GWRESEARCH

SPRING 2016

A SLAVE SHIP RESURFACES /// BRAIN TRUST /// MAPPING THE MINUSCULE

FROM THE VICE PRESIDENT FOR RESEARCH



BOUNCING BACK

It's been said by various people, in various ways, that the overwhelming factor in success is just showing up. And I would argue the rest is having the fortitude to stick around long enough to make success happen.

It takes guts. And, in the science world, it's perhaps never been harder to do than in these past few years, when the odds of winning grant funding, even for a great idea, are so

lopsided against you.

Recently, I was heartened to hear about one of our brilliant chemists on the faculty who persevered through a three-year funding gap and emerged from it in exquisite form—with a \$2.6 million award from the National Institutes of Health. (You can read about her here, on page 4.) She did it by hanging in there. After each stumble, she dusted herself off, honed the idea and tried it again.

That kind of dedication and resolve is every bit as important to teach our students as the periodic table and running a PCR. And as the student experience here increasingly includes exposure to science and engineering labs and to research of all stripes—participation in our two-day student poster competition has jumped 30 percent in three years—we have more opportunities than ever to demonstrate that quality.

I remember when I saw it for myself as a college student, before I'd ever envisioned a career in neuroscience. I got a call from a professor and was doubly surprised to hear that, first, I'd gotten the highest score on the final exam, and second, that he was offering me a student-worker spot in his lab.

It opened my eyes to research. But it also gave me a chance to see the volume of failed experiments and grant applications and dead-end ideas that pile up in a very successful lab.

The thing is, researchers solve problems, they decode nature, they defy limits because they relish the challenge and the opportunity to think differently or to glimpse something never before seen. As John F. Kennedy said in 1962, with the moon in his sights, we do these things "not because they are easy, but because they are hard."

So what's a little more adversity but fuel for the fire?

Sincerely,

fw M. Chalupa

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GEOGRAPHY

FROM SPACE, A NEW Lens on Poverty

A mapper of the developing world's slums looks to the face of photos in order to overcome big data's big challenges.



66

"We take the kind of visual imagery you see on Google Earth and we devise ways to automatically extract important information from it."

From 300 miles above the ground, Accra, Ghana, looks like most major cities. A satellite image shows a network of lines and rectangles, representing roads and buildings. To the untrained eye, the western African capital could well be a Google Earth map of any urban spot on the globe.

But Ryan Engstrom, a geography professor and director of the Center for Urban and Environmental Research, sees something quite different. Those lines cutting through the city are curved instead of straight, indicating this section of Accra lacks a well-maintained road system. Minimal right angles and corners distinguish wellconstructed buildings from slum shacks. There's sparse vegetation and high population density. An image of a two-mile stretch can even enable experts to make estimates on factors like literacy rates, unemployment figures, electricity use and trends in maternal and child health.

"The introduction of Google Earth has made it much easier to explain what we actually do,"

TOP A false-color infrared image of a 6-square-mile patch of Accra, Ghana, shows a wealthy area at right (red is vegetation) opposite a slum. BOTTOM Filtered data shows (from left) the straight lines of infrastructure; boxy shapes (i.e. buildings); and vegetation says Dr. Engstrom, who uses high-spatial-resolution satellite data to map slums in cities in the developing world. "We take the kind of visual imagery you see on Google Earth and we devise ways to automatically extract important information from it."

One of the ways Dr. Engstrom and his colleagues are doing that is by taking computer algorithms originally developed for facial recognition software and applying them to satellite images. The novel approach is proving to be more accurate, more adaptable and quicker than previous methods.

For the first time in history, more than half the world's population resides in cities, and efforts by scientists to diagram the surge in urbanization may have a profound impact on issues like pollution, public health, water, land use and quality of life.

In the developing world, nearly a third of the urban population lives in conditions that the United Nations defines as slums. In Accra, Dr. Engstrom says, the number is as high as 80 percent of the city's 2 million residents.

After years of struggling to afford prohibitively expensive data, recent changes in the satellite science world have provided Dr. Engstrom with troves of new resources—and some intimidating new obstacles. In the past few years, the government has reinterpreted its license agreements with commercial satellite vendors to make an archive of images freely available to federally funded researchers.

Dr. Engstrom, whose work has been supported by grants from NASA, the National Science Foundation and the National Institutes of Health, suddenly had thousands of high-resolution images at his fingertips at no cost.

In 2006, for example, Dr. Engstrom purchased a small image of Accra for \$15,000. Last year, he was provided 300 free images encompassing the entirety of Ghana taken over the last decade approximately two terabytes of data that would have cost more than \$1 million a few years ago.

"The landscape has completely changed," he says. "We can now take areas that were once, from an imaging perspective, blank canvases and fill them in with information that will lead to transformative breakthroughs in how we understand, study and manage urban environments."

But having access to vast stores of data does have its price: the complex and time-consuming process of making sense of it.

"There are thousands of images taken every day," Dr. Engstrom says. "You can't sit down and look at them all. It's become more and more important to create an automated process that extracts the crucial information we need." -John DiConsiglio

RESEARCH NEWS



FUNDING

ON THE MONEY

A successful career in science is as much about winning grants as it is about resilience.

