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

Fall 2005

www.american.edu/cas

catalyst

AMERICAN UNIVERSITY SCIENCE

EDITORIAL

SCIENCE ISSUES—YOU DECIDE: EVOLUTION IN EDUCATION

Eighty years ago, Tennessee prosecutors indicted a local teacher named John T. Scopes for teaching evolution in a state-run school. At the time, Tennessee had a law against teaching "any theory that denies the story of the Divine Creation of man as taught in the Bible," teaching "instead that man has descended from a lower order of animals."

Today, the controversy about teaching evolution continues as schools across the country consider alternative ways of teaching the origin of human beings. Does religion have a role in education? Is evolution the only viable way in the education system to describe the origins of humans?

The Kansas Education Board recently approved new standards requiring schools to teach more criticisms of the theory of evolution. In 1999, the Kansas education board deleted most references to evolution in textbooks, according to the Associated Press. In 2000, a new education board defined standards that reinstated evolution in textbooks. This year's wrangling over evolution comes due to a change again in the school board committee.

Many who oppose teaching evolution suggest "intelligent design" as an alternative. Intelligent design is a theory (scientific or otherwise) that states that life is best explained by an intelligent cause rather than an undirected process such as natural selection.

Those who support the teaching of intelligent design say that evolution is just a theory and disregards the role of a higher being. Furthermore, they suggest that students ought to have options regarding possible ideas about how the world began.

Some scientists suggest that evolution and religion need not be incompatible. But most scientists state that there's a vast difference between a religious theory and a scientific theory. Evolution is a scientific theory, which means that its hypothesis has been corroborated and verified by different scientists.

Of course this conflict isn't merely between the scientific community and Christian conservatives. Yet another aspect is whether schools that mention intelligent design are endorsing a Judeo-Christian view on how human beings came into existence.

This conflict, therefore, poses the following questions: Should schools teach intelligent design in a science class alongside the theory of evolution? Are scientists right to say that intelligent design will confuse rather than enlighten? Is the scientific community wrong not to allow for alternatives to evolution?

What views on human origin do you feel should be taught in school:

a.) Only evolution
b.) Only creationism
c.) Intelligent design
d.) Evolution and creationism
e.) Evolution and views from a variety of religions
f.) Only views from a variety of religions

Mishri Someshwar
Assistant Editor

See results of stem cell research survey on the inside back cover.

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

If you wish to make a donation online, go to giving.american.edu/gift. Under Areas of Benefit, choose College of Arts and Sciences, then fill in the amount of your donation. At the Designation/In honor of window, key in: Catalyst magazine. Thank you.

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, journalism '06
april.astor@american.edu

Assistant Editor:
Mishri Someshwar, journalism '07
ms1044a@american.edu

Faculty Advisor:
Christopher Tudge
ctudge@american.edu

Senior Writers:
Michael Menachem
Lauren Riney

Please submit letters to the editor to
ms1044a@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 *The Matrix,* the cover features AU math department chair Jeff Hakim and biology master's student Jessica Lidstrom. Photo by Jeff Watts.

TABLE OF CONTENTS

GO TO
http://www.american.edu/cas/catalyst
+ fill out survey
= chance to win movie tickets

SCIENCE STARS:

Student projects affecting you!

THE SHAPES OF NUMBERS

By Lauren Riney, biochem '05

IT'S EASY TO PICTURE A RIEMANN SURFACE. Think of a sphere or a donut or a pair of pants. Now imagine that the points on these surfaces correspond in a precise way to complex numbers. You get a mathematical structure that seems to have applications all over the place in mathematics.

How can such seemingly simple objects be loaded with so much deep information? Ask **Stephen Wheatley (MATH '06).** Every other week, he met with mathematics professor I-Lok Chang to discuss Riemann surfaces. As they worked their way through a text on the subject, Chang offered guidance and answered questions. The rest was up to Wheatley.

These surfaces are very useful because they can represent multiple-valued functions more intuitively and understandably.

In number theory, Riemann surfaces come up in the proof of Fermat's Last Theorem, the most famous mathematical theorem of all times. In the theory of complex functions, Riemann surfaces are the most natural spaces on which functions live. In hyperbolic and spherical geometry, dynamical systems, cryptography, and many other areas of math, they also have a knack for being at the center of the action.

From his research, Wheatley hopes to learn much from Riemann surfaces because the subject encompasses a whole range of higher-level math. Understanding the topic would be a successful result.

Wheatley did research at the math department while teaching at a math camp called MathTree. MathTree helps third to ninth graders with basic math up to algebra 1. After his research, he plans to lecture on Riemann surfaces at a conference in the district area and most likely at a colloquium at American. He hopes to one day become a mathematics professor.

SEA CREATURES SHOULD FEAR HUMANS

OVER THE SUMMER, **WALKER TIMME (BIO '06)** researched the impact of human pollution on corals and coral reefs. She looked at nitrogen isotopes (i.e., atoms of nitrogen that differ in atomic mass) in coral.

The N15 isotope is associated with pollution caused by humans, so by looking at the ratio of N14 to N15 isotopes, it is possible to investigate the relative amount of human-induced pollution the coral was exposed to. Timme tested coral samples from the Bahamas collected by a colleague of biology professor Kiho Kim.

She took the coral layers, ground them up, and had each layer analyzed for the ratio of N15 to N14 content, Timme said.

To do this, she put the coral into formic acid which hydrates it and makes it easier to tease off the layers.

