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

Spring 2005

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AMERICAN UNIVERSITY SCIENCE

EDITORIAL

Science Issues—You Decide!

In November of this year, Californians passed Proposition 71, which will allow for a $3-billion bond to be spent on human embryonic stem cell research over the next 10 years. The money will fund stem cell researchers in universities, hospitals, and research institutes along with cloning projects for medical research.

Embryonic stem cells are found only in umbilical cords and in embryos. Some argue that it is important to research such cells because, when combined with the right hormones and growth factors, they can become any type of cell in the body. This gives them a high potential to treat some diseases. In fact, many researchers believe that the cures to many debilitating diseases, like Parkinson's, will likely be discovered through stem cell research. Much of the opposition to stem cell research arises from religious or moral values.

Those that oppose stem cell research feel that, although it could lead to great advances in cures for diseases, no loss of potential human life is worth these gains. The Republican Party officially opposes the measure, and the current administration has limited federal funding of stem cell research. In addition, U.S. law prohibits the use of federal funds for research using newly derived embryonic stem-cell lines. The Republican Party espouses a "culture of life" and equates stem cell use in research with killing a human being.

Opponents of embryonic stem cell research have pointed to adult stem cells as an alternative. However, proponents of the research point out that it is rare to find adult stem cells with the ability to become the specialized cells of tissues. Adult stem cells are limited in the number of tissues into which they can develop. They most often differentiate into the cell types of their tissue of origin. They are also difficult to maintain in laboratory conditions and hard to isolate.

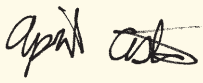
Support for research on adult stem cells demonstrates one of the current trends in stem cell research. That trend is to move away from embryonic stem cells toward other alternatives. This is occurring because people in many countries where this research is carried out fear it will encourage abortions. The thought is that giving people a scientific and moral use for aborted fetuses will tip the scales toward abortion for undecided people.

In addition, a March 2004 report from the President's Council on Bioethics warned against creating in-vitro embryos specifically for research as society could begin viewing fetuses as "natural resources." They also requested a ban on cloning human embryos for stem cell research.

Let us know what type of research you support:

a) Research with fetal stem cells under all circumstances
b) Research with fetal stem cells under some circumstances
c) Research with fetal stem cells under no circumstances
d) Research with adult stem cells
e) No stem cell research whatsoever
f) Not sure

Go to http://www.american.edu/cas/catalyst to voice your opinion and be entered for a chance to win a Hollywood Video gift certificate. Results will be published online and in the next issue of *Catalyst.*



April Astor
Editor

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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 semi-annual 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!

Editors:
April Astor, print journalism '06
april.astor@american.edu
Associate Editor and Faculty Advisor:
Dr. Susan Solarz
solarz@american.edu
Senior Writer:
Liza Gutierrez, journalism and public affairs '04

Please submit letters to the editor to
april.astor@american.edu

AMERICAN UNIVERSITY
WASHINGTON, DC

Catalyst is published semi-annually 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 *Swingers,* Jesse Bascom, psychology junior, raises a beaker to science.
Photo: Jeff Watts

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FIND OUT WHY LAURA CASPAR IS INTO DIRT ON PAGE 5.

SCIENCE STARS:

Student Projects Affecting You!

DIABETES, NAMED THE SIXTH-LEADING CAUSE OF DEATH IN THE UNITED States in 2002, affects 18 million Americans. More than 700,000 have Type I diabetes. **Catie Small (BIO '06)** spent her summer in the basement of Hurst Hall, conducting scientific research to examine one of the common genetic factors that help explain how Type I diabetes is acquired.

Diabetes is characterized by the body's inability to produce insulin, which is needed to take sugar from the blood. The two types of diabetes, Type I and Type II, are caused by different factors. Type I is largely genetic and manifests itself early in life. Type II usually occurs after the age of 40, often in obese people.

Small did her research by the side of her former professor, Lynne Arneson. For eight weeks Small worked with non-obese diabetic mice, referred to as NOD mice, to determine the effects of anchor amino acids, with a focus on the abilities of the peptide-binding groove of I-A^{g7}.

I-A^{g7} is a molecule in NOD mice that corresponds in structure and origin to HLA-DQ8, its human genetic counterpart. The presence of HLA-DQ8 is strongly believed to have a direct link to Type I diabetes. As stated in the project's hypothesis, "By determining which amino acids most affect the conformation of class II molecules [I-A^{g7}], a better understanding of Type I diabetes can be reached."

There are four pockets, or indentations, in this molecule which enable for binding of a peptide antigen in I-A^{g7}; the P9 pocket is considered the most influential, according to the project's abstract. The project involved modifying peptides that bind to the pockets to see if this would cause a conformational, or shape, change in the molecule. From their research, Small and Arneson confirmed that a change in the P9 pocket, due to the altered peptide, changed the molecule's shape. They were able to determine this by using antibodies that recognize different conformations of I-A^{g7}. Studying how conformational changes in different pockets affect the molecule will help determine which pocket is most influential in susceptibility to diabetes.

Now **Sarah Doaty (BIO '05)** is continuing the research as her honors capstone project. Her project is an extension of the work Arneson and Small did over the summer. While they focused on the P9 pocket of the peptide-binding groove, she is focusing on the P6 pocket. Studies have shown that a conformational shift in the P9 pocket can have an effect on the P6 pocket.

Doaty is studying two peptides: GAD65 amino acids 207-220 and Transferrin amino acids 55-68. These peptides are very similar except for the amino acid that fits into the P6 pocket.

"Despite their many similarities, the two cause different conformations when bound to the MHC Class II molecule," said Doaty. "Since the two differ only in the amino acid in the P6 position, it is thought that this may play a role in the overall conformation." For her project, she is switching the amino acids in GAD and Transferrin to see if GAD resembles Transferrin after the change and vice versa. This semester Doaty and Arneson will see if a conformational change occurs as a result of the amino acid change. "This is done by expressing the constructs in cells and then using Western Blotting to examine the reactivity of antibodies."

"Hopefully the ongoing project will give us a clearer understanding of exactly how peptides interact with I-A^{g7}," said Small.

