A Ticket to Space, Please
By Shirin Karimi, literature and premedical studies ‘11

Space has always been a place that most people have viewed with wistful eyes or perhaps an expensive telescope. We stare at our own universe from the safety of Earth with the knowledge that space is a destination that only astronauts have the privilege of visiting. However, with the advent of commercial space travel, we could very well be preparing itineraries for our vacations into space in the near future.

While NASA has previously held strong on its position to only allow for government-funded space expeditions, it has opened its arms to the private sector in the face of budget cuts and the fading glow of the Space Race. In the name of expedience, efficiency, and delegation, the changing of the guard occurred on December 8, 2010, with the launch of the first privately designed and built rocket. The successful launch of the Falcon 9 rocket of the Space Exploration Technologies Corporation, or SpaceX, reflected the beginning of the company’s $1.6 billion contract with NASA for 12 flights to take supplies and cargo to the space station after NASA cancelled its Ares I rocket launch.

While Falcon 9’s historic journey took a mere 3 hours, 19 minutes, and 3 seconds from launch to touchdown, the significance of its journey is in its flawlessness. For such an important venture, one would expect there to be at least some errors, as science precludes 100 percent accuracy. However, with one successful journey behind them, NASA and its contractors can hope for many more as the private sector takes over supply transportation, leaving NASA to focus its finances and efforts on more large-scale expeditions.

This shift from publicly to privately funded space travel was unheard of when President Kennedy announced his goal of sending a man to the moon by the end of the 1960s. However, with SpaceX’s contract and entrepreneurs like Virgin CEO Richard Branson hoping to make space travel accessible to anyone who can spare $200,000, this space age reveals a shift in what science deems possible. What was unheard of before is now a feasible goal. What was paid for by taxpayers before is now a sign of ingenuity by those same taxpayers. And as we end 2010 and 50 years of dreaming about space, we can now dream about seeing it in person.
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- Astronomy
Can something the size of a grain of rice play a pivotal role in the biodiversity of our freshwater environment? According to junior Kait Esson, the answer is yes. Exploring the springs and caves of the Shenandoah Valley area in Virginia, Esson investigated *Gammarus minus*, a small freshwater crustacean that plays a bigger role in our ecosystem than meets the eye.

*G. minus* is a basic-level organism in the environment that takes up and shreds leaves, removes the nutrients, and then provides them to other organisms nearby. Because of its most basic function, *G. minus* plays a key role in the interactions of other organisms and ultimately in the environment’s biodiversity. Esson’s research on the crustacean consisted of two projects, both in the lab of biology professor Dan Fong, a cave ecologist and *Gammarus* specialist. The first project investigated its size variation in surface populations, and the second examined its blindness in cave populations.

In the springs and caves of the Shenandoah Valley, Esson took many random samples of the organisms using a D-frame dip net and looked into size variation in sexual selection. “When the *Gammarus* are mating, the males carry the females in what we call amplexing pairs,” she explained. Esson picked out these amplexing, or entangled, pairs and preserved them in ethyl alcohol.

“What we found was that bigger males tend to select bigger females.” Why that is so, she does not yet know but says they plan to conduct more research next season to determine why.

Esson also found that size variation in *G. minus* is influenced by the presence of sculpins, small fish that feed on *Gammarus* in the springs. Collecting random samples of the crustaceans in springs with sculpins and in springs without sculpins, she compared the two groups.

Interestingly, springs with sculpins had smaller *Gammarus* but more biodiversity, while springs without sculpins had bigger *Gammarus* but less biodiversity. “Although they are important, having too much would mean leaving less room for biodiversity,” Esson explained. “Like in many organism interactions, there needs to be a balance.”

Currently, Esson is investigating blindness in *Gammarus* populations in caves. Because there

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MAKING USE OF STATISTICS IN AND OUTSIDE THE CLASSROOM

By Brittany Horowitz, public communication, '12

For some, it can be difficult to figure out what to do after graduation. For Philip Gautier, it meant earning a master’s in statistics at American University, after graduating from the University of Maryland in 2008 with a degree in economics. Since beginning his studies at AU, Gautier has been able to work on fascinating projects with two faculty members.