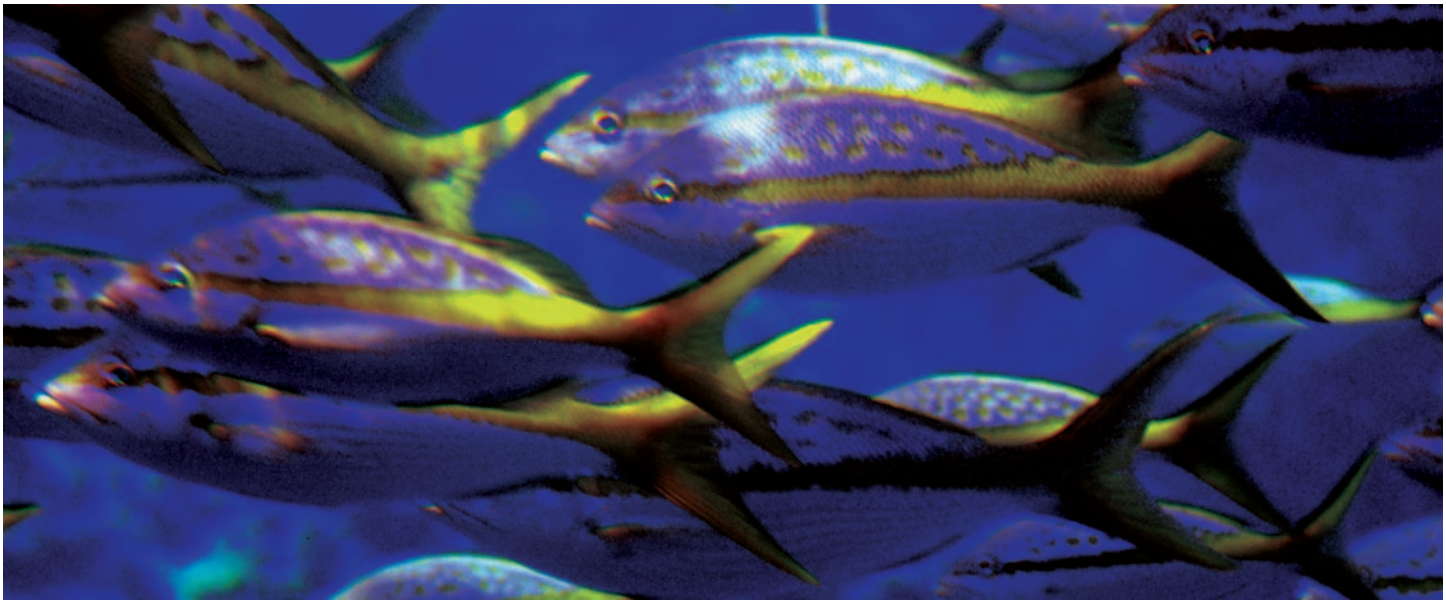
Each of the layers is likely to represent one year's worth of growth. From a piece of coral 5 mm in diameter, Timme could to tease apart more than 30 layers or 30 years of growth. This work is much like looking at the growth rings of long-lived trees to understand past environmental conditions.

Once that was done the layers were ground up and sent to an off-site lab for isotope analysis.

Timme hypothesized that as human-induced pollution increases, so would the N15 content in each carbon layer.

She worked on the project with Professor Kim and says the research is likely to continue into the fall.

The Grebe Award is helping to pay for some of Timme's research expenses. The competitive award is given to biology undergraduate applicants for summer research.



SOMETHING FISHY IN THE CHEM LAB

By Lauren Riney, biochem '05

ALTHOUGH **JONATHAN EDWARDSEN (CAP/CHEM '07)** LOVES BEING OUTSIDE, HE DEVOTED HIS summer to working with fish eyes in the AU chemistry department. The goal of his research was to develop new methods and procedures to determine dopamine levels.

Research has shown that the retinal clock in fish, and most other vertebrates, controls melatonin synthesis and release. Because melatonin inhibits the release of dopamine, Edwardsen's research could be used to assist people with Parkinson's Disease.

Dopamine is a neurotransmitter that transmits chemical signals in the nervous system. The neural cells which produce dopamine deteriorate in Parkinson's patients and cause less dopamine production. Parkinson's symptoms, such as muscular rigidity, resting tremor, and difficulty with movement, appear when dopamine levels are very low.

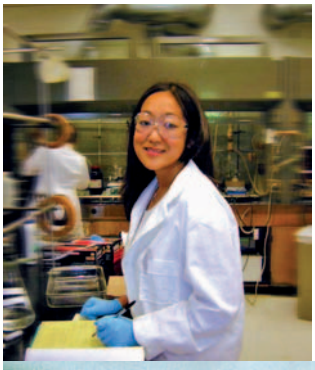
It is believed that Parkinson's patients suffer from a dopamine deficiency in the basal ganglia of the brain. A new procedure to determine dopamine levels in fish could be applied to human diseases. According to Jonathan, quantification of dopamine levels would allow for sound analysis and direction for what is a cause of Parkinson's. Since it is still unknown what causes the disease, quantification of it at this stage is critical.

The procedure that he used involves high performance liquid chromatography (HPLC). The sample is injected into the machine, which has an electrochemical detector and an ultraviolet detector. The column in the HPLC machine separates the dopamine in the sample in order to determine the amount of dopamine as well as if there are any impurities. The next phase of the project is to use LCMS (liquid chromatography mass spectroscopy) to further analyze the sample. Edwardsen hopes to develop a new method of determining the dopamine concentration by means of LCMS, GCMS (gas chromatography mass spectroscopy), HPLC, or a combination of the three.

Edwardsen received a stipend for the summer by winning a Schwartz scholarship.

MAKING MEDICINE

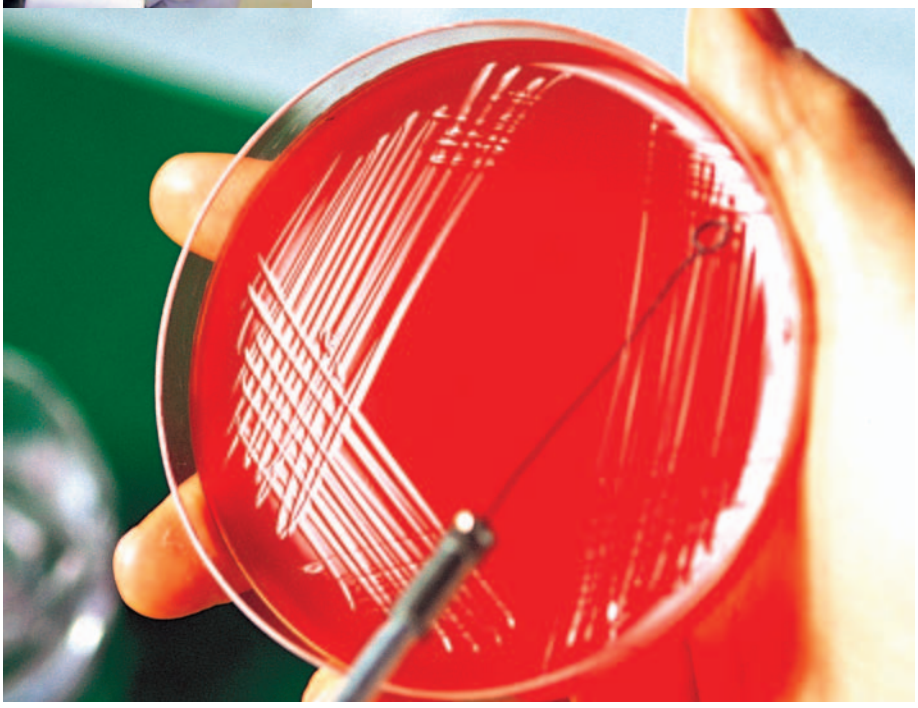
By Erika Viltz, journalism '05



WHILE SOME STUDENTS (BUT NOT AU STUDENTS) were stuck making coffee in an office internship last summer, **Lisa Hutchinson (CHEM '06)** made medicine—drugs she hopes will make a difference in the world.