CAN MICE HELP STOP A KILLER?

By Jessica MacDonald, journalism '05

MUSIC WITH PIPES . . . NO, NOT BAGPIPES

By Michael Menachem, public communication, '04

WHEN AUDIO TECHNOLOGY STUDENT **NICK KRILL (CAP '05)** WAS IN EIGHTH GRADE IN DELAWARE, HE KNEW that his drive for writing songs and recording with his band would lead to other musical endeavors. The musician has always been interested in the scientific and mathematical aspects of music, combining physics with electronics. He found AU's program and close proximity to his hometown to be a great fit, allowing him to play with his band on weekends.

Krill has been working alongside audio technology staff technician Matt Weiner on a research paper that he is planning to submit to various trade journals including the *Journal of the Audio Engineering Society,* one of the most prestigious publications in audio technology.

"I hope my work will get others to think differently about the recording studio."

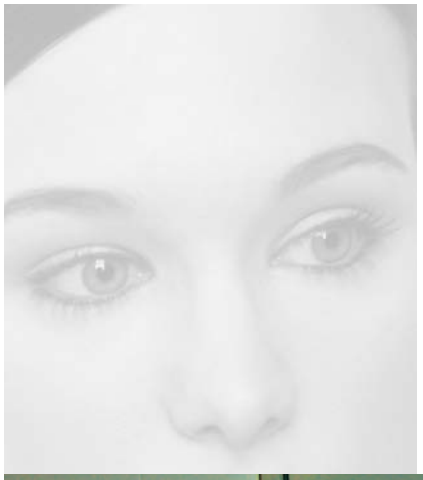
Curious about the mechanical structures of music technology, Krill constructed telescoping-type PVC pipes, changing the lengths while playing a series of tones and then measuring the different sounds. Krill noticed that as the pipe lengths changed, the resonant frequencies changed. What is interesting about different frequencies resonating at different lengths is that this suggests someone could change the tonal characteristics of a sound mechanically with the pipe. Typically this sort of tonal manipulation is done electronically. Throughout Krill's numerous tests and experiments, his main goal was to explore something different and to manipulate sound in the studio. The main point of the research was trying to find mechanical audio signal processors that are analogous to typical electronic signal processors.

"I hope my work will get others to think differently about the recording studio," said Krill, who is currently interning in the engineering department at AU's NPR-affiliated WAMU 88.5 FM station and working on projects at Inner Ear Studio.

Krill is awaiting news from the National Conferences for Undergraduate Research, to which he submitted a paper this fall for consideration. Looking forward, Krill hopes to continue playing with his band, the spinto band, start his career as a recording engineer at some Philadelphia-area studios, and eventually build his own recording studio.

TOXIC BREAST IMPLANTS

By Gina Passarella,
broadcast journalism and public policy '05



NEARLY 2 MILLION WOMEN IN THE UNITED States who may be at risk from silicone breast implants could be safer due in part to the efforts of an American University student.

A biochemistry major who is also in AU's Post-baccalureate Premedical Certificate Program, **Andrew Surmak (CHEM '07)** is part of a research team studying the toxic effects of platinum found in breast implants. Platinum has been associated with various illnesses, including allergic reactions and dermatitis.

Surmak is studying under chemistry professor Susan Maharaj, who has been working in this field for years. Relying heavily upon student assistants in her research, Maharaj said Surmak is "crucial to the completion of this project."

Since the platinum used in the encasing of the implants lingers in the body, Surmak and Maharaj are trying to find a way to flush the toxin out of the system before it becomes a health risk. Little research is being done in this area, and it is in high demand by industry professionals, said Maharaj. Surmak and Maharaj are coauthoring a paper on a subject dealt with in few other peer-reviewed articles.

The research project could last through next summer and maybe longer, Surmak said.

The opportunity for publication was one of the biggest selling points for Surmak when it came to deciding on a university. "AU offered exposure I would not have gotten elsewhere," Surmak said. "The mere possibility of being published as an undergrad is pretty incredible."

Surmak was not always interested in science. In fact, his work at AU will earn him his second bachelor's degree. The 25-year-old Baltimore native graduated from George Washington University in 2003 with a degree in international economics. It was not until his senior year that he decided he wanted to pursue a career in medicine.

Surmak grew up with a doctor in the house. His father is a vascular surgeon. "I never thought medicine was anything novel, pretty bread and butter," Surmak said. He realized, however, that he wanted to do something more tangible than economics. Medicine seemed to be a natural fit. "It's a very versatile field," he said.

His interest in medicine is what caused Surmak to choose Maharaj's research project. The direct link to health and the great demand for research in the area attracted him, he said.

Surmak hopes to go to medical school after his time at AU. Two areas of interest to him are oncology and thoracic surgery.

Surmak grew up with a doctor in the house. His father is a vascular surgeon. "I never thought medicine was anything novel, pretty bread and butter."

GETTING DOWN AND DIRTY

By Liza Gutierrez,
journalism and public affairs '04

LEARNING ABOUT OUR VAST ENVIRONMENT means understanding the little things—actually, more like the microscopic things. Graduate student **Laura Caspar (ENVS '05)** is working with Professor Karen Bushaw-Newton to study how bacteria mediate different parts of the nitrogen cycle.

"Everything in the world needs nitrogen to grow," Caspar said. If a large level of nitrogen, common in rainwater runoff, is added to an ecosystem, a boom in plant growth and microbial life will occur both above and below ground. Rain collects nitrogen compounds as it travels down land and connects to rivers and streams. "We want to see if that additional nitrogen affects the whole structure of the bacteria in soil," Caspar said.

The team is following that path, examining bacteria from upland forest or field areas, down to the bank, or riparian area, and in the in-stream areas.

"We're trying to understand the relationship between bacterial diversity in soil sediments as you move across a lateral gradient or an elevation gradient," she said.

A threefold soil analysis is uncovering bacterial diversity, the various nitrogen compounds, and such physical aspects as the level of organic matter or pH levels, she explained.

"We're trying to characterize the entire habitat to see if we can see any trends as you move along that elevation gradient," she said.