Gautier has had the opportunity to collaborate in the Department of Economics with Professor Mary Hansen, who is examining the effects of recessions on government subsidies to families with foster children. The research is looking at the outcomes for kids in the foster care system and works to measure how long children stay in a certain foster care setting, since it is a sign of an unhealthy system, if children are moving around a lot.

Gautier’s work with Hansen began when she came into the Statistical Consulting Center of the Department of Mathematics and Statistics. The center, which is staffed by graduate students including Gautier, is open to students and faculty for consultation on projects with statistical applications. Hansen came in for assistance with downloading, cleaning (looking for typos and mistakes in the data), and analysis. “Results can be useless if you don’t clean properly,” Gautier explains. “This database is coming from so many different agencies with different practices. It is an ongoing process, and it takes forever.” As it turned out, cleaning and reformatting the data took six months (about half of the project time).

Throughout the project, Gautier has been looking at data spanning the entire country from 1995 to 2008. Examining the effects of the recessions in that period on the levels of subsidies to foster families, as well as the effects on lengths of stay, he has found mixed results. The preliminary findings have shown that the amounts of subsidies increased with a decrease in the number of families being offered subsidies. Gautier explains that during
these recessions the federal government increased funding to state governments to encourage them to keep up with subsidies even as revenue fell. All local government foster care and adoption agencies are required to report to the Adoption and Foster Care Analysis and Reporting System (AFCARS), from which Gautier obtains the data for the project. AFCARS is a powerful database, because it is not a survey or sample but contains information on every child in the system. Gautier also works with a database specific to Washington, D.C., through its Child and Family Services Agency, which includes data given anonymously. The database allows him to look at outcomes across years in D.C., work with massive amounts of data, and track large numbers of children, while also keeping the information private.

Gautier has been working with Hansen for 13 months, and in January, the preliminary results were presented at the Allied Social Sciences Associations Conference in Denver. He received funding from the university through the Mellon travel grant to attend the conference. “The goal of the research is to use the evidence that we find in data to analyze the effects of government policy towards kids in foster care,” explains Gautier, adding that the research could be used to inform policymaking in the future.

Gautier has found his work with Hansen beneficial: “It was an opportunity to apply some of the statistical analysis and statistical computing methods I am learning now to socioeconomic-related questions.” Hansen has found the extra assistance valuable: “Philip has been a tremendous asset because of his focus. He is genuinely interested in mastering the difficulties of sifting through great mounds of data in order to extract relevant information. His particular focus has been essential for the project we are tackling together, because the base of the project is 8.5 million observations of administrative data; 8.5 million observations would intimidate most people, but not Philip!”

Gautier has also been assisting Professor Betty Malloy in the Mathematics and Statistics Department on a machine-learning algorithm for combining statistical models. His work has been with an algorithm called the Super Learner, which was developed by Mark J. van der Laan of the University of California–Berkeley. Malloy has been working on a long-term study of workers in the automotive industry to determine whether their exposure to metalworking fluids has a relationship to the occurrence of cancer. A statistical model would explain the relationship between two or more variables. Gautier explains that the big question is, “Which model does one use?”

The Super Learner creates an ensemble of models and combines them into one model with the strength of multiple models. “You can use the strengths of multiple models together,” explains Gautier. He is using cross-validation to analyze the data properly. When collecting data, there is a signal, and there is noise (just like when a person talks on a cell phone—there are words and there is static). Gautier explains that there is information that actually reveals something in a data set, which is the signal, but there is noise (the static) that comes from randomness from the data set. The danger of any statistical procedure is that a person might not be able to tell the difference between signal and noise. Cross-validation avoids the noise.

Gautier took two mathematical statistical courses with Malloy, which led to his work with her: “I knew that she was working on this algorithm, and I have a particular interest in machine-learning, so I went for it and asked if I could work with her.”