Her area is antibiotics, medicines developed to treat bacterial infections. Creating new and better antibiotics has become increasingly important because over time bacteria can become resistant to antibiotics like penicillin. Bacteria create an enzyme called beta-lactamase, which causes a resistance to antibiotic drugs and keeps them from doing their job. Without another medication, patients who are infected with a drug-resistant bacteria are left without other treatment options.

By creating a drug with a similar structure to the current medicine, but with slight variations, she hopes to provide an alternative.



But whatever the results, for Hutchinson it's equally important to discover more information in this area and provide ideas for future scientists to study.

Like many other biochem majors, Hutchinson worked directly with chemistry professor Monika Konaklieva in the chemistry department. Konaklieva wrote out the steps for Hutchinson to follow and Maya Kostova—a graduate student who was working on a similar project—guided Hutchinson on day-to-day issues. Their goal was to create three antibiotic samples that they could send away to be tested "to see if they actually work or not," Hutchinson says.

While these exact compounds and structures have never been created before, she used typical organic lab techniques to make the reactions, clean the samples, and test the compounds—procedures scientists around the world use all the time—so along the way she mastered a host of tools to help her in the future.

Doing this kind of research has been a good experience for Hutchinson; the pre-med student craves a career in healthcare. She plans to attend medical school after completing her degree in May 2006.

GLOWING BUBBLES

By Nick Hoover, journalism '05

SENIOR **KELLY REIDY (CAP '06)** ATTEMPTED TO MIX SOUND AND LIGHT in a novel way for her honors supplement last semester.

"I'm really interested in sound and wanted to explore it in more of a physical context than I had before," the physics and audio technology double major said.

Reidy's project was to produce an air bubble in a flask of water that would emit light as pressure from sound made it expand and collapse.

Reidy hooked up a function generator—which creates a variable voltage signal in the form of a sine wave—by wire to very small pieces of ceramic (piezoceramic transducers). She then epoxied the pieces to opposite sides of a water-filled flask. These pieces would pass sound waves at pitches too high for the human ear to hear. As Reidy turned the function generator's amplitude up or down, the unheard sound would get louder or softer, meaning an increase or decrease in the voltage of this signal.

Gluing the ceramic to the flask made the sound waves create pressure changes in the water as they resonated and created standing waves in the flask. An oscilloscope was connected to the flask to monitor these changes in pressure.

When Reidy set the function generator to output the correct voltage and frequency, she was ready to insert the air bubble into the water. She carefully squirted bubbles into the water with an eyedropper.

If her calculations and experimental settings were precisely correct, a bubble would be levitated in the exact center of the flask. The pressure that pushes air bubbles to the top of water, balanced with a sound-induced pressure that pushes things down in the water, aided by pressure from sound waves coming from both sides of the flask, should cause the bubble to move to the center of the flask.

Now, as she increased voltage from the function generator, the bubble began to dance in the middle of the flask, with dances as elaborate as one bubble rapidly orbiting a nearby bubble. This was as far as Reidy was able to get with her project, but only because she didn't prepare the water correctly. She said she has corresponded with others who have done the same project and will get it right in the fall.

Reidy said that in order for the procedure to work, she needed to eliminate all but 20 percent of the gas normally present in water by boiling it off. Next time, she will boil the water for twice as long to eliminate all the gas, and then add a bit of water to try to get closer to that 20 percent.

If all goes well, when Reidy returns to her project, as the function generator gets closer to a critical voltage, pressure will make the bubble expand and contract to its smallest possible size extremely rapidly: 26,000 times each second.

At its smallest, Reidy says, the pressure inside the bubble will be close to the pressure at the center of Jupiter—think incredibly high pressure, 20 million times higher than atmospheric pressure—and the temperature inside the bubble three times that of the sun's surface.

At this point of rapid expansion and contraction, the bubble should begin to appear to emit a steady blue light, light which in actuality is 26,000 pulses a second, each lasting less than a nanosecond, a miniscule fraction of a second. This is called sonoluminescence.

Although Reidy may achieve her glowing bubble this fall, there are still mysteries to be uncovered, perhaps by a future AU student. Scientists don't yet understand why the bubble gives off light, Reidy says.

By Mishri Someshwar, journalism '07

DOES REFLECTING ON POSITIVE EVENTS MAKE PEOPLE HAPPIER AND healthier? A study conducted by **Cara Moody (FREN '05)** and psychology professor Tony Ahrens aimed to figure out just that.

"We wanted to explore how being aware of positive events affects gratitude," Moody said. They studied the effects on the day that the positive event occurred and again at the end of the study.

Participants in the study went to the psychology lab and filled out a series of questionnaires about their feelings and thoughts. Then, daily for two weeks they took an online survey that asked them to write about a positive event that day and answer some questions about their feelings. Half the participants wrote about a good event for which someone else is responsible. The other half wrote about an event for which no one is responsible. At the end of the two-week period, the participants came back to the lab to fill out more questionnaires.

There is very little scientific data on the emotion of gratitude, Moody said. She mentioned that one previous study showed that practicing gratitude increased subjective well-being. However, that study focused on gratitude for events caused by someone else. Moody pointed out that for some people gratitude includes feeling thankful for events that no one caused.

A pilot study suggested that it is possible to distinguish these two types of people. In their study, Ahrens, Moody, and other students in the lab tried to replicate those results with a larger sample. This research will help to define terms within gratitude research. "If we can further explore the relationships between different types of gratitude, mindfulness, and emotions, our research might have implications for emotional well-being and the treatment of depression," Moody said.

Moody received an undergraduate research grant from CAS to perform the study and will be presenting the findings at the CAS Undergraduate Research Conference in spring 2006.

STUDENT TARGETS KILLER

By Rebekah Moan, journalism '06

LUNG CANCER IS THE SECOND MOST COMMON FORM OF CANCER and the leading cause of cancer-related deaths for adults, according to the National Cancer Institute. An American University graduate student is trying to change that.