Caspar is studying three different areas of land within the Monocacy River Natural Resources Management Area, which consists of 2,000 acres of natural areas and farmlands along the Monocacy River in Frederick, Maryland, according to an online report from the Maryland Department of Natural Resources.

Caspar ultimately wants to work in soil conservation. "I'm fascinated with how we can apply better agricultural techniques to soil conservation," she said. "Everyone thinks about the plants . . . but they don't think about the soil that influences the plants, or the bacteria in the soil that can allow certain plants to exist."

MAKING CHAOS POSSIBLE

By Nabila Ali, international studies '06

SUMMER BREAK WAS NOT A TYPICAL COLLEGE freshman vacation for **Deema Yazigi (MATH '07)**. Unlike some of her peers who were busy partying, Yazigi spent her summer conducting math research with Professor Richard Brown. Yazigi was selected to work on a bifurcation research project by AU's Department of Mathematics and Statistics and was awarded $2,000 for her work.

A bifurcation is a change over a period, which can lead to chaos. A dripping faucet leaking one drop at a time is in equilibrium. If water pressure increases, two drops might come out at the same time, followed by a pause, and then another two drops. This is a bifurcation. If the pressure and flow continue to increase, irregular, chaotic dripping may ensue. In technical terms, a bifurcation is a qualitative change in an attractor's structure from equilibrium to periodic oscillation as stress increases in a system.

Throughout the summer Yazigi met with Brown three times a week to research this topic. She used Mathematica software to solve complicated equations. Much of her research involved finding values of several unknown coefficients that form matrices.

Yazigi said one of the biggest challenges for her while doing the research was using linear algebra. She had no past experience with some of the math involved and also had never used complex software programs to solve large equations. Yazigi said she did not mind the hard work and actually enjoyed the high level of stress that came with the project.

Although she liked her work immensely, Yazigi said, one of the biggest disappointments for her was not feeling a sense of accomplishment from the project. One of the research goals was to find patterns in equations. Yazigi said she found no patterns and many of her research questions went unanswered. Unfortunately, the summer break ended and she had to stop working on the project.

Despite some of her regrets, Yazigi said that winning the award for conducting research motivated her. "It was a big surprise for me," she said. "I was only a freshman." In the future Yazigi wants to participate in similar research and hopes to become a noted mathematician one day.

FIGHTING THE GOOD FIGHT

By Debbie Kang, journalism '06

SOME CHEMISTRY STUDENTS MAY STILL BE trying to figure out the atomic number for lithium, but not **Magdalena Mroczkowski (CHEM '06)**. She is currently working on synthesizing new antibacterial agents in the form of beta-lactams, a class of antibiotics that includes penicillin. (See Professor Profiles, page 10.) The problem with beta-lactams arises when bacteria synthesize beta-lactamase. This enzyme renders beta-lactams like penicillin inactive, resulting in resistance to that antibiotic.

Beta-lactam is a chemical structure that is versatile in use, but Mroczkowski is focusing on its capabilities to prevent microorganisms from growing.

"Personally, I am working on synthesizing one beta-lactam structure and aiming toward a certain mass so that it is enough to be used for testing in the microbiology labs that we are going to send it off to," she said.

Right now, Mroczkowski is working on making 500 mg of beta-lactam. When she's finished, she will attempt to start on a new structure that has never been made before. She believes the research will delay resistance. Since bacteria become resistant to antibiotics quickly, new antibiotic structures must be made.

Such research is time consuming. Fortunately, Mroczkowski can maintain her schedule through multitasking. She can start her experiments with chemical reactions with procedures taken from journals and simultaneously study for her other classes.

"It gets overwhelming at times, but Professor Konaklieva is very flexible, and I basically make my own hours, around my schedule," she said.

Although she never worked in a lab before, Mroczkowski was motivated to try by Professor Monika Konaklieva's Organic Chemistry class.

"Medicine always interested me," she said, "but at the same time, I prefer chemistry to biology. So I thought medicinal chemistry was a good combination of the two. And just in general, I thought the prospect of working on a potentially new antibiotic was pretty exciting."

NOT YOUR NORMAL SHIPBOARD MINE DETECTOR

By Mary Specht, journalism '08

IT'S HARD TO THINK OF SOMETHING **CHRISTY FERNANDEZ (CAP '04)** hasn't done. The physics major is a Ronald E. McNair scholar and has interned with Hillary Clinton, *Latina Style* magazine, and the National Institutes of Health, among others.

She is currently working with the Department of Defense for NAVAIR, on a naval base doing electrical engineering work (optics/physics) for the navy. More specifically, she is working to improve the method for seeing underwater by resolving reflections of backscatter from laser light. This is energy scattered back to the laser, interfering with the image quality. Reflections come from thin layers in the water column as well as underwater objects. The current technology has many applications: from mine detection to studying ecological life like phytoplankton which form thin layers in coastal waters of about 1 to 10 meters in depth. The National Aeronautics and Space Administration, among others, currently uses a LIDAR (Light Detection and Ranging) setup for possible cloud layer analysis or atmospheric analysis of CO_2 or O_2.

The system Fernandez is working on is called LOCO (Layered Organization of Coastal Oceans): Shipboard LIDAR, which is used as a range-gated LIDAR system—using modulation to chop down a pulse. This better resolves backscatter from either layers or objects underwater that are captured by the receiver.

"It's hard to use radar to analyze or better resolve anything underwater," she said. "Analysis of backscatter makes it difficult to deduce what you're looking at. But light at a particular wavelength, specifically 532 nm, which is similar to the color of water in coastal oceans so it highly absorbs, can be used. Also, a shorter pulse helps to better analyze certain things like thin layers of phytoplankton or even mines underwater."

Fernandez is helping to program a controlling unit and a laser unit for the shipboard LIDAR. Her computer programs will communicate with the hardware. She is also putting together the optics and tools necessary for chopping an 8ns pulse down to a 2ns pulse. However, she is not using the usual technique of combining light with radar. She is using a range-gated modulation system.

"It's a different technique and we're building our own prototype," she said. "If it's successful and we're able to do something that can better identify, then it will possibly be used for the fleet."