By Matthew Stoss

It's all but invisible by the end, in the journal article that touts a discovery and the press that follows. But undergirding success in science is often the agony and agita that went into securing grant funding for the project. Applications take months to write and most of them are rejected. The fact that grant success can be tied to keeping one's job heaps on another layer of aggravation.

"I've forgotten meals-but

"The winning edge is vanishingly small."

• 16.3%

The amount of new research project grant applications funded by the National Institutes of Health in 2015, out of 47,338 applications everybody's like that," says Cynthia Dowd, a medicinal chemist who's been awarded three of the 28 "major" grants (above \$50,000) she's applied for since coming to GW in 2007. "You're just like, 'Oh, crap, I forgot lunch today.""

Last year, the National Institutes of Health—the world's largest public funder of biomedical research passed on 84 percent of the 47,338 applications for new research-project grants. And for more than three years, Dr. Dowd had been among the multitudes spurned. But in January, the NIH said yes to her \$2.6 million request, ending her funding drought and no small amount of despair.

"You feel like you're failing," Dr. Dowd, a former NIH scientist, says of the grant dry spells inevitable in a researcher's career. "You can't wallow in it too long or you just get super depressed. But it drives a lot of people away from academia, for sure. If I hadn't gotten this one ..."

Following the August 2012 expiration of a \$721,000 NIH grant, Dr. Dowd's research into designing a new molecule to combat malaria and tuberculosis went unfunded, kept afloat financially by universitysupplied mini-grants to keep her staff employed and producing the data necessary to get funded again.

The winning proposal was the third iteration of a pitch submitted first in 2011 and again in 2014.

"Persistence is a very important thing," says Leo Chalupa, GW's vice president for research. "It's a very difficult thing to do because you're being beaten up, so to speak. ... But for somebody to say, 'OK, I'm going to get up and put another one in and heed the comments they gave me and improve it and so on,' that's a wonderful thing."

Michael King, the chair of GW's chemistry department, says the fiveyear, \$2.6 million grant positions Dr. Dowd for future grant success.

"In the research community, it's a cycle," Dr. King says. "If you are publishing, and the publications have impact, then the reviewers will look at what you're proposing and they're saying, 'Well, this particular individual, not only do they have a good idea, but you know they're going to turn that good idea into results.' And then when you land the big grant, now your peers have validated these ideas that you have."

The problem is that the federal pot isn't getting bigger. Dr. Chalupa and Dr. King attribute it to budget cuts and sequestration. Private donors and foundations have offset that somewhat, just not enough.

In 1999, the NIH received 20,831 grant applications for new research projects and OK'd 26.6 percent of them, dispensing \$1.5 billion. In 2015, the number of applications had more than doubled, and the NIH approved just 16.3 percent of them, giving out \$3.6 billion.

Research grants are a small portion of the more than \$30 billion the NIH gives out every year, and adjusted for inflation, there has been only a 12 percent increase in overall research-grant funding since 1999. The result is a lot of good science goes unfunded in a system that, at worst, feels capricious.

"So much of it is luck. Who happens to be in the room when they're discussing [your proposal]?" Dr. Dowd says. "The winning edge is vanishingly small."

The grant-application process is about, if anything, managing failure. Dr. Dowd says she copes by ensuring her existence isn't defined by grants.

"You wear a lot of hats," she says. "You wear the grant hat and the research hat and the teaching hat and the service hat. You do outreach to high schools, you go to your kid's second-grade class and show them how water works. ... If we all just lived in the grant world, it would stink. It would really stink because there's so much rejection and people telling you, 'Go home' and sort of slamming the door in your face. But you have all these things to keep you going."

PREVENTION

120

The number of new HIV cases

that were prevented among injectiondrug users in Washington, D.C., from 2008 to 2010, following the launch of a city needle-exchange program that previously had been blocked by Congress, according to a new study. The findings amount to an estimated 70 percent monthly drop, on average, in new cases among needle users and potential savings of \$44 million in health care costs, according to Monica Ruiz, the Milken Institute School of Public Health researcher who led the study.



RESEARCH NEWS CHARTICLE (*

ISIS IN AMERICA

The shooting spree at a potluck last December in San Bernardino, Calif., was the deadliest act of terror on American soil since 9/11, killing 14 people and wounding 21 others. And it came at the hands of seemingly unassuming parents who were inspired by the Islamic State, or ISIS.

The circumstances, however, weren't a complete surprise to those who had been following the rise of violent extremism in the U.S.

One day before the shooting, *The* New York Times ran the headline, "ISIS Followers in U.S. Are Diverse and Young." The story detailed the findings of a six-month study by GW's Program on Extremism, which painted a picture of ISIS followers in the U.S. that the young, suburban California couple fit into well: They tend to be young, mostly male but increasingly female, the report found. They're active on social media and are spread across the spectrums of race, age, class and background. The vast majority are U.S citizens or permanent residents.

It challenged notions of what extremism looks like nationwide. And in the days after the attack, the nascent think tank quickly became a go-to resource for the media, lawmakers and others.