Jessica Lidstrom (BIO '05) completed her master's thesis research this summer at the National Institutes of Health with AU biology professor Kathleen DeCicco-Skinner.

Lidstrom targeted the most common type of lung cancer, non–small cell lung cancer, which accounts for 80 percent of all lung cancer cases according to the National Cancer Institute. She worked with drugs that specifically target genes that have been modified as the cancer progresses.

Lung cancer patients have a decreased level of the protein peroxisome proliferators-activated receptor gamma (PPARγ). PPARγ is believed to negatively interfere with the signaling pathways of another protein, NF-kappa B (NF-κ B), which is responsible for the inflammation that accompanies lung cancer. In addition, NF-κ B activates genes that help the cell survive and grow. Lidstrom researched the relationship between PPARγ and NFκ B and the mechanism behind how NF-κ B can be down regulated.

"I'm trying to elevate the level of PPARγ by administering drugs [to the lung cancer cells] that specifically target and activate PPARγ, which can reduce the level of NFκ B, resulting in reduced tumor growth and inflammation," she said.

Lidstrom's research included both *in vitro* and *in vivo* studies. She worked with six different cell lines of non–small cell lung cancer and treated them with different concentrations of the potential cancer drugs PGJ2, Rosiglitazone, Ciglitazone, and Troglitazone to determine the drugs' effect. Over the summer she conducted an *in vivo* study using mice. Lung cancer cells were injected into the mice and were allowed to form a tumor. The mice were treated with different PPARγ antagonists (drugs) to see if the tumor size was reduced.

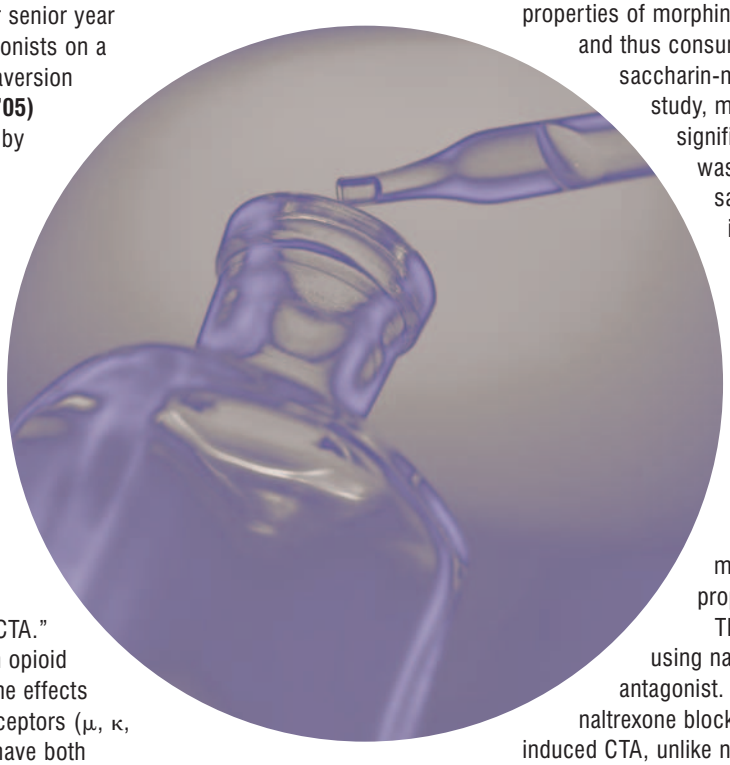
So far they have seen a relationship between PPARγ and NFκ B. By fall Lidstrom hopes to be one step closer to finding an effective treatment for lung cancer.

RATS ON MORPHINE

By Linda Lee Hassan, journalism '06

MORPHINE IS WIDELY AND EFFECTIVELY USED FOR TREATING PATIENTS with chronic pain. But morphine can cause many problems in patients, including constipation, nausea, fatigue, and addiction.

Erica Lipizzi (PSYC '05) spent her senior year researching the effect of opioid antagonists on a morphine-induced conditioned taste aversion (CTA). She and **Caitlin Monks (PSYC '05)** were part of a three-person team led by psychology professor Meredith Fox. Knowledge gained through their experiments may be beneficial in the study and treatment of drug abuse.



Morphine is in a class of medications called "opioid analgesics" that work by affecting the way the body senses pain.

"There are three opioid receptor subtypes in the brain that morphine binds to," Lipizzi explained. "We tested the effects of drugs called antagonists, which block the effects of morphine at the receptors, and how they impact the development of a morphine-induced CTA." The goal was to assess the use of an opioid antagonist which selectively blocks the effects of morphine at one of three opioid receptors (μ, κ, and δ). Since morphine is known to have both rewarding and aversive properties, they hoped to get an idea about the roles that each receptor plays in the aversive properties of morphine by antagonizing the effects of morphine at one receptor subtype at a time. The balance between the rewarding and aversive properties of a drug might determine whether it will be used or abused.