The range-gated system is different in that she is not combining light with radar. Instead, she is using a modulator which rotates the polarization of incoming light. A modulator will shorten the pulse and this is why it is called a range-gated system.

"By using a range-gated system it is possible to shorten the pulses and better resolve what you are looking at in the water," Fernandez said. "I'm trying to create a more vivid picture of what we're seeing below the water."

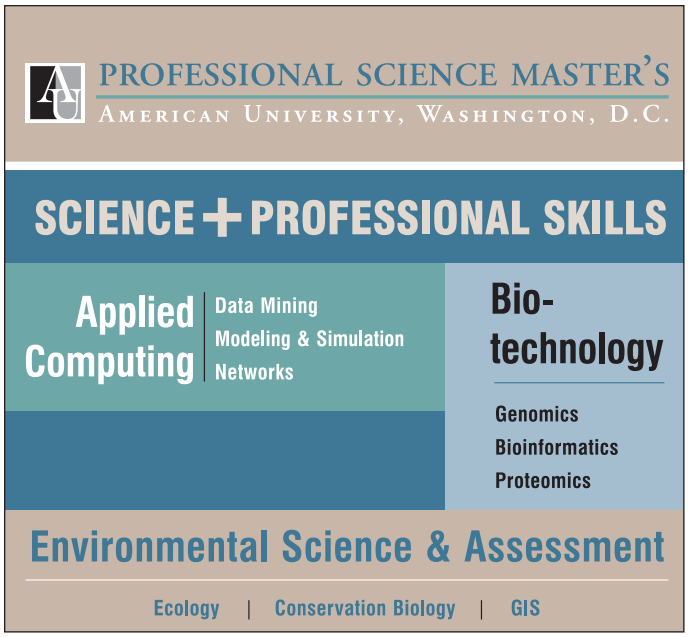
Editor's Note: As we went to press, we learned that Christy Fernandez had just been accepted into the electrical engineering PhD program at Duke University.

SCIENCE EDUCATION BEING RETOOLED

By Melinda Beard

AMERICAN UNIVERSITY HAS LAUNCHED A NEW 36-CREDIT-HOUR master of science degree program with three concentrations—applied computing, biotechnology, and environmental science and assessment. Students benefit from a multidisciplinary curriculum, an internship, a team capstone project that addresses real-world problems, lectures on topics of current interest in applied science, and seminars and workshops in professional skills development. For example, weekend and evening events are devoted to learning and practicing crucial skills, such as communications, teamwork, problem solving, budgeting, and project management. Thus graduates are able to communicate with other scientists and with nonscientists, understand a company's financial picture, and work in a team setting. Unlike most science master's degrees, which are stepping stones toward the PhD, the new AU program, called Professional Science Master's, focuses on applied science rather than pure research. Workforce analysts agree that science and technology industries demand more focused, more industry-responsive, and shorter, timelier educational opportunities. AU's new degree has been developed with assistance from the Sloan Foundation, known worldwide for its commitment to science and technology education, and the Council on Graduate Schools. An advisory council of local industry and government professionals has input into the curriculum and the ongoing program, assuring the degree's pertinence.

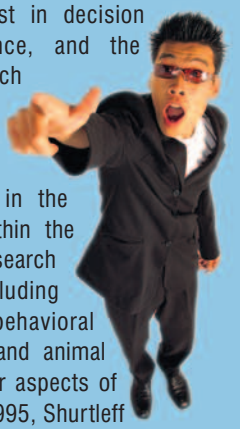
Go to american.edu/psm for more details about the program, including a list of advisory council members. Please contact Melinda Beard at mbeard@american.edu or 202-885-3626 with suggestions or inquiries.



PSYCHOLOGY

Dr. David Shurtleff,
Director, Division of Basic Neuroscience and Behavioral Research (DBNBR), National Institute on Drug Abuse (NIDA), National Institutes of Health

Dr. David Shurtleff directs a division whose primary goal is to provide grant support of research that relates to the public health problem of drug abuse and addiction. DBNBR accomplishes this through developing and supporting an extramural program of research in the basic biomedical and behavioral sciences at universities, medical schools, and other research organizations. Research focuses on the mechanisms of addiction, drug craving, effects of drugs on behavior and cognition, long-term chronic effects of drugs, and drug metabolism. Basic research concerned with understanding the complex interrelationship between HIV-AIDS progression and transmission and drug abuse is also supported. The research supported by DBNBR provides important fundamental information to prevent or intervene in drug abuse and addiction. Shurtleff is responsible for management of DBNBR program operations and maintains specific interest in decision theory, cognitive and behavioral science, and the neurosciences as these areas of research relate to drug abuse and addiction. Before becoming director of DBNBR, Shurtleff served as the deputy director for the division and as a health scientist administrator in the Behavioral Sciences Research Branch within the division, where he supported extramural research in the basic behavioral sciences, including research in the cognitive sciences, behavioral economics, decision theory, and human and animal models of impulsivity, risk taking, and other aspects of drug addiction. Prior to coming to NIDA in 1995, Shurtleff was a research psychologist at the Naval Medical Research Institute in Bethesda. While with the navy he conducted basic behavioral, electrophysiological, cognitive, and field research on a variety of issues related to cognitive performance, environmental stress, and peripheral neuropathy. Before joining the Naval Medical Research Institute, Shurtleff was a research fellow at the Walter Reed Army Institute of Research, in the Department of Medical Neurosciences.



AU Degrees: PhD experimental psychology 1989.

To learn more about NIDA, please refer to: http://www.drugabuse.gov/NIDAHome.html. To learn more about the Division of Basic Neuroscience and Behavioral Research, please refer to: http://www.drugabuse.gov/about/organization/DBNBR/index.html.

GETTING OUT OF DODGE

Erin Allgaier, *third from right*

STARS, SCIENCE, AND SUMMER CAMP

By Mishri Someshwar, journalism '07

FOR PHYSICS STUDENT **ERIN ALLGAIER (CAP '05)**, finding time for an internship was difficult. Between playing on the volleyball team and taking 15 credit hours per semester, she had her plate full. However, she decided to apply for a summer internship through Research Experience for Undergraduates, a government science program. The program helps to pair undergraduate students with faculty members from other universities to assist in research.

