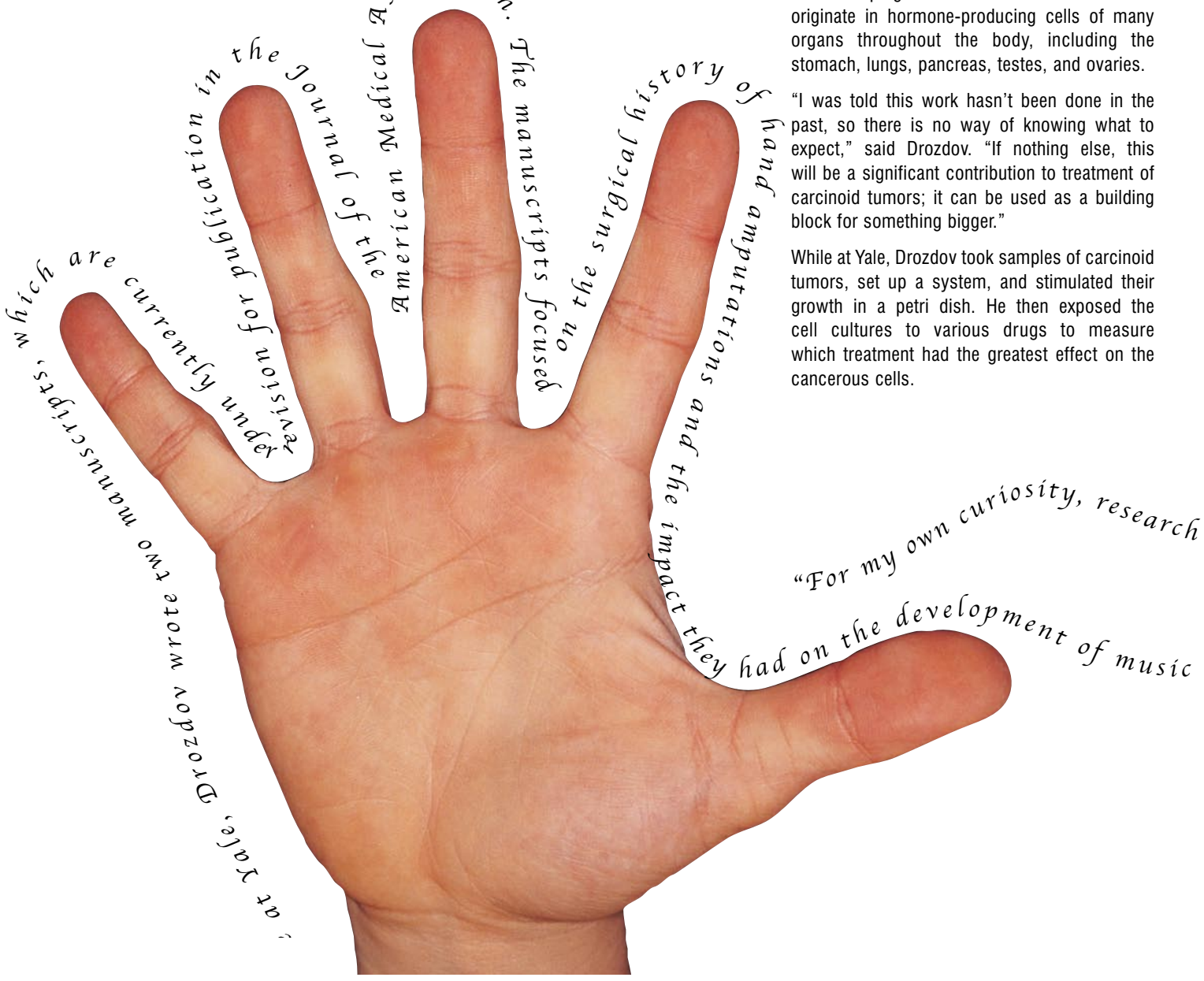
By Haifa Al-Mubarek, broadcast journalism '08

WHEN PEOPLE FIND OUT THAT **IGNAT DROZDOV (CAP '06)** is a physics and music major, they rarely expect him to talk about work on cancer research. Drozdov studied DNA and cancer risks while at Yale University last summer.