The program, which launched in June 2015 under the Office of the Vice President for Research's Center for Cyber and Homeland Security, aims to look at violent and nonviolent domestic extremism. The goal is to add data into a debate driven largely by fear and to paint a nuanced picture of a polarizing subject.

"The issue is there," program director Lorenzo Vidino says. "Let's have a reasonable debate about it." -David Frey





BIOLOGY

BUILDING—AND Becoming— Architecture

A colony of the army ant *Eciton hamatum* can contain hundreds of thousands of ants. Those ants spend their days out looking for other ant nests to raid. When they find one, they fight, steal the larvae and carry the tasty spoils back to their young.

But army ants aren't just raiders. They're also architects, using their own bodies to make their trails faster and smoother. As they run, they cross over leaves, twigs, holes—and the bodies of their sisters.

"These self-assembling structures that army ants build are very unique in the ant world," says GW biology professor Scott Powell. Army ants plug potholes in the forest floor and build ladders to help the colony traverse tree trunks. They even build a temporary nest, complete with tunnels and rooms, that's reassembled every night by living ants who grab onto each other and hold on tight.

As a graduate student, Dr. Powell studied how the ants plug holes. Now, he is part of a team of researchers trying to understand more about how army ants build one kind of structure: bridges.

The question, he says, is this: "How do you have these relatively simple, uninformed individuals that interact to solve a bigger problem?"

For a new study, Dr. Powell's co-authors—Chris Reid, then a postdoctoral fellow at the New Jersey Institute of Technology, and Matthew Lutz, a PhD student at Princeton University—carried out experiments with colonies of army ants living on Barro Colorado Island, a Smithsonian research site in the Panama Canal.

Once they were coaxed onto a research apparatus, the ants were sent on a V-shaped detour, a pair of

skinny plastic platforms connected by a hinge. In every experiment, the ants started a bridge at the joint between the two platforms—the pointy inner corner of the V-shape. Gradually, more ants would glom onto the outside edge of the bridge, which then inched away from the corner and back toward the line of the main trail.

The researchers found that the ants didn't always make the shortest possible route. Instead, they adjusted the bridges constantly. When more ants were running through, the bridge moved farther to make a shorter route; when traffic let up, the bridge moved back toward the corner. The research was published in December in the *Proceedings of the National Academy of Sciences.*

The researchers developed mathematical models that suggest the ants are constantly managing the costs and benefits of the bridge. Bridges speed traffic, but tying up ants in bridges means risking having inadequate numbers at a battle.

"It's just a bunch of ants running around in the forest," Dr. Powell says, but it's also something else: "an extreme example of collective problem solving." -Helen Fields

> Army ants build a bridge near the joint of the research tool.

INITIATIVES

FERTILE GROUND

A landscape built on ideas is one that's constantly changing, with new faces, new labs, new buildings. Here are a few of the faces behind recent shifts:



Kevin Pelphrey Autism and Neurodevelopmental Disorders Institute

More than a decade ago, as an earlycareer researcher at Duke University, Dr. Pelphrey was studying the development of the "social brain," which governs facial recognition, eve gaze and other functions related to personal interaction, and his work only touched on autism, which counts social deficits as one of its hallmarks. But that changed after his 3-year-old daughter was diagnosed with the disorder. "Before, I was intellectually interested in helping people, but I never imagined that I could see treatments that will benefit my child in my lifetime," he says. "It does give me drive."

This winter, Dr. Pelphrey became the director of GW's new Autism and Neurodevelopmental Disorders Institute, created in partnership with Children's National Medical Center.

Dr. Pelphrey—who came to GW from Yale University—serves as the Carbonell Family Professor in Autism and Neurodevelopmental Disorders. The institute's work, he says, will focus on less-studied topics: autism in girls (it's almost five times more common among boys), and developing interventions and transitional tools for adolescents and adults with autism.



Eduardo M. Sotomayor GW Cancer Center

Dr. Sotomayor, a medical oncologist and top immunotherapy researcher, joined the university last summer as director of the new GW Cancer Center, an umbrella for cancerrelated services and research that will have a particular focus on personalized medicine.

Dr. Sotomayor previously was scientific director of the DeBartolo Family Personalized Medicine Institute at Moffitt Cancer Center in Tampa, Fla. Originally from Peru, he spent years at the University of Miami and Johns Hopkins University studying cancer immunotherapy, which harnesses the immune system to fight tumors-a field that, when he began in the early 1990s, was considered uncharted, a "road to nowhere," he says. By 2013, though, cancer immunotherapy was the journal Science's "Breakthrough of the Year." That trajectory, he savs, offers reassurance about the direction of cancer research.

"It's the difference between being alive or dead," he says. "A few years ago, I would say, 'You need to put all your things in order because there is nothing else to offer you.' Now, with these immunotherapeutic approaches and others under development, there is hope."



Alan Greenberg and Gary Simon

D.C. Center for AIDS Research

A five-year, \$7.5 million grant from the National Institutes of Health is putting AIDS researchers at GWincluding the doctor who diagnosed D.C.'s first AIDS patient—at the front of the fight against the disease.