Professor Nancy Morrison, head of the observatory at the University of Toledo, sent Allgaier research material and background on what Allgaier would help to research starting in early June.

Morrison's team is studying the star Deneb and trying to determine whether its mass loss is rotationally modulated or periodic.

Allgaier spent about 35 hours a week, for 10 weeks, learning to analyze stellar spectra (the distribution of energy emitted by a star, arranged in order of wavelengths). She also learned to use a reflecting telescope.

Morrison and her team of researchers had collected spectra over the past 11 years, which Allgaier began to analyze, creating a few dynamical spectra that allow them to look at the change in mass loss over a season's worth of data.

"I got to participate actively in research that put doing most labs in class to shame. It felt more like 'real' science, I guess, because I felt like I was actually making discoveries," Allgaier said.

During her summer in Toledo, Allgaier also got the chance to work with other students and physics professor Alejandra Lukaszew to design a weeklong on-campus high school science camp.

While the camp had academic elements, such as professors' lectures, there were fun activities as well, such as designing bridges with Popsicle sticks and building a DC motor, Allgaier said.

"Working with students on research is fun," said Morrison, who has worked with five other students through this program. "Usually, they are highly motivated, and they get a lot of work done. Erin was even more so than most students."

Morrison said that it was challenging for her to fit in the responsibility of supervising a student with summertime research, professional conference travel, and vacation.

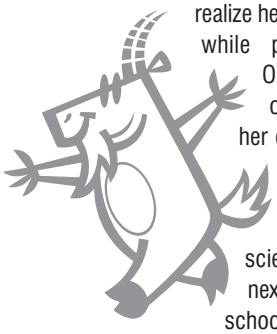
For Allgaier, her experience couldn't have been better. "I got to spend the summer doing research and learning about stuff I hadn't known about before and hanging out with a bunch of people who love physics—what could be greater?" she said

While the camp had academic elements, such as professors' lectures, there were fun activities as well.

THE SCIENCE OF SEXUAL ORIENTATION

By Sara Blatchly, political science and communications studies '07

TRISH HALL (PSYC '06) HAS HAD ANYTHING BUT AN ordinary career progression. Hall, a graduate student in the Department of Psychology, began to realize her passion for the field of psychology while practicing her first profession. Originally a hair stylist, and then an owner of a hair salon, Hall listened to her clients talk about intimate details of their personal lives. After years of working in a salon, she decided that learning about the science of people's lives would be the next logical step. So she returned to school.



"I wanted to learn more about behavioral and cognitive neuroscience," said Hall. "I wanted to learn how the physical part of the brain plays into how you act."

Hall conducts psychology research under Professor Cathy Schaeff, chair of the Department of Biology, a noteworthy collaboration between the two disciplines. Her last study involved how biology plays into sexual orientation.

"We know that body symmetry can get thrown off by prenatal stress, creating fluctuating asymmetry," Hall said. To determine if prenatal stress is a factor in homosexuality, studies have assessed the levels of fluctuating asymmetry—small, random departures from bilateral symmetry—in the bodies of both gay and straight people. During Hall's study, which lasted for two years, she observed the body symmetry in homosexual and heterosexual people. She did this by using digital calipers to measure eight traits used in other studies as an indicator of symmetry—the four fingers, wrists, elbows, knees, and ankles.

"There is a statistically significant difference in averages between gay and straight people of overall body symmetry," she said.

Connections had previously been established in men linking prenatal stress and shifts in sexual orientation. Hall expected to see the differences in developmental instability in gay and straight men based on previous research that shows the connection. What she and Schaeff also discovered is that this holds true for females as well, which hadn't yet been established.

"The type of work I do is on the very edge of sexual orientation research," said Hall. "It adds another piece of information to how we understand how biology impacts sexual orientation." However, Hall pointed out that they found heterosexual people who had higher levels of fluctuating asymmetry than the average homosexual. "It's not just stress during development that determines sexual orientation; there are other factors, both social and cultural, that have an influence. These results are just evidence that there is a combination of factors."

Hall hopes to graduate from American University sometime during the 2006–2007 school year, depending on the research she is conducting. When she graduates, she will have a PhD in behavioral neurological psychology. Eventually, she would like to teach psychology on the college level.

PROFESSOR PROFILES

By Liza Gutierrez, journalism and public affairs '04

THE MOST RESILIENT BACTERIA HAVE A STALWART ENEMY, AND HER name is **Professor Monika Konaklieva.** "We are always in a war with bacteria. Sometimes we win, sometimes bacteria win," she said.

Konaklieva is fascinated by the adaptability that allows bacteria to flourish even in the harshest conditions. "They are incredible survivors," she said. Her latest research focuses on microbial resistance and anti-microbial compounds.

Bacteria have developed several protective mechanisms, the most important being production of the enzymes beta-lactamases, which protects them from the beta-lactam family of antibiotics, including penicillin. Beta-lactams disrupt the integrity of the bacterial cell wall by inhibiting the enzyme that stitches the wall together, which can lead to cell deformation or leakage of its contents, Konaklieva said. Beta-lactamases fight back by breaking the chemical bonds in the four-member beta-lactam ring, thus inactivating the drug.

Beta-lactamases can defeat the drug before it reaches its target. "They are the soldiers of the bacteria that are sent, as an army, to kill drugs," she said.

"A strategy for overcoming bacterial resistance is to kill organisms that produce beta-lactamases," Konaklieva said. She is working to create inhibitors that release a microbial toxin to attack beta-lactamases, hindering the ability of the microorganisms to mutate for survival. This molecule, nitric oxide, is difficult for bacteria to circumvent due to its small size and ability to stay in the active site of the beta-lactamase enzyme.

Konaklieva's research differs from conventional methods because it allows bacteria to attack some of the beta-lactams, which will contain the toxin. The nitric oxide is designed to be released upon deactivation of the antibiotic by the bacteria. The challenge is to keep at least one step ahead of the bacteria, Konaklieva said.