He said that his end goal is always "cur[ing] cancer, or at least lowering the cost of treatment by introducing drugs rather than doing surgery." He hopes to create a program that would help predict whether a DNA strand is at risk of developing carcinoid tumors. Carcinoids originate in hormone-producing cells of many organs throughout the body, including the stomach, lungs, pancreas, testes, and ovaries.

"I was told this work hasn't been done in the past, so there is no way of knowing what to expect," said Drozdov. "If nothing else, this will be a significant contribution to treatment of carcinoid tumors; it can be used as a building block for something bigger."

While at Yale, Drozdov took samples of carcinoid tumors, set up a system, and stimulated their growth in a petri dish. He then exposed the cell cultures to various drugs to measure which treatment had the greatest effect on the cancerous cells.



His interests in both art and sciences have allowed Drozdov "to develop a more abstract way of thinking, recognizing patterns" and predicting results before computing problems, he said. "For my own curiosity, research I've done in music, creativity, trauma, and mental illness is most satisfying . . . This research made me go outside the textbook and push forth my own ideas." Because of this, he has expanded his knowledge in the history of medicine, philosophy, and ethics.

While at Yale, Drozdov wrote two manuscripts, which are currently under revision for publication in the *Journal of the American Medical Association.* The manuscripts focused on the surgical history of hand amputations and the impact they had on the development of music for people with one hand. He has also authored an analysis of musical compositions written for people born with extra fingers.

As a part of his cancer research at Yale, Drozdov researched transcription factors and target gene algorithms. Researchers hope this avenue of inquiry will lead to a better understanding so that they may use various gene signals to predict the risk of cancer in the gastrointestinal tract.

At the same time, he continues to research the impact of physical trauma and mental illness on creativity. In fact, it was his unique ideas on the neurological origins of creativity and the impact of severe trauma on creative behavior that led him to work at the Yale School of Medicine. He says that he would like to "establish a new area of exploration to explain where creativity came from and how it is underlined." The National Institutes of Health in Washington, D.C., is funding both his studies on cancer and creativity.

"Quite satisfying is most illness mental and trauma, creativity, music in done've I

NOT YOUR AVERAGE MUSIC MAJOR

for people with one hand.

PROFESSOR PROFILES

BIOLOGY PROFESSOR TACKLES ENVIRONMENTAL ISSUES FROM THE ANACOSTIA RIVER TO AU

By Rebecca Shillenn, journalism '06

WHILE OTHER CHILDREN COLLECTED seashells or pebbles on the beach, a young Stephen MacAvoy was collecting dead animals that had washed ashore.

"My parents weren't very happy about it," he said with a smile. "I'd carry those stinky things with me in the car all the way from North Carolina to Connecticut."

Now a biology and environmental science professor, MacAvoy brings a Portuguese man-of-war (a marine siphonophore related to jellyfish), floating eerily in a plastic zip-lock bag, to class. He has been a professor at American University for five years and specializes outside the classroom in biogeochemistry and ecology.

Currently, MacAvoy is studying the effect of sewage and water quality on microbes in the Anacostia River. For the past year he has been testing the water for evidence of bacteria by looking for specific biochemical indicators. He hopes to discover the amount and source, human or animal, of sewage in the river and how it is affecting the bacteria. MacAvoy, who is also cochair of AU's Environmental Issues Project Team, said this research may aid cleanup of the Anacostia.

"The better we understand how ecosystems function, the better informed management decisions we can make," he said.

MacAvoy is also working on the connection between marine and freshwater ecosystems in Virginia's James River, focusing on migratory fish such as herring, which he calls "nutrient delivery vectors."

"It is essentially a marine nutrient pulse arriving at the freshwater system," he said. He is collaborating with Virginia Commonwealth University, which owns property on the river. Before, during, and after the spawning period, MacAvoy traces isotopes in the fish and the freshwater, searching for nutrients left behind by the marine fish. He said understanding the role these fish play in the ecosystem is important for showing fisheries and commercial ventures how to best protect the links between marine and freshwater systems.

This research is important for studying the East Coast's environment and ecosystems, but MacAvoy said his collaboration has turned out to be a boon for American University's biology program as well. Through his work with Virginia Commonwealth, the two universities are building a partnership, and students from AU are able to do research and fieldwork on the river.