The grant funds a new Center for AIDS Research in the nation's capital, one of 19 across the country. The citywide consortium brings together nearly 200 researchers from three GW schools-the Columbian College of Arts and Sciences, the Milken Institute School of Public Health and the School of Medicine and Health Sciences-as well as American, Georgetown and Howard universities, Children's National Medical Center and the Veterans Affairs Medical Center. The center is led by GW Department of Epidemiology and Biostatistics Chair Alan Greenberg and Gary Simon, the Walter G. Ross Professor of Medicine and of Microbiology and Tropical Medicine, who, in August 1981 at GW Hospital, diagnosed the first D.C. patient with AIDS.

The center will focus, among other things, on funding early-stage, women and minority investigators, and on building interdisciplinary collaborations.

POLITICS

TRACKING THE RIPPLE EFFECTS OF POLITICAL CAMPAIGNS

Political wonks follow polls, endorsements and money to study campaigns. Now, they can track the power of a candidate's words, too.

The PEORIA Project's

57,427,624 -Donald Trump

> 24,550,084 Hillary Clinton

most recent report found that Donald Trump dominated news and social **media mentions between March 15, 2015 and Jan. 17, 2016**, more than doubling that of the next closest candidate, Hillary Clinton. All the top tweets about Mr. Trump, however, were negative. And both candidates took a backseat to rivals Ted Cruz and Bernie Sanders in the number of times their websites were shared, one metric of voter engagement.

20,993,263 Bernie Sanders

The Public Echoes of Rhetoric in America (PEORIA) Project, a joint endeavor between GW's Graduate School of Political Management and Zignal Labs—a company specializing in media analytics launched in May 2015 to assess the effectiveness of the presidential campaigns' ongoing communication strategies.

"We're quantifying the old vaudeville and marketing phrase about how well messages 'play in Peoria' and everywhere else," says Project Director and Associate Professor Michael Cornfield. "Whose brands are catching on, and whose are catching flak?"

The group's reports rely on a mix of indicators from Zignal, which curates mentions of the candidates in real time from social media, more



than 200,000 news outlets and more than 900 domestic television channels.

In the team's first report, for example, Dr. Cornfield and Associate Professor Lara Brown. the school's interim director, tracked and measured 10.3 million news and social media mentions from mid-March to mid-May 2015, covering candidates' formal announcements to run, the amount of time those remained popular topics and sentiment surrounding the announcements and the candidates. "The Year in Echoes," the fifth and most recent report, released this January, looks back at 2015 to find the winners and losers in the battle to get campaign messages heard and echoed by the general public.

OBESITY \$69B

The estimated national tab for severe obesityrelated medical expenses in 2013, roughly 40 percent of which was paid for by federal and state resources, according to a study in *Health Affairs* co-authored by Assistant

Professor Michael W. Long of the Milken Institute School of Public Health. More than 1 in 3 U.S. adults are considered obese and 1 in 7 has severe obesity.

PUBLIC HEALTH

DIAGNOSIS OF Adhd Among U.S. Kids Jumps 43%

Twelve percent of U.S. children and teens had a diagnosis of attention deficit hyperactivity disorder, or ADHD, in 2011, an increase of 43 percent since 2003, according to a new study.

The findings, which appeared first online in December in *The Journal of Clinical Psychiatry*, suggest that 5.8 million children ages 5 to 17 have ADHD, says lead researcher Sean D. Cleary, an associate professor of epidemiology and biostatistics at Milken Institute School of Public Health.

Researchers, who mined data from a national survey of parentreported health information, also found a 55 percent jump in prevalence among girls, whose numbers rose to 7.3 percent in 2011, up from 4.3 percent in 2003. The increase may reflect better recognition of the symptoms, which can be different than in boys, the researchers wrote.

The disorder is more likely to be diagnosed in boys, according to authors, and their numbers rose nearly 40 percent, to 16.5 percent, during the same period.

Among all kids ages 15 to 17, the study found a 52 percent increase in diagnoses, rising to 14.6 percent in 2011.

And although the parentreported prevalence in 2011 was lowest among subgroups identified as kids in homes where the primary language is not English (2.9 percent) and among Hispanics (7.7 percent), those groups saw the highest percentage increases over 2003: 107 percent and 83 percent, respectively.

While the study wasn't designed to explore the reasons for changes, the researchers say, the overall rise may point to a true increase in the number of diagnoses or overdiagnosis.

Among subgroups, they wrote, the uptick might be a function of better access to Spanish-language health resources and increased cultural acceptance of the disorder.

STUDENT RESEARCH

A record number of abstracts—for studies exploring everything from gender and racial biases among voters to the treatment of multidrug-resistant pneumonia—were among the projects submitted for this year's universitywide Research Days. The annual twoday poster session, run by the Office of the Vice President for Research, marked its 21st year in March.

Here's a look at the rise in participation over the past few years. For more on the event, visit **go.gwu.edu/GWRresearchdays16**



SPORTS

STUDY FINDS Racial bias in Promotion of NFL COACHES

White position coaches in the National Football League are more than twice as likely to be promoted to coordinator positions than their minority peers, regardless of age, experience or career performance, according to a study released in January.