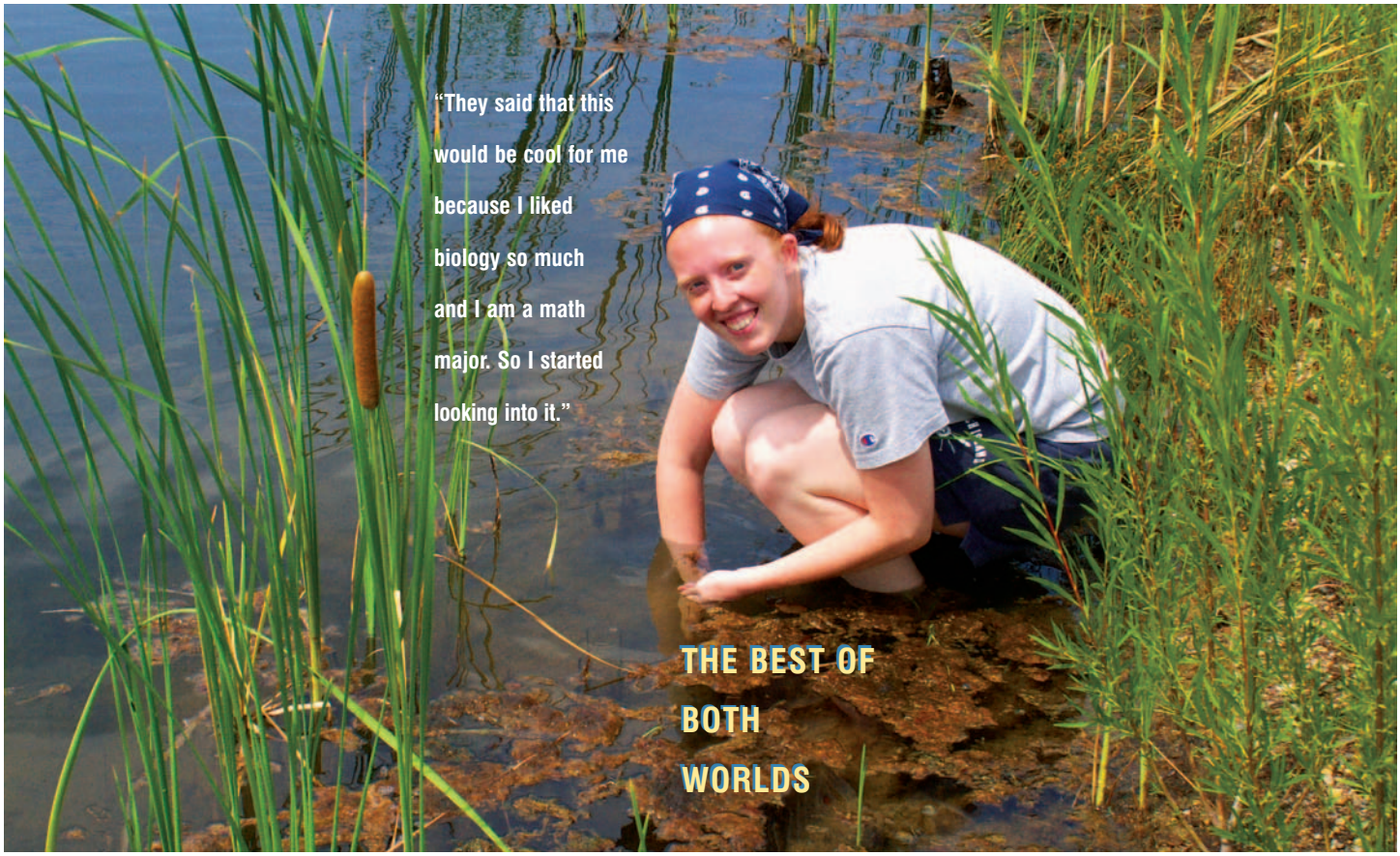
Lipizzi said her team was able to evaluate the roles of each receptor in morphine's aversive properties because of the drug's ability to induce a CTA in laboratory rats. That is, the rats paired the aversive properties of morphine with a novel saccharin solution, and thus consumed less saccharin following saccharin-morphine pairing. In this particular study, morphine alone did not induce a significant CTA, probably because it was administered 40 minutes after saccharin presentation (typically it is immediate).

However, when morphine was administered in combination with the δ opioid receptor antagonist nalatrindole, it resulted in a significant morphine-induced CTA. Thus, the naltrindole appeared to increase the adverse effects of morphine in a dose-dependent manner. These findings suggest that the δ opioid receptors may be involved in the aversive properties of morphine.

The team later repeated the study using naltrexone, a selective opioid antagonist. In that study, the team found naltrexone blocked the development of a morphine-induced CTA, unlike naltrindone, which increased the aversive effects. Last summer the team continued the study using MR2266, a κ opioid antagonist.

Lipizzi won an award for her research at American University's 15th Annual Ann Robyn Mathias Student Research Conference held April 2.

GETTING OUT OF DODGE



By Andrea L. Alford, journalism '06

FINDING THE PERFECT CAREER IS ALWAYS difficult, but graduate student **Kristina Donnelly (MATH '05)** hit the jackpot. She spent most of her summer vacation testing the waters of a prospective career in theoretical ecology at Michigan State University's ELME science program, an opportunity that she could not pass up.

ELME (Enhancing Linkage between Mathematics and Ecology) is an extensive seven-week course at MSU's Kellogg Biological Station. The program, designed for those with minimal mathematical training, taught students how to apply mathematical and statistical tools to ecological questions. The two-part program began with three weeks of math courses that introduced the dynamics of mathematics in ecology and evolution. Students constructed experiments and models that further illustrated the linkage between theoretical methods of ecology and statistical information.

Donnelly described it as "a basis for the study of mathematical biology . . . kind of a review of some of the basic methodology."

The bulk of the ELME program is the four-week fieldwork course where students use problem-solving skills in field studies on terrestrial and aquatic ecosystems. Students can integrate math and ecology through conceptual and practical research approaches and hands-on fieldwork.

Although she was a math major, Donnelly developed a liking for biology and believed that the ELME program would provide insight into a profession that merges the two subjects, giving her a feel, she said, of what exactly she wanted to focus on. Donnelly was first introduced to the idea in the winter of 2004 when two of her professors, Susan Solarz and Kiho Kim, approached her about the theoretical ecology field. Donnelly explained, "They said that this would be cool for me because I liked biology so much and I am a math major. So I started looking into it."

Donnelly followed up her time in Michigan with an internship in August at the National Institutes of Health, modeling the spread of chronic wasting disease. "This is very preliminary, but we are hoping to discover the effects of culling programs on the spread of the disease," Donnelly said. "Culling is thinning out the population to reduce its density, in order to stop the spread," she explained. Donnelly will ultimately write a paper about her findings and is hoping to apply what she learned through the ELME program to her research at NIH. Donnelly will be returning to AU this fall in the graduate statistics program.

PROFESSOR PROFILES

THE SOUND OF MUZAK AND DRUGS

By Mary Specht, journalism '08

PROFESSOR PAUL OEHLERS KNOWS WHAT A trip on crystal meth sounds like. He said it wasn't hard to write the soundtrack to *Most High*, an award-winning film about addiction, because "usually that's what I write anyway."

"My music I guess, makes people think of drugs," Oehlers said. He prefers "sort of weird techno" and likes to combine orchestral and synthesized sounds. Oehlers said someone described the music accompanying one of his dozen short films, a piece that involved the alphabet, as "Sesame Street on acid."

His style was perfect for *Most High,* and director Marty Sader chose Oehlers over about 300 other musicians to make the soundtrack that Variety described as an "extraordinarily evocative, often dissonant score . . . an extended overlaid trip in itself."

But not all of the music was as memorable, Oehlers said. The project gave him the chance to create everything from mesmerizing trip tunes to cheesy grocery store music. "I really struggled writing bad grocery store music." The challenge amused Oehlers, who gets a kick out of irony.