The data being analyzed includes information year after year about employees and their levels of exposure, as well as other important information, including age and lifestyle. The Super Learner has been seen in different literature, but it has yet to be used with the Cox Model, which analyzes anything that happens just once. In this case, the Super Learner analyzes the data of initial cancer diagnoses. Gautier explains that his work with Malloy is aimed to use the algorithm to the Cox Model, so they can analyze the automotive workers data set and help determine the risks of cancer associated with metalworker fluids. In the end, findings from this work will help to inform policies regarding the safety practices of metalworkers.

While working toward his master’s degree, Gautier has been able to take material from the classroom outside into real-life projects involving copious amounts of data. These projects are just two examples of the tremendous work AU students are completing while still in school.
A FUSION OF AUDIO TECHNOLOGY AND PHYSICS

By Michala Phillips, environmental studies, '13

John Geraghty, a senior at American University with a passion for both audio technology and physics had the opportunity to further both interests last summer at the National Institute for Standards and Technology (NIST). NIST, our nation’s first physical science research laboratory, gives budding scientists like Geraghty a chance to explore advanced fields of science, with its unique Summer Undergraduate Research Fellowships program (SURF). The program lets undergraduate students do cutting-edge, hands-on research through assignments overseen by an NIST researcher. Students applying for the SURF program can choose to intern in one of NIST’s six laboratories: the Material Measurement Laboratory, Physical Measurement Laboratory, Engineering Laboratory, Information Technology Laboratory, Center for Nanoscale and Science Technology, and NIST Center for Neuron Research. Once 130 students are chosen, they spend their summer at NIST facilities in Gaithersburg, Maryland.

For his internship, Geraghty worked on the transverse motion of the main induction coil in the Electronic Kilogram Experiment, a project with a goal of redefining the mass standard. Currently, mass is measured in terms of a physical object: the kilogram, the last base unit in the International System of Units, which is not defined in terms of fundamental constants and quantum references. Because mass changes every year, the physical constant is an inaccurate way to measure it, so Geraghty’s project worked to improve the measurement of Plank’s constant, the relationship between the energy of a particle and the frequency of its wave. Improving this measurement would provide an alternate definition of the mass standard by utilizing a watt-balance system. A watt-balance system is the ratio of mechanical power to electrical power using an induction coil to generate voltage in one mode and an electrical force to balance the acceleration of gravity on a mass in the second mode. Variability of the induction coil must be measured to compensate for misalignment.

To tackle this measurement problem, Geraghty was to create a lock-in amplifier, which creates a pure sound by eliminating background noises. Before even attempting to develop the amplifier, however, Geraghty had to spend time acclimating himself to a graphical programming environment called LabVIEW, which scientists and engineers use in developing test, measurement, and control systems. Removing unwanted noises fixes many of the problems from the previous system, while increasing the resolution of the detection program. Geraghty’s work on the amplifier was central to the project,

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Michaela Harper (chemistry, ’12) may just have the best internship ever: She earns university credit and a small paycheck and has a guaranteed job when she graduates—and her work will put bad guys in jail. As a trainee in forensic chemistry for the Drug Enforcement Administration (DEA), Harper is learning to analyze illegal substances seized in drug busts.

Harper first started working for the DEA in 2009, intending the experience to be a one-time summer accounting job. By the next summer, she was working at the agency through the federal government’s Student Career Experience Program (SCEP), which, upon graduation and internship completion, can lead to a permanent job. Through SCEP, a student interns for at least 640 hours. To complete this requirement, Harper works 20-hour weeks during semesters and fulltime over the summer. And so this Medford, New Jersey, native has turned the obligatory summer-break job into the makings of an exciting career, no photocopying or coffee-fetching necessary.

Harper may be a trainee, but she does the same level of work as DEA chemists—testing real drug samples from pretend cases, until finished with training. Two big factors in sentencing a person accused of drug possession are the drug’s salt form and purity. She is almost finished with learning the protocols for powders and is about to start the much harder task of pill sampling. A pill must be crushed into a powder to perform testing, thus creating a challenge, because there must be enough material in the original form left over for evidence. If she crushes too many pills to perform the tests, there will not be any physical evidence of the original pill form to present in court. The work can be demanding, but Harper enjoys the feeling of accomplishment when she correctly analyzes evidence on her own, knowing that someday her results will be good enough for court testimony.