Though not covered by the NFL's Rooney Rule—which requires teams to interview minority candidates for head coaching and senior operations jobs—these promotions can have an effect on the racial makeup of head coaches in the league. Offensive and defensive coordinator positions are directly beneath the head coach, and the researchers found that 70 percent of head coach hirings involve a promotion from a coordinator position.

For the study, the team of researchers from the GW School of Business and Georgetown, Emory and Iowa State universities tracked the careers of more than 1,200 coaches from 1985 to 2012.

The researchers identified a promotion advantage among white NFL position coaches, who are 114 percent more likely to be promoted to coordinator positions than their black counterparts. *–James Irwin*



SPACE

SCIENTISTS WATCH AS STAR IS SWALLOWED BY BLACK HOLE

A team of astrophysicists for the first time watched from the beginning as a supermassive black hole drew in a star, ripped it apart and ejected an outflow of matter—a cosmic burp—moving at nearly the speed of light.

Their research, published in November in the journal *Science*, tracks the star's destruction and the simultaneous eruption of a short, spectacular radio-wave flare.

"We have never seen matter from a star streaming into a supermassive black hole and the black hole emitting a stream of matter at the same time," says Alexander van der Horst, a GW physics professor who was part of the team. The observation, he says, will help scientists understand the formation of these outflows, called jets.

Supermassive black holes—the largest of the ultra-dense areas of space from which not even light can escape the gravitational pull—are believed to be at the center of most massive galaxies, including our own Milky Way.

The destroyed star, about the size of the sun, was first observed in its bright death throes by a team from Ohio State University using an optical telescope in Hawaii. At 300 million light years away, the star was "relatively nearby," Dr. van der Horst says. Previous observations were at least three times farther away.

Alerted to the event, Dr. van der Horst's team—led by Sjort van Velzen, a Hubble fellow at Johns Hopkins University—quickly turned radio telescopes in the Netherlands and United Kingdom on the trapped star. By combining that data with data from optical and X-ray telescopes, the team could glean what a news release from Johns Hopkins University called "a multi-wavelength portrait" of the entire event. —*Ruth Steinhardt* **RESEARCH** NEWS

MEDICINE

PRAWN BRAWN May Curb Parasite in Africa

The Diama Dam that spans the river dividing Senegal and Mauritania in West Africa was intended to improve crop irrigation when it was built in 1986. But, while it prevented saltwater intrusion, it also created an ideal freshwater habitat for a snail that hosts the parasitic worm *Schistosoma*—while blocking the migration of snaileating giant river prawns.

As a result, villagers along the Senegal River Basin have suffered an ongoing, massive outbreak of schistosomiasis. More than 200 million people worldwide are infected with the parasite, which can lead to bladder cancer, liver failure, anemia and an increased risk of contracting HIV. There is no vaccine, and treatment can be costly, reinfection is inevitable and drug resistance is a growing concern.

"It's a logistical nightmare, even with a reasonable drug," says Michael Hsieh, a urologist and associate professor in the School of Medicine and Health Sciences. "The only real measure to prevent schistosomiasis is to avoid contact with infected waters. These bodies of water are used not only for drinking, but also bathing and as a latrine, because of a lack of infrastructure."

But Dr. Hsieh and an international research team have identified a more sustainable solution: reintroducing river prawns to the Senegal River Basin.

Inspired by an experimental study that introduced North American crayfish into Kenyan

villages in 1999, researchers at Stanford University and other partner institutions hypothesized that stocking prawns in villages could also prevent the spread of schistosomiasis in Senegal.

"These [native] prawns are very well-known to these communities," Dr. Hsieh says. "Before the dam was built, they were considered a delicacy and were very much a staple of the local diet as well as a good source of protein."

To test whether reintroduction of the snail's predator could control schistosomiasis in humans, the researchers stocked a village's water contact site with prawns and then compared it to a nearby control village. During an 18-month period, they found 80 percent fewer infected snails and a 50 percent lower disease burden (the average number of parasite eggs in a person's urine) in people living in the prawn-stocked village. Using a mathematical model, the researchers found that stocking prawns, coupled with infrequent mass drug treatment, could eliminate the disease from hightransmission sites, they reported in a study published last year in the Proceedings of the National Academy of Sciences.

Dr. Hsieh, who began the research as a Stanford faculty member, is continuing to study schistosomiasis at GW with SMHS researchers Jeff Bethony and Paul Brindley. Their work includes developing models that could be platforms for testing new treatments and vaccine candidates. Meanwhile, the research team plans to continue the prawn experiment in other communities in Senegal to try to firmly establish a cause and effect, Dr. Hsieh says.

They hope that the benefits of reintroducing river prawns could be twofold—a disease prevention strategy and a form of sustainable development. *—Lauren Ingeno*

EVOLUTION

A BIG, Diminutive Find

An 11.6-million-year-old ape fossil is challenging assumptions about the last common ancestor of gibbons and hominids, the group that includes humans and great apes.

Scientists have thought that small apes evolved from larger ones, mainly due to the lack of small apes and ancient gibbons in the fossil record. The new evidence suggests they may have begun together, or that the ape line may have emerged from something more akin to the newly identified gibbon-sized ancestor.