Oehlers was drawn to the project because Sader offered him artistic freedom, a rare quality among directors. Oehlers dedicated himself to the project, working closely with Sader even though the two didn't meet until after the film was completed. They discussed the soundtrack via phone.

"I think most composers are careless and irresponsible working on their music," he said. Some will compose a feature film soundtrack in only a month, Oehlers said. "I want to spend as much time working on my music as the director spends on the film."

"A lot of stuff I write uses mathematics," he said. He bases some of his tracks on Golden Sections, a ratio of 1 to .618 discovered by the Greeks. The ancient proportion represents classical beauty and can be used to time music themes.

The film won awards at numerous film festivals, including the prestigious Golden Starfish for best narrative feature at the

Hamptons International Film Festival in October. The award includes more than $180,000 in goods and services and is the largest of its kind. *Most High* also swept awards ceremonies at Indiefest Film Festival in Chicago last year, taking five of the eight prizes, and won the top jury prize at the Atlanta Film Festival.

Oehlers came to AU last fall, around the time *Most High* came out. He said he loves the audio tech program here. The program, which includes about 60 students, is small enough to feel like a community.

"I can help [students] better," he said. "I don't feel like I'm helping a number, I feel like I'm helping a person."

MOVIN' ON UP

By April Astor, journalism '06

ON JULY 1, PROFESSOR JEFF HAKIM TOOK OVER AS CHAIR OF AU'S math department. He is now generating crazy (aka creative) ideas to get the department the reputation it deserves. For instance, he'd like to see if virtual reality could be used in Calculus III classes to visualize things in three dimensions. He also plans to redo the departmental Web site in a humorous, newspaper-style format like *The Onion.*

"I'm thinking that it shouldn't be that hard to make the world's greatest math department Web site. We should be able to do that."

Hakim said that coming up with ideas is the easy part. Following through on them is the real test.

When describing his own mathematical research, Hakim refers to something called the "local-global principle" in number theory.

"Imagine if the laws governing the motion of electrons around a nucleus were strikingly similar to the laws governing the orbits of planets. Then you might use what you know about electrons to suggest things about planets. Number theory behaves like this. I study the local theory."

Specifically, Hakim works in a field called Representation Theory, the study of the arithmetic of matrices. Matrices are tables of numbers, but the numbers he uses are strange ones called p-adic numbers. They have important applications to number theory, one of the oldest branches of mathematics.

"There are also deep connections between this stuff and physics. Some of what I do is remarkably similar to what [physics professor] Nate Harshman is doing," said Hakim. "That's when math gets interesting—when there are unexpected connections and linkages."

He is currently working with a colleague on a theory called Distinguished Tame Supercuspidal Representations. Once complete, it will generate lots of examples and spin-offs. The goals of his work are to accomplish something of interest to number theorists and also to contribute to the larger area of harmonic analysis. Hakim explains harmonic analysis as the ability to break up a function on a space into atomic pieces.

"If you take any shape, there are going to be certain atomic particles associated with it and you can decompose anything into these particles. My job has been to find these atomic particles for some exotic spaces that come up in number theory."

Hakim is optimistic that this information will have implications for the global aspects of number theory.

"The most wonderful thing about mathematics," Hakim says, "is that you can make wild conjectures about what you think is true and you are usually not that far from the truth."

PHYSICS

Dr. Demetrius Venable

Professor of Physics and Chairman of the Department of Physics and Astronomy at Howard University

If you've ever wondered where data about the atmosphere comes from, Demetrius Venable can tell you.

Venable, who received a master's degree and a doctorate in physics from AU, is a professor of physics and chairman of the physics department at Howard University. He specializes in optical physics, doing remote sensing of the atmosphere with a lidar system.

This consists of shooting laser light into the atmosphere and observing how the light interacts with atmospheric particles. Photons are scattered back into detectors and can be used to glean information about the atmosphere. Venable's work focuses on measuring water vapor and changes in water vapor as a function of altitude. He measures it in time scales of several minutes.

Venable's data is useful to colleagues who have models for climate prediction. They can use the information he provides to develop models that discuss climatology. He is currently working on a project to develop new techniques of using ground-based lidar to measure daytime lower troposphere ozone and water vapor.

He advises current science students to focus on their research skills now, because they really do pay off in the long run. "Those who are participating in physics and in science in general have good careers ahead of them," he said.

AU Degrees: MS physics 1972, PhD physics 1974

HEALTH POLICY

When Science and Government Collide

By Michael Menachem,
public communication '04

You don't have to be a science major to be invested in scientific progress in America.

"Everyone needs to participate in science," said American University alumnus Gary Kline. As an undergraduate at AU, Kline admired students who pursued scientific majors although he never had much interest in the subject himself. Kline came to Washington as a government major. He thought science courses were what "smart people" took.

After working for the Alliance for Aging Research and in various law and lobbying jobs, Kline returned to AU for a master's degree in public policy with a focus in health policy.

Now he's a legislative analyst at the Federation of American Societies for Experimental Biology (FASEB), which represents 22 independent societies with more than 65,000 members.

Believing an underfunded scientific enterprise is unhealthy for the U.S. economy and its citizenry, Kline advocates for scientists and researchers, making sure government officials understand the importance of science funding. He also provides tools to scientists to help them educate both their community and elected officials about the important work they do.

"For the future of science to be sustained, scientists have to take action," said Kline. "When funding declines, the younger ones have to stand up. They have to get more political, even though science is not political. One of the most important things our country has is the scientific enterprise."

AU Degrees: BA government 1997, MPP 2003

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 of the 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

RESEARCH TECHNICIAN IN HUMAN EMBRYONIC STEM CELL BIOLOGY

An NIH-funded position is available at Mount Sinai School of Medicine to study regulation of human embryonic stem cell differentiation and development, using federally approved human embryonic stem (ES) cell lines. Projects focus on signaling pathways and transcription factors involved in formation of stem or progenitor cells and their differentiated cell types.

The ideal candidate has at least a BA or BS degree and a strong background in molecular or developmental biology. Previous independent laboratory research experience required. Experience with mammalian cell culture highly desirable. Salary is generous and commensurate with experience. Flexibility in schedule required.

Please e-mail or fax: CV, names and contact information for at least three references to: Margaret H. Baron, MD, PhD; Department: Medicine & Molecular, Cell and Developmental Biology; Mount Sinai School of Medicine; phone, 212-849-2442, e-mail, margaret.baron@mssm.edu. Interview required.