The first step to running tests on an unknown powder sample is to determine the drug involved, since proper analysis depends on its identity. One presumptive test often performed is a color-reactant assessment, for which a forensic chemist apportions small amounts of the sample. Scott’s reagent solution, a mixture of cobalt thiocyanate dissolved in water, is commonly added to the sample, followed by hydrochloric acid. A cocaine base turns pink from the cobalt solution, then blue turning to...
pink with the hydrochloric acid. When chloroform is added, a pink top layer and blue bottom layer indicate cocaine. Once the chemist has a better idea of which type of illicit drug is in the sample, further tests confirm its identity and purity.

One instrument often employed in drug analysis is the gas chromatography-mass spectroscopy detector, which combines two important tests into one machine. Gas chromatography separates the components of a powder sample by injecting it with an inert gas, like helium, that carries it through tubing coiled into a cylindrical column. Each type of molecule progresses around the column at different rates, depending on its affinity for the tubing’s walls and the material in the center of the column. Using these progression rates, the machine isolates the molecules and their prevalence within the substance. The mass spectrometry section then vaporizes the substance (i.e., transforms it into a gas) and ionizes the components, fragmenting them into smaller, charged particles with unique masses. An electric field exerts a force on a moving charge to change its speed, and a magnetic field applies a force altering the charge’s direction of motion. The magnitude of the electromagnetic forces depends on both a particle’s charge and mass: A highly charged particle experiences larger forces, and a massive particle resists changes in motion due to its high inertia. The charged fragments passing through the electric and magnetic fields of a mass spectrometer separate, depending on the magnitude of the forces they experience, allowing chemists to collect and measure identical components. The instrument produces a mass spectrum, which is a representation of the intensity of the charged components and the mass-to-charge ratio (m/z). The position and intensity of the m/z values are called a fragmentation pattern and provide qualitative information about the compound. The resulting fragmentation patterns of each component of the sample are unique, allowing for the confirmation of the identity and adulterants of any illicit drugs. Finally, the chemist compares her results to substances listed in references, like the Merck Index, a catch-all guide of chemical and physical properties of every known chemical compound.

Before she could even pick up a pipette at the DEA, Harper had to learn the agency’s strict policies for evidence handling and testing procedures. Like any other law enforcement agency, the DEA stresses the importance of proper handling of evidence, because any break in the evidence chain of custody can exclude the sample’s use as case evidence. Harper credits her organic chemistry lab classes for providing an introduction to calculating uncertainty on data results and for using laboratory equipment, but the DEA has more specific protocols and very complex machines requiring extra training. To quality as an expert witness at trials, she must, not only analyze drug samples correctly, but also be able to explain technical, jargon-laced results to the average Joe in the jury.

“Orgo” was not the only AU class that helped Harper’s work efforts, others, including Criminalistics, Crime and Society, a General Education chemistry class, touched on her research. For a case-study assignment for this class, e.g., she created a realistic scenario, “following” the case from an undercover buy through the lab analysis and the trial to court sentencing: “It’s interesting to think about the whole process.” Professor James Girard, who taught the class and chairs the Chemistry Department, is Harper’s internship advisor. She keeps him updated of her progress at the DEA by sending him the monthly reports she does for work.

No other AU student had used SCEP to work with the DEA before, but with the help of the Career Center, the paperwork went through and now her internship credits fulfill a Chemistry Independent Study requirement—but the SCEP’s big challenge was earning the DEA’s top secret clearance. She has already decided to continue working for a federal agency, even once she completes the program and graduates, and hopes to remain in her current location for several years before moving to another laboratory. Harper also plans to attend graduate school for forensic chemistry—whenever her busy work schedule will allow.

Michaela Harper

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It sounds like the beginning of a corny joke: What do baseball players, artists, and the Neural Correlate Society have in common? All three have a keen interest in the research of Professor Arthur Shapiro, who specializes in vision psychology, with projects in color vision, motion, and peripheral vision. Approaching his projects from both psychophysical and physiological standpoints, he demonstrates his illusions with flash-based animations.