"This fossil discovery is providing a missing chapter to the beginning of ape and human history," says Sergio Almécija, assistant professor of anthropology in GW's

assistant professor of anthropology in GW's Center for the Advanced Study of Human Paleobiology.

The partial skeleton, representing a new genus and species, belonged to an adult female that weighed around 10 pounds and bore features of both living great apes and gibbons, according to the researchers.

The findings, by researchers from GW and the Institut Català de Paleontologia Miquel Crusafont in Barcelona, were published in October in the journal *Science*.

A JUMP IN NSF

GW moved up 10 spots to No. 83 in new National Science Foundation rankings of federal research funding expenditures for 2014. Separately, in total R&D expenditures—which includes funding from the federal government, the university and other sources—GW rose to No. 92, up from No. 98 the previous year. Expenditures are a key measure of research activity.

FAST-TRACKING Ideas to market

GW launched a master's degree program in regulatory biomedical engineering in an effort to help engineers bring inventions to market faster. It's offered jointly by the School of Engineering and Applied Science's Biomedical Engineering Department with the School of Medicine and Health Sciences' Regulatory Affairs Program.

HONORS

Marc Lynch, a professor of political science and international affairs, was named one of 33 Andrew Carnegie Fellows this year by the Carnegie Corporation of New York. Each will receive up to \$200,000 toward research and writing aimed at addressing pressing challenges to democracy in the U.S. and international order.

Associate Professor of History Marcy Norton was awarded a Guggenheim Fellowship

this year from the John Simon Guggenheim Memorial Foundation. The award will support the completion of her second book, a history of human-animal interactions in Western Europe and indigenous America between 1500 and 1800.

Astrophysicist Chryssa Kouveliotou was elected to the American Academy of Arts and Sciences this year,

among an international class of scholars, artists, philanthropists and business leaders. A renowned expert on gammaray bursts—the most powerful explosions in the universe—Dr. Kouveliotou also is a member of the National Academy of Sciences and in 2012 was named one of the 25 most influential people in space by *Time* magazine.

Technology Commercialization Office Managing Director **Steve Kubisen was named a fellow of the National Academy of Inventors.**

Marie Price, a professor of geography and international affairs, was elected president of the American Geographical Society.

Chemistry Professor Peter Nemes was named a Beckman Young Investigator last summer by the Arnold and Mabel Beckman Foundation—one of just eight young faculty members in the chemical and life sciences to receive the distinction that year. Dr. Nemes will receive \$750,000 over the next four years to develop technology that can identify and quantify proteins expressed by a single neuron in the mammalian brain.

RESEARCH NEWS

THERAPY 'BOTS

Children with autism sometimes find it easier to engage with robots than with people, whose communication signals can be subtle and difficult to read. That led Chung-Hyuk Park, a professor in the Department of Electrical and Computer Engineering, to think about how a robot might help children with autism learn to navigate social situations.

His robots encounter the kinds of sensory issues that kids with autism spectrum disorder—estimated to affect 1 in 68 children in the U.S.—may have trouble handling, such as loud music, bright lights or strong smells. The robots then try to communicate what they need: asking someone to turn down the

APPY

music, shut off the lights or move the pungent flowers. Student research on the project—which uses the humanoid robots Darwin Mini and Robotis (Darwin) OP2, which demonstrate movements and gestures, and Romo, an iPhone rover that models facial cues that correspond to specific emotions—tied for first place in the biomedical engineering category at this year's universitywide Research Days poster competition.

"We are all trying to approach [autism therapy] from different angles," Dr. Park says. "Children with autism, they like robots. ... When they are interacting with robotic systems they show more engagement and more interaction, and their verbal skills increase, their touching and physical interaction increases. ... We are trying to use this system to [help them] be more engaged."

> See video of the robots at go.gwu.edu/ GWRautismrobots

PUBLIC HEALTH

A NEW BEEF WITH FAST FOOD

Higher levels of industrial chemicals used in fast-food packaging found among people who ate the most

People in a national survey who reported consuming more fast food were exposed to higher levels of potentially harmful chemicals known as phthalates, according to a new study.

The research, one of the first studies to look at fast-food consumption and exposure to these chemicals, appeared in April in

the journal *Environmental Health Perspectives*.

Ami Zota, a professor who led the research team from the Milken Institute School of Public Health, says the findings "raise concerns because phthalates have been linked to a number of serious health problems in children and adults."

Phthalates belong to a class of industrial chemicals used to make food-packaging materials, tubing for dairy products and other items used in the production of fast food. Other research suggests these chemicals can leach out of plastic food packaging and can contaminate highly processed food.

Studies of exposure to these chemicals indicate they can damage the reproductive system and may lead to infertility.

The team looked at data on 8,877 participants who had answered detailed questions about their diets over the previous 24 hours, including consumption of fast food. The participants also gave a urine sample that could be tested for the breakdown products of two specific phthalates: DEHP and DiNP.