Mount Sinai School of Medicine, on Manhattan's Upper East Side adjacent to Central Park, provides a highly interactive scientific environment and excellent facilities. Fully equipped, state-of-the-art laboratory is in a beautiful new research building. A number of other laboratories at Mount Sinai have a common interest in cardiovascular biology, developmental biology, hematopoiesis, gene regulation, and stem cell biology. Postdocs, research assistants, and students participate in a formed Stem Cell Biology Journal Club and in various seminar series throughout the institution.

STAFF CLINICIANS

The National Institute on Drug Abuse (NIDA), National Institutes of Health, seeks a staff clinician to work in the Intramural Research Program, Baltimore, Md.

The Molecular Neurobiology Branch (MNB) is seeking an internist, neurologist, or psychiatrist to contribute to clinical aspects of the branch's human addiction genetics and pharmacogenomic research programs. Duties include protocol development and implementation, monitoring and aiding recruitment, consenting of subjects in genetic and pharmacogenomic protocols, and improving information flow between laboratory-based genotyping and haplotyping, and subject recruitment for genotype-based interventions. The incumbent will work with the chief, MNB, to maintain a state-of-the-art clinical program that significantly advances knowledge of the role of human genetic variation in individual differences in drug responses and vulnerability to addiction and related phenotypes. A PhD and/or clinical research experience are desirable. Submit materials to: Ms. Alvina Walters, DHSS/NIH/NIDA/IRP, Molecular Neurobiology Research Branch, TRIAD, Room 3610, 333 Cassell Drive, Baltimore, MD 21224. Inquiries: 410-550-2843x145; fax, 410-550-1535; awalters@intra.nida.nih.gov.

INTERNSHIPS

NATIONAL ZOO GLOBAL SPECIES ADDRESS BOOK

The National Zoo's Monitoring and Assessment of Biodiversity (MAB) program has openings for interns to help research inventories and species lists of animals and plants in protected areas throughout the world.

The MAB Program gathers and standardizes documented biological inventories of the plant and animal species of the world's protected areas into a Smithsonian Global Species Address Book (GSAB). The MABFauna and MABFlora database already has species data from more than 1,000 protected areas in more than 100 countries, with about 30,000 protected areas in 191 countries to go. GSAB users include: protected-area managers, scientists, and students seeking data sources, ecotourists seeking the locations of specific species, policy makers, and conservationists.

Interns will: identify protected areas and request species inventories; research species inventories in print and online and network with conservation organizations; enter species data in MABFauna and MABFlora software for Internet posting. Bottom line: rescue data from obscure sources, save it from disappearing in this "information age," and negotiate free public access to it.

Interns must: desire to make a difference in conservation and environmental policies and practices; appreciate the use of comparative empirical data in conservation; and be able to use elementary computer software.

Students from all academic disciplines have been successful as interns in this project. Interns need not have a background in the biological sciences.

This is an ongoing project. Interns may start at any time. Application is ongoing. Apply at http://nationalzoo.si.edu/undergradinternships/research/FormRegApp.cfm.

In addition to submitting the online application, send the following items as e-mail attachments to cauthornk@crc.si.edu: cover letter, current résumé or CV, college transcript (unofficial or electronic version is acceptable), contact information for two references (affiliation, address, phone number, and e-mail address) and indicate how they know you.

COLUMBIA HEIGHTS COMMUNITY SCIENCE WORKSHOP (CSW)

Interns will assist in the development of science curriculum and in community outreach.

The CSW is a neighborhood science center that offers informal science education programming to underserved audiences to provide youth with diverse, creative, and substantive science experiences.

Interns will learn organizational skills and strategies required to teach multiple audiences, conduct research on a science program at the National Zoo, assist teachers in developing lesson plans, and assist with education programs at the Amazonia Gallery and Community Science Workshop.

Interns will be required to submit a paper summarizing their experiences. Projects

developed by interns will be incorporated into the Community Science Workshop science program.

Applicants must be enrolled in a science or education program at a high school, college, or university and should be comfortable with youth (K-12). Term of appointment ranges between six and ten weeks.

Send, fax, or e-mail your résumé and a brief personal statement describing your educational goals to: Mario Castellanos, Internship Application, National Zoo, Department of Conservation Biology, 3001 Connecticut Ave., NW, Washington, DC 20008; fax, 202.673.4686; e-mail, castellanosm@nzp.si.edu.

NATIONAL SECURITY AGENCY SEASONAL INTERN PROGRAM FOR INFORMATION ASSURANCE (SIP/IA)

Working at NSA for a semester you can earn while you learn the field of information assurance (IA). You will be involved in information operations that protect and defend the Nation's top-secret information and information systems, as well as providing for restoration of information systems by incorporating protection, detection, and reaction capabilities.

Applications must be received by March 15 for the fall semester (Sept.–Dec.), June 15 for the spring semester (Jan.–May), Oct. 15 for the summer semester (June–Aug.).

SIP/IA is a 12-week program open to select college upperclassman and graduate students whose concentration is in information assurance. The student must return to school for at least one semester following the internship.

For purposes of this program, IA encompasses the scientific, technical, and management disciplines required to ensure computer and network security, such as: system/network administration and operations; systems security engineering; information assurance systems and product acquisition; cryptography; threat and vulnerability assessment, including risk management; Web security; the operations of computer emergency response teams; information assurance training, education, and management; computer forensics; defensive information operations.

Relevant academic disciplines, with concentration in IA, include, but are not limited to: mathematics, biometrics, computer or electrical engineering, computer science, software engineering, computer programming, computer support, database administration, computer systems analysis, operations research, information security (assurance), and business management or administration.

An intern must: be a U.S. citizen, have a GPA of 3.0 or higher, be a college junior, and be eligible for a security clearance.

Students are paid a competitive salary commensurate with experience and education. You will receive annual and sick leave, enjoy federal holidays, and participate in agency-wide extracurricular programs. If you attend an out-of-state school, you are eligible for a round-trip airfare ticket to and from school or mileage reimbursement up to the cost of a government issued airline ticket.

Application must be submitted online on or before the respective deadline for the semester in which you are applying. Applications received after the deadline, as well as incomplete packets, will not be considered.

To submit a résumé online, go to http://www.nsa.gov/careers/students_1.cfm#sipia, click the Apply Online link, and select View Job Posting/Apply for Job. Under Student Programs select College Summer Programs and click on the Search button. Add Info Assurance Intern Program to your Job Basket and click on Apply for Jobs in Basket. Follow directions as prompted.