Before arriving at American in fall 2009, Shapiro attended the University of California–San Diego for undergraduate work in mathematics and psychology. He completed his PhD in psychology at Columbia University and his postdoctoral work in vision psychology and ophthalmology at the University of Chicago. He has also held positions at Lewis and Clark College and Bucknell University.

In May 2009, Shapiro placed first, for a second time, in the Neural Correlate Society’s Illusion of the Year contest. His winning illusion demonstrates the phenomenon in baseball when a batter cannot predict the path of a curveball. Shapiro hypothesizes that differences between the batter’s nerves in the central nervous system and in the periphery accentuate the break in a curveball. The nerves of the fovea, or central vision, are very fine and capable of distinguishing details such as color and contrast, while the nerves in a human’s peripheral vision are much coarser and therefore less able to interpret detail. The switch from the central to peripheral vision systems causes the brain to interpret curveballs as performing “all sorts of ungodly behaviors.”

“Curveballs physically curve. They’ll deviate from a certain line, but when a person is watching the ball, it moves from the fovea and the batter shifts his eyes off the ball. It always happens. It’s physically impossible to watch a major league curveball while focusing on it the whole time. What’s happening is you’re taking a spinning ball and moving it from the fovea to the periphery, which accentuates the curve,” he says.

To demonstrate this phenomenon, Shapiro created a flash-based animation that can be seen at www.illusioncontest.neuralcorrelate.com. (His other illusions can be viewed on his personal Web site, www.shapirolab.net.) These illusions set him apart from other vision psychologists and make his research intriguing to people from a wide variety of fields: medicine, baseball, and even art. “When you start building illusions, you’re saying ‘Look! Here’s a way of expressing an underlying phenomenon—something that’s really going on in the brain,’ and forcing people to confront it. They can see that something looks different when they look directly at it and when they see it in the periphery. For years people have said that the fovea is different than the periphery. And for years people have argued about different reasons for what’s going on and what the differences are. I’m creating illusions that say, ‘Here they are! The differences are big and they’re certainly not subtle and they create important differences in how we actually see.’”

That does not mean that Shapiro’s work is only comprised of making pretty images on a computer screen. “It’s not all light and fluffy," he says. “The part that’s the bread and butter is the work that’s done in the lab to understand basic neural processes which can later be applied to health-related problems." He and a colleague published an in-depth study on curveballs and how they relate to the differences between vision in the fovea and vision in the periphery.

What can an AU student expect from Shapiro’s lab? “I don’t want to give away too much,” he
laughs, “but we’re building up fun experiments in the laboratory with lots of students that involve motors and ropes.”

That is another thing about Shapiro—he loves sharing his work with his students. “I like to run my lab as an active discussion,” he says. “There are many ways of exploring both the phenomena and the underlying mechanisms. It generally takes a while for somebody to become really good at it, but there’s a lot of technical skills they pick up along the way. Students who come into the lab learn a range of skills—both in neuroscience and in programming. A typical student who comes in will learn to program in flash and learn to make these types of displays on their own to use them in their research. There’s lots of room for creativity.”

Shapiro is a firm believer in using technology like flash animation and computer simulations to our advantage. “Technology forces people to perform at a higher level. The skills learned in my classes will give skills applicable to the real world, regardless of a student’s field of interest.”

If teaching classes and studying curveballs are not enough to keep Shapiro occupied, he also has a handful of other projects on his plate. He recently received a $417,000 grant for 2010–2013 from the National Institutes of Health to perform a study on color vision. “Color vision is important for most peoples’ quality of life, and the deterioration of color vision often indicates serious health-related vision problems.” The techniques of the study “can be applied to the study of congenital stationary night blindness and visual decline that occurs as a result of aging.” He is also coediting the Oxford Compendium of Visual Illusions with Dejan Todorovic, a professor from the Department of Psychology at the University of Belgrade in Serbia. The book will have 100–150 contributors and contain numerous visual illusions. Add that to his three kids at home (11-year-old twins and a 9-year-old), and Shapiro stays quite busy.