MacAvoy tries to get his students as involved as possible, in the classroom and beyond. He has taken students to Calvert Cliffs, Maryland, in search of fossil shark's teeth, awed National Academy scientists when more than 100 of his students attended a science and religion lecture in Washington, D.C., and taken students hiking at Great Falls to study geology. "Students want to do stuff outside of class," he said. "You just have to set it up."

NEW PHYSICS PROFESSOR STUDIES QUANTUM COMPUTING

By Amanda Glensky, journalism '09

PROFESSOR PHIL JOHNSON SEEKS TO understand why one can observe certain quantum phenomena in the microscopic world of electrons, atoms, even molecules, but not in the larger, macroscopic realm.

"Many physicists, including me, believe that quantum mechanics applies to everything in the universe. If that's really true, I want to know what that implies about the macroscopic world," Johnson said.

To find this out, he builds state-of-the-art computer simulations of many complex quantum systems and is actively involved in the worldwide effort to build a quantum computer. Johnson also collaborates as a theorist at some of the most advanced quantum physics laboratories in the world.

Though he predicts it is decades from completion, a quantum computer could perform computations impossible with an ordinary computer because of quantum parallelism—the ability of microscopic objects to be in many places and configurations simultaneously, he said.

As a theorist, he builds computer simulations of quantum systems and runs them on an ordinary computer to understand how these systems behave and how to manipulate them.

Before coming to AU, Johnson was a National Research Council postdoctoral fellow at the National Institute of Standards and Technology (NIST), the premier national physics lab in the country. Johnson continues to work with NIST as part of its efforts to build a quantum computer and understand quantum information.

When at NIST, he works with a group headed by Bill Philips, one of the winners of the 1997 Nobel Prize for work on cooling and trapping atoms using lasers. NIST researchers are currently building on that work through a project that uses lasers to hold atoms in space. Each atom represents a single quantum bit or "qubit" of information. The interaction between all the atoms together will form a quantum computer. The experiment is still in its beginning stages; they are first studying how to control and direct a few atoms at a time.

The NIST group recently conducted an experiment to control the wave functions of individual atoms, confirming a number of Johnson's theoretical predictions. Everything in the quantum world is determined by these wave functions, Johnson said. An atom has no single position, but a wavelike probability of where it might be. To control quantum mechanical systems, he and fellow researchers found, one must control this wave function.

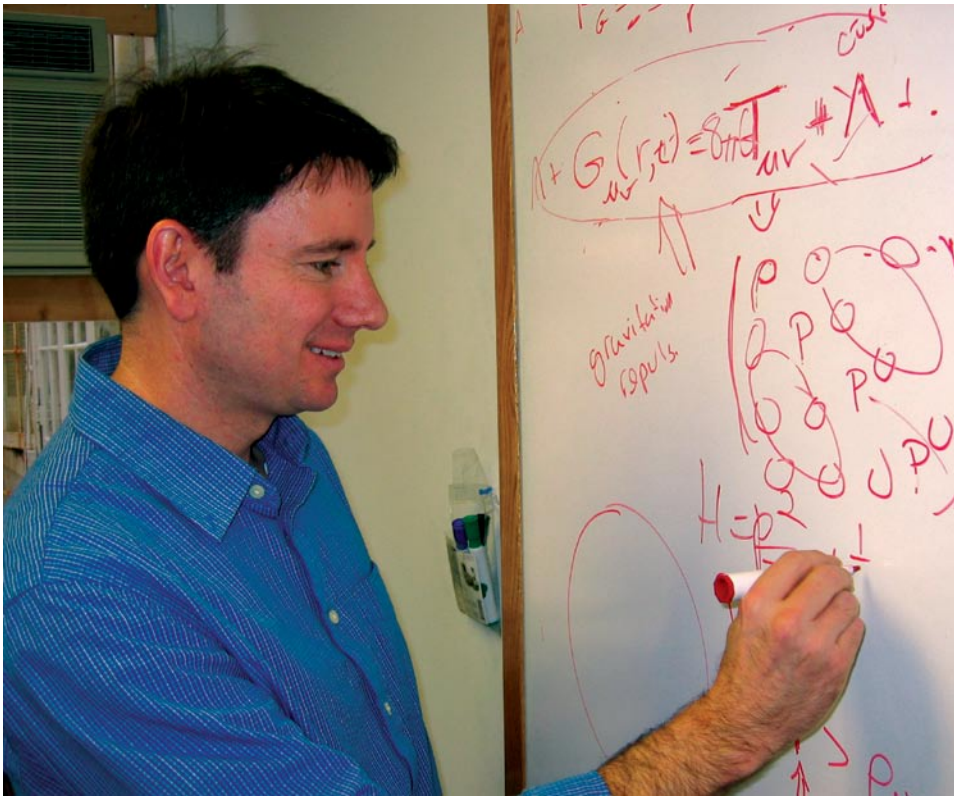
Johnson also collaborates with a leading group at the University of Maryland that is trying to build qubits using superconductors.