To be considered for SIP/IA, you must submit a complete application packet that includes a résumé with cover letter and official transcripts.

Important: When applying online, submit only your résumé. Please e-mail unofficial transcripts to jldarl2@nsa.gov.

SCHOLARSHIPS

NATIONAL INSTITUTES OF HEALTH SCHOLARSHIP

The National Institutes of Health (NIH) Undergraduate Scholarship Program (UGSP) offers competitive scholarships to students from disadvantaged backgrounds who are committed to careers in biomedical, behavioral, and social science health-related research. The program offers scholarship support, paid research training at the NIH during the summer, and paid employment and training at the NIH after graduation.

The NIH UGSP pays up to $20,000 per academic year in tuition, educational expenses, and reasonable living expenses to scholarship recipients. Scholarships are awarded for 1 year and can be renewed up to 4 years.

For each full or partial scholarship year, you are committed to two NIH service obligations that provide you with invaluable research training and experience at the NIH:

1) 10-week summer laboratory experience. After each year of scholarship support, you train for 10 weeks as a paid summer research employee in an NIH research laboratory. This employment occurs after receiving the scholarship award. Each scholar is assigned to an NIH researcher and an NIH postdoctoral fellow, who serve as mentors. You also attend formal seminars and participate in a variety of programs.

2) Employment at the NIH after graduation. After graduation, you continue your training as a full-time employee in an NIH research laboratory. You must serve 1 year of full-time employment for each year of scholarship.

NIH Undergraduate Scholarships are awarded on a competitive basis to students who show a commitment to pursuing careers in biomedical, behavioral, and social science health-related research. You must be a U.S. citizen, national, or qualified noncitizen; be enrolled or accepted for enrollment as a full-time student for the 2006–2007 academic year at an accredited 4-year undergraduate institution; be from a disadvantaged background (i.e., your financial aid office has certified you as having "exceptional financial need"); and have a 3.5 GPA or higher (on a 4.0 scale) or be within the top 5 percent of your class.

You are encouraged to apply online at http://ugsp.info.nih.gov. This Web site contains detailed information on the UGSP, as well as downloadable application forms. Click on Application Forms for the address if you prefer to mail your application.

Schedule for 2006–2007 awards: applications are available in fall 2005, deadline for receipt of completed application is February 28, 2006, and award notifications are made June–August 2006. For more information, see http://ugsp.info.nih.gov/exesumfaq.htm.

MORRIS K. UDALL SCHOLARSHIP

University nomination required—www.udall.gov
Campus deadline: September 30, 2005

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 grade point average and a history of leadership or activism related to the preservation or restoration of the environment. The scholarship provides up to $5,000.

The scholarship is also open to Native Americans and Alaska Natives who intend to pursue careers in tribal public policy or health care.

BARRY M. GOLDWATER SCHOLARSHIP

University nomination required—www.act.org/goldwater
Campus deadline: September 30, 2005

The Goldwater provides up to $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 grade point average for applicants is a 3.75.

Global Climate Change

By April Astor, journalism '06

The impact of global climate change—and an urgent call to action—was the subject of a photographic exhibit in the main quad during the summer.

The exhibit, NorthSouthEastWest, was created by the British Council USA and the British embassy to present the impact of climate change in communities around the world. The British Council wants to emphasize that global warming is an urgent environmental issue with local, national, and global consequences.

The exhibit illustrated some of the consequences and environmental issues of climate change through pictures and quotes. Each photograph captured a striking example of climate change and its effects, ranging from extreme weather events and observed glacier retreats to poor urban air quality and environmental refugees. The exhibit also highlighted ways to reduce carbon emissions through fuel cell technology, effective public transport systems, carbon capture and storage, and emissions trading.

A quote from actor and activist Leonardo DiCaprio noted that the effects will be felt most severely in such cities as New Orleans, Miami, and possibly even New York. He urged individuals to make efforts on the local level by contacting their representatives, as the U.S. government "fails to act."

"Climate change is the biggest challenge that we face in the world today," said Professor Sir David King, U.K. chief scientific advisor. "Extreme weather events are becoming more common," he said. "Glaciers are melting. Sea ice and snow cover are declining. Animals and plants are responding to an earlier spring."

British prime minister Tony Blair said that "for government, climate change leadership must involve taking the issue from the margins to the mainstream to help guide policy and action . . . The clock is ticking, the climate is changing, but we can do something about it."

The exhibit was developed by the British Council in partnership with The Climate Group and Magnum Photos. The British Council first contacted AU biology professor Kiho Kim to see if the university would be interested in hosting the exhibit. The College of Arts and Sciences agreed and the exhibit ran from July 1st through August 1st.

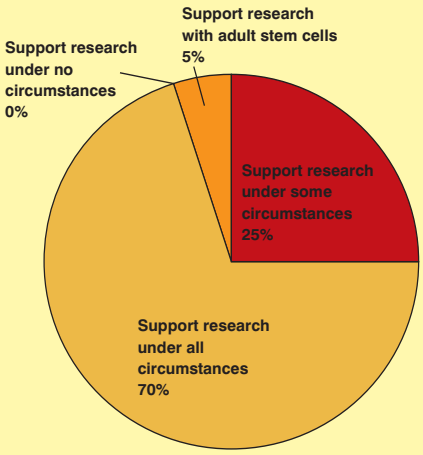
The Climate Group is a nonprofit organization working to accelerate the reduction of greenhouse gas emissions by assembling a leadership coalition of the world's most pro-active companies, cities, states, and national governments.

The British Council USA increases recognition of the wide array of learning opportunities available in the United Kingdom and facilitates educational cooperation between the United States and the United Kingdom. The organization also showcases British artistic achievement and scientific innovation.

Global climate change exhibit on AU campus

RESULTS OF READER SURVEY ON STEM CELL RESEARCH

Reader Support of Fetal Stem Cell Research



SIGN UP FOR MONTHLY E-MAILS TO FIND OUT ABOUT CAS EVENTS AT AU. **To sign up, contact Kim Counes at x2986, or to subscribe, send an e-mail to counes@american.edu with the subject line: CAS EVENTS-Subscribe.**

AMERICAN UNIVERSITY
WASHINGTON, DC

College of Arts and Sciences
American University
4400 Massachusetts Avenue, NW
Washington, DC 20016
www.american.edu/cas