With all of his interesting projects, AU students should expect to hear a lot more about Shapiro’s work in the future. The passion he holds for his subject carries through to his work in the lab and his work in the classroom. Students interested in ophthalmology, psychology, or even baseball should seize the opportunity to work with this enthusiastic and knowledgeable professor.
WIND TURBINES FOR AU . . . AND THE WORLD

By Jennifer Jones, environmental studies and political science, ’12

Terrence Sankar, an engineer and adjunct professor in the School of International Service, has designed a wind turbine that American University is planning to install on the top of the Bender parking garage. Seniors are currently fundraising for the turbine as their class gift. If they raise enough money, AU could have its first wind turbine soon.

Sankar received a PhD in engineering from Robert Marsh University in Pittsburg but did not always know he wanted to be an engineer. He started out as a watercolor artist and this love of art is apparent in his wind turbine design. Sankar says that in engineering, “if the structure is beautiful, it’s probably correct. If it’s not, it is probably flawed.”

Sankar based the design of the wind turbine on the logarithmic spiral—the same equation that describes nautilus shells, hurricane clouds, and spiral galaxies. The spiral begins at the axis of the turbine and coils outward. He designed the wind turbine, hoping to bring energy to people around the world. “There is no way to achieve any [UN] Millennium Development Goals without providing the poorest people with energy,” Sankar explains. “Billions of people across the world rely on burning kerosene to provide light at night, and cow dung for cooking. These sources of energy cause respiratory problems, high levels of partial blindness, and household fires throughout the world’s poorest countries. Women and children bear the brunt of these consequences.”

Lack of electricity also inhibits education, especially women’s education. Without electricity, students have limited opportunity to study at night. Women are at a particular disadvantage without electricity, because in many places they must walk long distances each day to bring water to their families. This takes time and prevents them from going to school, causing increased gender inequality.

Electricity can provide light for studying and energy for pumping water, both for domestic use and crop irrigation. It greatly increases women’s ability to attend school and relieves them of their water duties. In addition, the increasing price of fossil fuels will make it harder for the world’s poor to access electricity, unless different technologies are created and installed.

Sankar currently works with the World Bank/International Finance Corporation on Lighting Africa, a campaign to provide solar panels for light at night. However, Sankar wants to do more than that. He wants to increase local access to energy using local materials and local skills. So he designed his wind turbine.

With the turbine’s vertical axis, unlike that of traditional commercial wind turbines, wind
enters a large cupped opening on the left side of the axis. As the wind pushes against the back of the opening, the turbine turns. The wind continues through to a narrower part of the turbine near the point of rotation. The constricted space increases the acceleration and pressure of the air, with a small opening at the other side of the turbine allowing a stream of air to exit. Sankar explains that the force of the exiting wind pushes back on the turbine itself, turning it forward.

Additionally, the outside of the turbine is curved like the wing of an airplane, the effect of which is similar to the forces of flight: The air pressure on the inside of the rotating turbine is higher than the pressure on the outside of the turbine. This creates lift through Bernoulli’s principle, the same principle that allows airplanes to fly, and is generally conceptualized as pushing upward on an object. In this case the lift does not push upward; it pushes outward. This outward force also contributes to the spin of the wind turbine.

Sankar is currently perfecting and improving upon his design. He has tested different materials such as bamboo, cloth, parachute cloth, carbon fiber, and hexcomb material, a material with a beehive-like comb structure in the middle covered by a thin skin. A 22-foot model of the turbine was installed at Frostburg University. To measure its efficiency, he tests the torque, wind speed, and other forces.

Calculations project the efficiency of the wind turbine to be 30 percent, which is comparable to current commercial wind turbines. However, mathematical calculations are difficult and not always accurate. “Models look promising, but we haven’t proven how efficient it will be at full scale,” explains Sankar.

Sankar is aiming to create a wind turbine that functions well in many power output ranges, from tens of watts to hundreds of kilowatts. He sees great opportunity in the 100 kW range for residential- and community-power application.