Dr. Zota and her colleagues found that the more fast food the participants ate, the higher the exposure to phthalates. People in the study with the highest consumption of fast food had 23.8 percent higher levels of the breakdown product for DEHP in their urine. And those same fast food lovers had nearly 40 percent higher levels of DiNP metabolites in their urine compared to people who reported no fast food in the 24 hours prior to the testing.

Grain and meat items were the most significant contributors to phthalate exposure, the researchers found. Dr. Zota says that other studies also have identified grains as an important source of exposure to these potentially harmful chemicals.



MEDICINE

THE FIGHT Against Acne Goes Nano

Chalk up another entry on the list of medical ailments that can be treated with nitric oxide. The cellularsignaling molecule is already associated with the treatment of conditions such as pulmonary hypertension and acute respiratory distress syndrome, and it plays a key role in the function of medication for erectile dysfunction. A new study finds that the release of nitric oxide over time may also treat and prevent acne.

The research, published in the *Journal of Investigative Dermatology*, suggests that nitric oxide nanoparticles are effective at killing the bacteria associated with acne. More importantly, the nanoparticle treatment inhibits the damaging inflammation that results in the large, painful lesions associated with inflammatory acne.

"Our understanding of acne has changed dramatically in the last 15 to 20 years," says Adam Friedman, an associate professor of dermatology at the School of Medicine and Health Sciences and co-author of the study. "Inflammation is really the driving force behind all types of acne."

The study focused on a recently identified pathway that's responsible for the activation of the inflammatory process in acne. And the use of nanotechnology was crucial. Although the body makes nitric oxide for many purposes, its impacts are short lived because it interacts with its environment so quickly. The nanotechnology used by the team is capable of generating and releasing nitric oxide over longer periods.

FACING DIALYSIS AND A LACK OF INFORMATION

For aging patients, new grant funds development and testing of educational materials and patientadvocacy service

Dale Lupu has firsthand experience with the difficulties facing aging kidney patients. Her mother, who is 91, has one decree: She doesn't want to go on dialysis.

The blood-filtration treatment

was developed to prolong the lives of younger patients suffering from end-stage kidney failure, but an increasing number of patients over 75 are on dialysis, says Dr. Lupu, an associate research professor at the School of Nursing. And they may not be making the most informed choice when they take that step.

Among the constellation of medical issues that arise as people age, "kidney disease is something we can do something about. So it's being offered to people, and they're going on it," she says.

"But what we've discovered is that [dialysis] is not necessarily a happy place for someone who is suffering from multiple other health problems."

Dr. Lupu says the issue is communication. According to her research, few patients remember having conversations with doctors about what would happen if the treatment did not go well. And research by others has shown the decision is one that many later regret.

With a new \$600,000 grant from the Donaghue Foundation, Dr. Lupu and her team will test patient-education materials and the introduction of a nurse or social worker who would act as a planning "coach." That person would help patients articulate their values—for instance, whether they prefer a potentially lifesaving hospital procedure or more time at home with family—and would help patients understand the possible outcomes of their treatment options.

"It's not that we want to keep people off dialysis," Dr. Lupu says. "It's that we are alarmed that people are telling us they haven't had these conversations. There's a sense from some patients that they're just getting on a conveyer belt. Instead, we want them to feel like they're really involved, they know what's coming, they have support and they're doing what works for them."



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Professor Janne Nolan, who



NUCLEAR POLICY

Janne Nolan, a research professor of international affairs, is the founder and chair of the influential Nuclear Security Working Group, a body of scholars and current and ex-government and military officials that works behind the scenes to educate lawmakers and others, chiefly funded by the Carnegie Corporation of New York. The NSWG was consulted in last year's agreement with Iran and played a role in Senate approval of the New START Treaty between the U.S. and Russia in 2010.

We'll start general. What are the main things people should know about nuclear policy?

There are two very important and significant parts of nuclear policy. One is the safety and security of fissile materials—that is to say, the kind of materials that could be used to make nuclear weapons, and [which], increasingly, are seen to be potentially vulnerable to acquisition by substate actors, and that's

become a big headline issue.

The part that gets a lot less attention since the Cold War is the way in which countries that have nuclear weapons configure their forces and organize them for what we call deterrence—this is particularly the United States and Russia—and how those forces could be used in the event of a crisis resulting from a conventional war ... [or] from inadvertent use or false signaling.

Give us a little history on U.S. nuclear policy. Where did it start?

Our forces were organized around the basic premise of having to prepare for a Soviet first strike—a surprise first strike. And that scenario is really not very credible in the post-Cold War, even though our relationship with Russia is not great. ... So, are there arguments for maintaining forces on high alert today? No, not really. There are concerns about what happens if you start dismantling the forces separating the launchers from the warheads—and there's been a lot of resistance to that.

A lot of mystery surrounds nuclear weapons and nuclear policy. Is there a way to strengthen the public's nuclear literacy?

You correct it by removing some of the excess jargon and technicalities about the discussion and say this is about American security: It's about what all Americans participate in ... by paying taxes, by being citizens. It's not very difficult to find information about these issues. Clearly, I think experts need to make it more interesting because a lot of people have dropped off the radar screen since there's not a feeling of imminent threat [since the Cold War ended], so the assumption is that nuclear weapons went away somehow.