TAKE **THAT!**

Recently, Konaklieva and some of her students were at the International Symposium of the Sigma Xi Honor Research Society. Senior **Carey Myers (CHEM '05)** and graduate student **Maya Kostova (CHEM '06)** both received awards for their work creating novel enzyme inhibitors. Konaklieva works with a team of 10 students, composed of graduate and undergraduate students. She has been teaching at AU for five years.

> Konaklieva's research differs from conventional methods because it allows bacteria to attack some of the beta-lactams, which will contain the toxin.

LIVING ON NICOTINE

By Claire Maude, journalism '08

"WHAT MAKES SMOKING REWARDing?" asked **Professor Laura Juliano,** psychology, who is studying why, according to the U.S. Census Bureau, 22.7 percent of American citizens and up to 30.4 percent of American college-age adults smoke. Her studies focus on the psychology of drug use, specifically, tobacco and caffeine.

"I focus on tobacco and caffeine because they are legal and widely available drugs, which aside from their own importance, make them convenient models of drug addiction," she said. "Tobacco use remains very problematic, especially among college students. Her research addresses learning processes that motivate drug use and drug relapse, such as an individual's reactions to stimuli or situations that have become associated with drug use. Also, Juliano studies the placebo effect as it relates to people's expectations about drugs and treatments.

Her experiments try to answer the psychological questions of dependence, such as the relationships between mood and tobacco use. In a current experiment, Juliano is studying the strongly held belief among smokers that a cigarette will relieve stress; a belief that keeps smokers tied to smoking.

"Why do smokers believe that smoking alleviates stress?" asked Juliano. "Nicotine is a stimulant. Does smoking really relieve stress, or is it just a self-fulfilling prophecy?"

In treating cigarette addiction, Juliano looks for ideas far beyond a chewing gum or a patch. Questioning the emotional as well as the physical components of cigarette addiction, she works on developing treatments that incorporate the feelings that smoking brings.

In a study involving nicotine patches, Juliano along with doctoral student **Lisa Fucito (PSYC '07)** observe how information about the patch influences reactions to the patch during a brief quit attempt. "Some people are given information that emphasizes the positive effects of the patch, such as its ability to improve mood, while others are simply told the possible side effects" explains Juliano. "We're interested in studying ways to improve the effectiveness of nicotine replacement therapies with behavioral treatment adjuncts," says Juliano.

Her ultimate goal is to develop better treatments through her studies. "I think of it as lab research directly related to improving treatments," she said.

PIPING HOT: Jobs, Internships, and Scholarships

CAREER CENTER

Log onto www.american.edu/careercenter and click on Students in the blue bar at the top for current job, internship, and scholarship listings. You can get merit awards listed by field of study via www.american.edu/careercenter/oma/awardlisting.html.

JOBS

ENVIRONMENTAL PROFESSIONAL
Environmental Assessments + Consulting (EAC), Ft. Lauderdale, Florida EAC's technical expertise includes Phase I and Phase II environmental site assessments and other related real estate acquisition assessments, asbestos surveys for building demolition and renovation, mold investigations, remedial action plans, contamination assessments, site remediation, and hazardous waste management. Candidates must have: BS or BA in the environmental sciences, customer service and people orientation, excellent communication skills, and 0–2 years of experience in the above disciplines.
TO APPLY: Forward complete résumé to jbradshaw@verizon.net; fax: 941-378-9966
Visit EAC at: www.eacusa.com.

MEDICAL INFORMATION ASSOCIATE
Genzyme Corp., Cambridge, Massachusetts
The successful candidate will work in the Medical Information Department collaborating with a team of health care professionals to provide support for Genzyme's products, assimilating published medical and clinical study information; and creating custom medical responses for use by other employees. The ideal candidate has an associate's degree or 2+ years of work experience in a health care setting.
TO APPLY: http://www.newscientistjobs.com/viewjob.action?job.id=scij11377&index=5

RESEARCH ASSOCIATE (PHARMACOLOGIST)
Johnson & Johnson Pharmaceutical Research & Development, Springhouse, Penn. The Metabolics Research Team needs an in vivo pharmacologist to use in vivo preclinical approaches to characterize potential therapies for diabetes, obesity, and dyslipidemia and set up appropriate in vivo models and screening strategies and maybe contribute to other metabolic diseases projects on cachexia, aging, cardiovascular disease, etc. This position requires BS with 3 years of experience or MS with 1 year experience working with preclinical in vivo models/studies (knowledge of physiology and pharmacology of metabolic diseases is preferred).
TO APPLY: Apply directly online at http://www.jnj.com/careers noting Req. Code 0409529.

INTERNSHIPS

REPRODUCTIVE PHYSIOLOGY OF THE MALE GIANT PANDA
The Smithsonian's National Zoo's Conservation and Research Center Reproduction Department has an internship position in an extensive four-year reproductive physiological study of male giant pandas both at the National Zoo in Washington, D.C., and at the Chengdu Research Base for Giant Panda Breeding, Chengdu, P.R. China. The goal is to improve understanding of male giant panda reproductive physiology for use in applied assisted reproductive technology.

Students who are applying for the dates in China must have an up-to-date passport and be eligible for a Chinese visa, culturally sensitive, and willing to work in a non-Western setting. Specify on your application which term you are applying for:

At Chengdu Giant Panda Base, Chengdu, P.R. China
July–August 2005, deadline: June 1, 2005
February–May 2006, deadline: January 1, 2006
July–August 2006, deadline: June 1, 2006

At National Zoo, Washington, D.C
November–January 2005 deadline: October 1, 2005
November–January 2006 deadline: October 1, 2006

Funding for individual interns is uncertain. However, at this point interns applying for dates at the National Zoo have housing provided, and airfare to China and housing within China will be provided for interns applying for dates involving travel to China.
TO APPLY: http://nationalzoo.si.edu/UndergradInternships/Research/ReproScience/giantpanda.cfm.