Sankar wants to create a wind turbine that can provide electricity to both the poorest and remotest areas of the developing world, as well as the urban “built” environment in the developed world. Currently commercial wind turbines only run at wind speeds between 17 and 32 mph. At low wind speeds, the turbines do not move and at high speeds the equipment is shut down, because operators are afraid high winds will damage the equipment, which is expensive. To make a wind turbine effective in many environments, Sankar wants to make a wind turbine that generates energy at wind speeds from 6 to 60 mph.

He is currently designing an addition to the turbine that would increase efficiency at varying wind speeds, explaining that at low wind speeds, drag is the most effective force. Drag is a frictional force that works against an object moving through air. This force occurs in the wind turbine when the air pushes against the back of the cup-shaped opening. At high wind speeds, lift is the most effective force, so he is attempting to increase the lift in the design of the wind turbine, by placing two air foils, vertically, on the top of the turbine. The foils act as airplane wings to produce lift. As the turbine spins, the wind foils disrupt the flow of air over it. This disruption causes the wind to spiral and creates more air pressure between the two foils.

The high pressure between the foils and the low pressure outside the foils turns the turbine. Sankar envisions a wind turbine that some day spins by drag at low wind speeds and lift at high speeds.

Sankar looks at it this way: He says that nature did not create just a few big leaves to serve the planet, but instead, billions of leaves in many sizes everywhere. Similarly, he thinks, we will need millions of small and medium-sized wind turbines of various designs, individually and communally owned and operated, creating distributed electricity everywhere—in addition to large utility power plants and wind farms. “Wind is everywhere” Sankar says, “We need to harvest it everywhere.” In the face of energy poverty, increasing scarcity and costs of oil, and looming climate change, he intends to make a difference.
PUBLIC HEALTH: A NEW MAJOR AT AU

By Dr. Lynne Arneson, adjunct professorial lecturer of biology

A new major is coming to campus in the fall of 2011! In keeping with its proud tradition of educating highly qualified students for careers of service that put “ideas into action,” American University is pleased to offer the bachelor of arts and bachelor of sciences degrees in public health. The Public Health Program offers an interdisciplinary curriculum that provides the firm foundation required for careers in public health fields, while allowing individual students the flexibility to focus their studies on specific areas of interest. The bachelor of arts degree requires 47 credit hours and concentrates on the social and behavioral aspects of public health, while the bachelor of sciences degree is 58 credit hours and focuses on the scientific background of public health. A minor in public health will also be available upon completion of 25 credit hours.

After a set of required classes in public health, biology, statistics, epidemiology, and bioethics, students will be able to select seven (BA) or eight (BS) electives from four clusters: Global Health; Social and Community Health; Policy, Program Planning and Evaluation; and Health Sciences. By carefully selecting electives, students will be able to tailor their major toward their career of interest.

Public Health students will be required to participate in an internship, either locally or abroad. Following the core and elective classes and the internship, students will come together in the senior year in a capstone seminar, where students who have focused on different aspects of public health will work together on a case study, putting their various areas of expertise together to focus on one project.

Please see future issues of Catalyst for more information on this exciting major. If you have questions about the majors in public health, please contact Dr. Arneson at larneso@american.edu.

FUSION

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because it allowed for precision lacking in previous measurements. He did not have enough time to finish his project, but others are continuing the work and data collection.

Geraghty spent his days mostly working on the many facets of developing the lock-in amplifier, which furthered his interests in the audio and physics realms. Even more important, though, was the opportunity to study under an NIST researcher, who helped him understand the complexities and importance of his research at the institute.

Geraghty also attended weekly talks given by prominent speakers on topics ranging from robotics to Teach for America. At the end of the program, SURF students presented their projects.

Geraghty thanked professors in the Physics Department for giving him the opportunity to intern at NIST and for encouraging students to apply for every internship opportunity available and supporting their interests in general.