He often finds his quantum mechanics research overlaps with the material in his Modern Physics course, knowledge that he shares with his students. "It's a fun challenge to figure out how to do that," he said. Johnson plans to involve his students in quantum physics research projects he hopes they will continue after the semester.

The desire to teach at a liberal arts university influenced Johnson's decision to come to AU. "I tend to like to work on a lot of different ideas," he said, "including exploring ideas outside of pure science."

Teaching inspires new ideas for research, he said, but it can also be its own reward.

"When you teach something, even when it's something you thought you understood," he said, "when you actually go back and teach it, you're forced to go back, relearn it, and see it fresh."



VIVA LAS ALUMNUS

George Chambers, MD

Wah-Hui Ong, journalism master's student '06

DR. GEORGE CHAMBERS (CHEM, '92) CARRIES close to his heart a Hallmark quote: "Sometimes it takes a lot of rain before you get your rainbow. Don't give up; yours is coming." It was inscribed on a card given to him during medical school.

In colorful Las Vegas today, Chambers's career is far from rained out. The AU alum has won several accolades in his eight-year career. From 1998 to 2001, he earned the Best Obstetrics and Gynecology Resident-Student Teacher Award. As a resident physician in 2002, he was named the Robert E. L. Nesbitt, MD Outstanding Resident in obstetrics and gynecology. *Las Vegas Life* magazine recently listed him among the top eight obstetricians and gynecologists in the Las Vegas valley.

Since moving to Las Vegas in March 2003, Chambers says he has delivered about 1,000 babies. In addition to prenatal and postnatal care, Chambers also helps women with infertility evaluation, gynecologic disorders, and surgeries including cosmeto-gynecologic procedures.

Chambers has fond memories of American University. He remembers it for the education he received and the friendships forged.

"Nowadays when I travel to the Caribbean, Europe, or Latin America, I have friends who welcome me into their homes," said Chambers.

Above all, Chambers credits Professor Jim Roberts for the mental fortitude he developed through Roberts' tae kwon do classes and the late Dr. Nina Roscher, whom Chambers calls his teacher, mentor, scientist, and friend. Roscher taught him that as a scientist, one is always a student.

With stoic determination to excel and keep learning, Chambers continues to receive training in new procedures and updates his knowledge of new treatments available. For example, he is looking forward to offering his patients ExAblate, a new system using highly focused ultrasound to treat symptomatic uterine fibroids. Treatments he intends to offer in the near future include Gardasil, a new vaccine against human papillomavirus (HPV) designed to offer protection against cervical dysplasia and cervical cancer.

At his private practice, Centennial Hills Ob/Gyn Associates, Chambers says he and his colleagues are currently involved in a number of clinical trials. One study involves looking at the effectiveness and safety of Ospemifene in the treatment of vaginal disorders in post-menopausal women. Another study involves an evaluation of the safety of administering oral doses of a new modified-release tranexamic acid formulation that is expected to alleviate heavy menstrual bleeding.

In juggling work at his practice with continuing education, research, and family life, Chambers, who is also assistant clinical professor of ob-gyn at the University of Nevada's School of Medicine, puts his patients first and has a simple philosophy that guides his daily work—to end each day knowing that he has provided his patients with the best medical care possible. And his measurement of that? "The kind of care I would wish for my family," said Chambers.

"A REAL TROUPER"

Mesha Y. Williams, journalism master's student '07

WHEN **LAUREN RINEY (CHEM, '06)** INTERNED at the National Institutes of Health (NIH) in Bethesda, Maryland, she caught the "medicine bug."