CLOUDED LEPOARD BREEDING PROGRAM
The Smithsonian's National Zoo's Conservation and Research Center Reproduction Department has an internship position to study hormones and breeding success of clouded leopards. The intern will work 40 hours a week at the National Zoo's Conservation and Research Center in Front Royal, Va. (housing will be provided), and will conduct hormonal analyses on clouded leopard fecal samples from Thailand zoos. The intern will be trained on site in general laboratory techniques, fecal extraction, and enzyme immunoassay and have the opportunity to interact with diverse researchers studying a variety of endangered species. The intern must have a strong interest in biological, animal, or environmental sciences; at least three years of undergraduate coursework in the above-stated fields, including at least one laboratory course; and the ability to work independently. The intern should be detail oriented, efficient, responsible, and eager to learn. The term of appointment is three months or longer year-round.
TO APPLY: http://nationalzoo.si.edu/UndergradInternships/Research/ReproScience/leopards.cfm.

SCIENCE UNDERGRADUATE LABORATORY INTERNSHIPS
This program places students in paid internships in science and engineering at any of several Department of Energy facilities. Students work with scientists or engineers on projects related to the laboratories' research programs, each of which offers different research opportunities. Programs run from late May to mid-August, August through December, and January through May. The exact start date depends on the laboratory and will be given to participants accepted at that specific laboratory. Students are required to participate for the full term of the program. Participants should expect to spend more than 40 hours per week and more than eight hours per day in activities or research related to their internships.
TO APPLY: http://www.scied.science.doe.gov/scied/erulf/about.html

RESEARCH EXPERIENCES FOR UNDERGRADUATES (REU)
The National Science Foundation (NSF) funds many research opportunities for undergraduates through its REU Sites program. An REU Site is a group of 10 or so undergraduates who work closely with the faculty and other researchers on a specific research program of the host institution. Students are granted stipends and, in many cases, assistance with housing and travel. Undergraduates supported with NSF funds must be citizens or permanent residents of the United States or its possessions. An REU Site may be at either a U.S. or foreign location. Use the Web page to find subject areas supported by various NSF units or search by keywords to identify sites in particular research areas or with certain features, such as a particular location. Students must contact the individual sites for

information and application materials. NSF does not have application materials and does not select student participants. Contact information is listed for each site.
SEARCH FOR AN REU SITE: http://www.nsf.gov/home/crssprgm/reu/reu_search.cfm

SUMMER UNDERGRADUATE MATHEMATICAL SCIENCES RESEARCH INSTITUTE (SUMSRI)
SUMSRI, conducted under Miami University's Department of Mathematics and Statistics, seeks talented mathematical sciences undergraduates interested in advanced degrees, especially African Americans and other underrepresented minorities and women. SUMSRI runs from June 6 to July 22, 2005, on the university's campus in Oxford, Ohio. Students participate in problem seminars in mathematics, statistics, or computer science and attend a technical writing seminar, a GRE preparation workshop, two short courses on algebra and real analysis, and colloquium talks given by well-known mathematical scientists, as well as panel discussions on graduate school and career opportunities in the mathematical sciences. SUMSRI pays for the student's travel, room, board, and supplies, plus a $2,700 stipend. Funds may be available for travel and support to some selected national meetings. The ideal candidate will have completed the calculus series and at least one proof-based mathematics or statistics course with distinction. The candidates should be rising juniors or seniors and must be returning to their home institutions as undergraduates after the SUMSRI experience. SUMSRI is not currently funded to support international students. Application deadline: March 1, 2005.
TO APPLY: http://www.units.muohio.edu/sumsri/

SCHOLARSHIPS

FULBRIGHT GRANT
www.iie.org/fulbright
(On-campus interview required; university nomination not needed.)
Campus Deadline: September
The Fulbright funds an academic year of study in one of over 140 countries. Students usually design and carry out an independent research project or teach English conversation. The grants to teach English are available in a limited number of countries, however. Fulbright grants are open to graduating seniors and graduate students in virtually every field of study. You must be a U.S. citizen to apply.

BARRY M. GOLDWATER SCHOLARSHIP
www.act.org/goldwater
(University nomination required.)
Campus deadline: September
The Goldwater provides $7,500 a year for up to two years of study. It is open to sophomores and juniors who intend to earn doctorates and pursue research careers in the sciences, mathematics, or engineering. Due to national competition statistics, the minimum recommended GPA for applicants is a 3.75.

MORRIS K. UDALL SCHOLARSHIP
www.udall.gov
(University nomination required.)
Campus deadline: September
The Udall is intended for sophomores and juniors who intend to pursue careers in environmental public policy or environmental science. Applicants should have a strong GPA and a history of leadership and activism related to the preservation or restoration of the environment. The scholarship provides $5,000. The scholarship is also open to Native Americans and Alaska Natives who intend to pursue careers in health care or tribal public policy.

HOT WEB SITES

www.american.edu/cas
Go to CAS Web site for details on all AU science programs.

www.training.nih.gov/careers/careercenter/index.html

recruit.sciencemag.org
The Science Professional Network provides links to job listings, with complete position descriptions.

www.scijobs.org
This Web site contains job listings in biology, chemistry, biochemistry, biotechnology and a range of other jobs in science.

www.earthworks-jobs.com
Earthworks has a large number of jobs for those interested in earth sciences and related fields.

www.sciencejobs.com
Search for jobs mainly in the fields of chemistry and bioscience. Also sign up for a "jobs e-mail" alert.

www.rileyguide.com/science.html
View opportunities in every possible natural sciences area.

www.tncrimlaw.com/forensic/
Forensic Science Resources.

www.MedZilla.com/
This site offers a great place to advertise jobs and find job-seekers in biotechnology, medicine, and health care.

www.scied.science.doe.gov
U.S. Dept of Energy, Office of Science Education.

www.fbi.gov/employment/academy.htm
This site offers unpaid internships with the FBI.

www.training.nih.gov/student/index.asp
This site lists research and training opportunities at the National Institutes of Health.

www.cdc.gov/hrmo/intshps4.htm
U.S. Centers for Disease Control and Prevention, and Agency for Toxic Substance and Disease Registry sponsored/coordinated student/training programs.

www.cyber-sierra.com/nrjobs/natres.html
Cyber-Sierra's Natural Resources Guide—The 'Jobs in Natural Resources' page—tends to focus on employment geared towards fieldwork and resource professions. New announcements are frequently added.

www.ecojobs.com
Search engine for several opportunities in environmental and natural sciences fields.