Since November 2009, Geraghty has been designing audiovisual systems for AU, installing its new recording studios, maintaining the equipment, and serving as assistant studio manager. He belongs to American’s chapters of the Society of Physics Students and the Audio Engineering Society. His involvement in physics and audio technology will continue this summer with an internship at an architectural acoustics company, allowing him yet another opportunity to follow his passions.
UNEARTHING
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is no light in caves, these organisms do not need to use their sight. “What I am doing is crossing the cave populations together to see what would come out in order to map the gene that the blindness is occurring,” she said. Esson will then look into the presence of the opsin pigment in the crossed offspring to detect the presence of sight. She is still awaiting the results.

Esson’s projects were funded by the Biology Department’s Grebe Award, an award that promotes research experience for undergraduates, and by the Cave Conservancy Undergraduate Fellowship Grant. After earning her bachelor’s degree, she plans to attend graduate school for a master’s and PhD in integrative biology.

Of all the courses for her biology major and environmental studies minor, ecology is the subject she likes most “because it puts all science practices together and allows me to see how everything works mathematically . . . Even [if] it means looking at the small things to get the bigger picture.”

COOL SCIENCE CLASSES

Astronomy: An Interview with Jaim Coddington

By Helen Killeen, international studies and environmental science, ’13

Like many students who come to American University, Jaim Coddington came for a degree in international studies. He is one of those few lucky undergraduates who seem to have a good sense of what he or she wants to do and how to get there. Coddington’s concentration is in international politics with a focus on Eurasia, and he hopes to work in the Foreign Service at some point after he gets out of school.

Students like Coddington, who chose majors that have little to do with labs, mathematical equations, or Bunsen burners, often become annoyed to learn that high school was not the end of their science exposure; that, in order to satisfy General Education requirements, they might once again be forced to drag out their TI-89s and learn about the structure of atoms. Those who wallow in these fears often end up carrying a sense of resentment with them as they wander into Hurst or Beeghly twice a week. Coddington did not come across as much of a wallower when I interviewed him about his experience taking Astronomy (PHYS-220). Although he gracefully admitted he had been a little frustrated at the prospect of taking a science class, he was clearly not the type to hold a grudge.

Coddington took Astronomy this past fall to satisfy his second-level General Education requirement, but he ended up getting much more out of it than simple credits. I asked him, why astronomy? You cannot get much further from international politics in the Caucasus than the study of celestial objects. He answered that because there are so few science classes that he could apply to his major, the General Education Program actually gave him the freedom to choose what he thought would be most interesting: “Astronomy sounded totally unique, and like something that I might never get the chance to study again.”

I asked him to describe the course for me. “It was a big class, but the professor was friendly and obviously knew what she was talking about. We started with the solar system and proceeded to the Kuiper Belt and the Oort Cloud.” The Kuiper Belt is the collection of frozen debris just outside the orbit of Mercury. Today, we include Pluto as part of the Kuiper Belt. Outside that lies the Oort Cloud. Composed of more frozen volatiles, the cloud defines the outer most limit of our solar system’s gravitational field.

“We also talked about planets and their moons, and went as far out as talking about galaxies, different kinds of stars, and black holes. It was a pretty broad range of topics. My favorite though was when we talked about Jupiter’s moons. They could have liquid water, which means they could have life. One of them is a giant ball of magma. It’s cool stuff!”

I asked Coddington if learning about Jupiter’s moons had changed his academic plans at AU, or if delving into the world of astronomy had altered the way he thought about the universe. He said that although he wants to continue on his path to the Foreign Service, rather than begin pursuing a career as an astronaut, taking Astronomy at AU has made him interested in reading on his own about the celestial world. “If I hadn’t had to take it then I probably wouldn’t have, but I’m glad that I did.” He said, “I’d recommend it for anyone, whether they have a background in science or not.”

Before I left, he asked me if I knew where meteor showers came from. I told him I didn’t, and he explained that all meteors come from the tails of comets spinning into Earth’s gravitational pull. He explained that “contrary to popular belief they don’t come from broken up bits of asteroid. What’s really interesting to me, though, is the fact that the total mass of all the asteroids in our solar systems is less than that of our moon, and that our moon is actually bigger than Mercury!” Where else but in astronomy class are you able to ponder the proportions of the galaxy—and be able to call it work?