Riney's career path was charted after she e-mailed the principal investigator at NIH, and when as a college undergraduate she began working for the National Human Genome Research Institute in the biochemical genetics section. Riney studied the mutation pattern of genes in hopes of finding a cure for gray platelet syndrome, a rare genetic disorder that causes patients to bruise or bleed more easily than normal.

As a part of her responsibilities, Riney did research and used high-tech lab equipment like sequence analyzers, thermocyclers, and gel electrophoresis instruments to study the series of mutations.

Sound complicated?

Not so for Riney, who describes herself as curious and generally fascinated by how science and medical concepts intersect. However, the part of her research she enjoyed most was not studying mutations but having the opportunity to work with patients. She learned a good deal by interacting with them, drawing blood to help with research.

"What made it a really interesting project was that I was able to see patients, and it became much more than research," she said.

Riney thought her experience at NIH would prepare her for medical school after graduation from American. She applied to several schools last year, but after going on interviews she was wait-listed. Disappointed, Riney decided to pursue her backup plan and applied to a biomedical science master's program.

This fall, she began studying at the Arizona College of Osteopathic Medicine, taking classes like physiology, immunology, epidemiology, and hospice training. However, she did not have to rely on her backup plan for long. Riney was accepted to four medical schools: in Arizona, Illinois, Pennsylvania, and Virginia.

"She's a trouper," said Professor Frederick Carson, AU's pre-medical advisor. "She once got into a car crash, broke some ribs, and still came in that week for a chemistry exam."

Riney left the master's program in December and began working in a doctor's office this winter to save money for medical school next year. She plans to become a research physician or have her own practice someday.

Riney, who grew up in Germany and came to the United States to attend college, credits American University and NIH for preparing her for her dream career. She hopes other people who hear her story will not give up on their goals when faced with challenges.

"I hope people feel both inspired and encouraged by my story because science and medicine are hard fields to get into, but if you persist and really know what you want, it will happen," she said.

INTERNSHIPS

The National Science Foundation
Founded by Congress in 1950 to support scientific research, the NSF is the only federal agency that supports research into all aspects of science study. Numerous openings in all fields and levels are available throughout the year, including student appointments and grad student programs.

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National Institute of Standards and Technology

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Smithsonian National Museum of Natural History

The country's foremost museum of science offers numerous prestigious internships. Internships are available from biology to geology research, education outreach, lab work, and information technology. Internships are competitive, so apply early.

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Opportunities:
www.nmnh.si.edu/rtp/other_opps/internintro.html

Smithsonian National Zoological Park

Originally founded in 1889, the National Zoo now focuses on research into conservation and sustainability while educating the public about animals and the issues they face. Ongoing internships are available for students at all levels in research, veterinary care, and animal management.

About:
www.nationalzoo.si.edu

Opportunities:
www.nationalzoo.si.edu/undergradinternships

National Council for Science and the Environment

For students interested in science policy, this nonprofit based in Washington, D.C., aims to promote sound science in environmental policies. It provides a neutral forum for scientists to share their findings and promotes responsible and accurate research.

About:
www.ncseonline.org

Opportunities:
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Advanced Concepts Group

The Advanced Concept Group is always looking for talented and motivated engineers, technical researchers, and statisticians who can help improve national security technology. Its recent focus has been on improving information sharing between the military and police agencies.

About:
www.acg-dc.com

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COOL classes

The Molecular World

By Justin Hall, journalism '09

Students who want a general education class in chemistry that they can truly benefit from should sign up for The Molecular World (CHEM-100G) taught by Professor John Armstrong.

Professor Armstrong, who has taught at the California Institute of Technology and has worked for companies such as Procter and Gamble, brings a wealth of knowledge to the classroom.

Through his engaging stories about topics from the creation of nuclear bombs to how to test the composition of diamonds from around the world, Armstrong's blend of textbook teaching and real-world experience leaves students with the chemistry skills they will need for life after college.

Social Psychology

By Jessica Stone, public communication '09

I watched a clip from *Chapelle's Show* in class last week. Did you? Social Psychology (PSYC 205G) with Professor Clara Cheng, is one of my favorite courses I have taken here at AU. I had anticipated a straight lecture class but was pleasantly surprised to find an engaging professor and fascinating material. During class we watch film clips (most recently, *How Much to Kill a Puppy?),* participate in exercises, and take surveys, all of which further our understanding of Professor Cheng's lectures. The relatable social topics of this course make it a great choice for any student.

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