For more hot Web sites, go to the on-line *Catalyst* at http://www.american.edu/cas/catalyst/.

CAS TESTS GRANTS FOR SCIENCE HONORS CAPSTONE PROJECTS

Junior science honors students can benefit from CAS's test program of awarding $250 seed-money grants for senior capstone projects. If successful, this pilot project will continue. To qualify for the test, you must:

- be a biology, environmental studies, chemistry, math/stat, physics, or psychology major
- intend to graduate in May 2006
- have your faculty supervisor's written approval of your senior capstone project proposal by April 15, 2005
- submit your approved proposal to the chair of your department by April 15, 2005

Combined bachelor's–master's (5-year) students must register for all undergraduate requirements by May 2006 in addition to the above requirements.

So get a move on! Start thinking about your senior honors capstone project now. Find a faculty supervisor, develop an interesting project, write up your proposal, and submit it via your supervisor to your departmental chair. **Reap the reward!**

EVENTS CALENDAR AND *COOL* CLASSES

February

Feb. 17

7:00 p.m. Alpha Epsilon Delta Pre-Medical Honor Society field trip to the National Library of Medicine for a private tour of the new exhibit, Changing the Face of Medicine. Contact: Carey Myers at imabiogeek@hotmail.com

Feb. 18–21

The Great Backyard Bird Count takes place on campus in conjunction with the Cornell Lab of Ornithology. Biology professor Chris Tudge will be conducting a survey of bird populations on campus. For more information or to volunteer, contact Chris Tudge: ctudge@american.edu.

Feb. 25

5:00 p.m. Application deadline for CAS's annual Ann Robyn Mathias Student Research Conference. Entry forms are available from department chairs or at american.edu/cas/src.html. Address applications to Lauren Tabbara, SRC Associate Director, College of Arts and Sciences, Battelle 159. For more information, contact Lauren Tabbara at x 2436 or tabbara@american.edu.

March

March 15

7:30 p.m. Meeting of Alpha Epsilon Delta Pre-Medical Honor Society, followed by 8:00 p.m. officer election. Hurst 102.

March 18

Noon–2 p.m. Health Careers Forum, sponsored by the premedical programs of CAS, is open to the entire AU community and guests and will feature a light buffet lunch, awards to outstanding students in the health professions, presentations by representatives of various health fields, and meetings with admissions personnel. Contact Dr. Frederick W. Carson, Premedical Programs Coordinator, fcarson@american.edu, if you have questions. Mary Graydon Center, rooms 4 and 5.

March 21

Spotted owl controversy continues. A discussion with Jim Lyons, professor, Yale School of Forestry; director, Casey Trees Foundation; and former Undersecretary of Natural Resources and Environment for USDA, "Operationalizing Biodiversity and Implementing Ecosystem Management," 5:20–6:35 p.m., Hurst 104; RSVP: solarz@american.edu.

March 23

7:00–8:30 p.m. John Marburger, science advisor to President Bush, to speak on campus: "The Roles of Institutions and Scientists in Policymaking." Location: TBA.

March 24

6:30 p.m. Careers in psychology: information session for psychology majors and minors who want to learn about the various career options and opportunities for BAs in psychology. Location: TBA.

April

April 2

CAS's annual Ann Robyn Mathias Student Research Conference, in Battelle-Tompkins. CAS will award funds to the graduate student and the undergraduate student who present the best scholarly and creative work, as judged by faculty and student referees, in one of the disciplines that make up three clusters—arts and humanities, social sciences, and physical science. Sessions run all day, and lunch is provided to participants and audience members. For more information, contact Lauren Tabbara at x2436 or tabbara@american.edu.

April 4

5:20 p.m. Careers in Conservation Biology Speaker Panel. Guest speakers: Elizabeth Kim, JD, PhD, Environmental Protection Agency; Dave Jansen, House Resources Committee; Margaret Spring, JD, Senate Commerce Committee, Subcommittee on Oceans; Frank Letkiewicz, Cadmus Group, environmental consulting; Chris Palmer, president, National Wildlife Productions. Hurst 104; RSVP: solarz@american.edu.

April 19

7:30 p.m. Meeting of the Alpha Epsilon Delta Pre-Medical Honor Society, followed by 8:00 p.m. study break; a movie will be shown and food will be provided. Hurst 102.

April 27

12:30–2:30 p.m. Department of Mathematics and Statistics departmental awards and recognition session, Bentley Lounge.

Date and location TBA

Alpha Epsilon Delta Pre-Medical Honor Society to sponsor formal to benefit a community of local homeless shelters. Sign up for calendar listserv for details.

May

May 7

12:00–1:00 p.m. Psychology majors graduation party and awards ceremony. Asbury 102.

COOL CLASSES

ATEC-101 Fundamentals of Audio Technology

Usually offered every fall. Everything you've always wanted to know about sound from its properties to yours—that is, audio components and how they work. Prerequisite: permission of instructor.

MATH-170 Precalculus Mathematics

Usually offered every term. This is the course for you if you intend to take MATH-221. Prerequisite: three years of high school mathematics, or MATH-15x, or permission of department.

CHEM-230 Earth Sciences

Usually offered every term. You don't usually think about evolution applying to the earth, but it does—remember the tsunamis that hit Asia December 26? Learn more about the phenomenon than TV news told you. Prerequisite for General Education credit: CHEM-100G, CHEM-110G, PHYS-100G, PHYS-105G, or PHYS-110G.

BIO-220/BIO-220G The Case for Evolution 5:2

Usually offered every term. From the initial organic soup some four billion years ago to the relatively recent emergence of humans—and how technological advances will influence human evolution—all in one semester. Prerequisite for General Education credit: BIO-100G or BIO-110G or PSYC-115G.

PSYC-235/PYSC 235G Theories of Personality 4:2

Usually offered every term. Use four major approaches—holistic, dynamic, learning, and trait/biological—to understand your own and others' personalities. Prerequisite for General Education credit: ANTH-150G or PSYC-105G or SOCY-100G or WGST-125G.

Members of AU's Pre-Medical Honor Society at Children's Hospital, cheering patients and caregivers with candy, toys, and great costumes

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