The amount the United States is projected to spend on its nuclear forces between 2015 and 2024. The U.S. has about 7,500 nuclear warheads. Russia has a comparable arsenal.

> For the 2016 fiscal year, the U.S. budget is about \$3.9 trillion. The defense budget is **\$580 billion**, or 15 percent.

*All figures from the Congressional Budget Office

We hear a lot about "political partisanship." Does that affect the nuclear debate, too?

Unfortunately, many of these issues are kind of stand-ins for the ideological debate. So if you talk about cutting the defense budget, it's assumed that you're an ideological liberal and for disengagement from the world. There isn't enough educated discourse about what is all this for and what we're doing, et cetera. There's the assumption that the more you spend, the safer you are.

A conspiratorial question: Is the government hiding this stuff from us?

There is tons of stuff published: what we spend on nuclear weapons and for what reason and where they are and where they're made and how they're designed and what it all means in terms of international relations. So, no. There's a lot of information. There's no deliberate effort to obfuscate. There are certainly things that are classified. ... I do think experts have contributed to the lack of public interest by not being clear about what the stakes are and not finding the right hooks.

Now, the big question: Is it possible to rid the world of nuclear weapons?

It's a question of under what circumstance, under what kind of verification schemes, under what kind of agreements would you reach. You would have to have stages of reaching such agreements and have a lot of technical arrangements to make sure that countries are complying, but ultimately it's a question of will and compliance. How many countries are interested in pursuing such a world? GWR

RESEARCH NEWS SHELF IFE

CENSORY Overload?

Law Professor Catherine Ross searches through a legal fog for the line between protected speech and creating "safe spaces" in public schools.

A 13-year-old punished for wearing a black armband to school in protest of the Vietnam War. A teen sent out of class for saying he did not accept homosexuality. Even a kindergartner suspended for calling a classmate a "poo-poo head."

All were disciplined not for something they did, but for something they said. And since all were public school students, the U.S. government was punishing them in violation of their First Amendment rights.

"We should be teaching [students] to be active citizens who are engaged and feel they can speak up and be listened to and maybe have an impact on society," says GW Law School Professor Catherine Ross. "Instead, we're teaching them that we have an authoritarian state and that you speak up at your peril, which is very dangerous for the long-term health of our democracy." Her new book, *Lessons in* *Censorship: How Schools and Courts Subvert Students' First Amendment Rights*, takes on the vast and often contradictory question of what students are allowed to say.

During a sabbatical at Princeton University, Ms. Ross worked through the available body of law on U.S. public schools and the First Amendment. It was a daunting task. The U.S. Supreme Court has chosen not to rule on many questions of free speech in schools, and lower courts often contradict themselves and each other. Plus, many cases are settled before litigation is complete or never make it to litigation at all.

The tangle of avoided and conflicting answers to those questions shows that free speech is low on lists of judicial priorities, Ms. Ross says. But the discussions happening in schools can be a microcosm of discussions nationwide.

"These speech cases involve all of the highly disputed political and cultural and social issues of our time: politics, war, weapons, immigration, LGBT rights,

LESSONS IN

CENSORSHIP

CATHERINE J. ROSS

abortion," she says. "And students are on both sides of all of these issues." And it's important not to censor students even on less weighty matters, she says. "The First Amendment protects foolish speech as well as important speech."

A narrow band of speech types are not protected by the First Amendment and can be constitutionally censored by schools, including libel, slander and speech that crosses into criminal harassment. The Supreme Court also has granted schools the ability to regulate on-campus speech likely to cause a "material disruption" of the educational environment as well as "true threats" to the school's safety.

But those standards, in turn, are complicated by questions about schools' responsibility to provide "safe spaces" on campus and online, like with cyberbullying.

Ms. Ross says she believes schools should be as hands-off as possible when it comes to speech. That doesn't mean they are powerless, though.

In the face of a nasty comment from a student, a school can "create a culture in which they make it clear that the community disapproves,"

she says. "... These can be teaching moments rather than moments to penalize." —*Ruth Steinhardt*

Lessons in Censorship: How Schools and Courts Subvert Students' First Amendment Rights (Harvard University Press, 2015) Catherine Ross

Stone: An Ecology of the Inhuman (University of Minnesota Press, 2015)

Jeffrey Jerome Cohen, professor of English

In 2006, while finishing a book about race, Dr. Cohen noticed how heavily anti-Semitism during medieval times relied upon geological terminology, for example, calling Jews "stone hearted." That set off a study of the subject, including a focus on the ways that "time unfolds for humans at a much swifter tempo than it does for much of our planet." He wondered whether that's why earlier cultures entrusted their monuments to stone. "They knew it would endure," he says. And across human history, stone has been mankind's lively, unwitting sidekick, serving as "windbreaks for fire, as axes for war or industry, as a substance for lasting art," he writes. In every "rocky encounter," stone wasn't inert but proved its "ability to intensify our desires and possibilities."-Menachem Wecker

After Apollo? Richard Nixon and the American Space Program (Palgrave Macmillan, 2015)

John M. Logsdon, professor emeritus of political science and international affairs

The founder of the Elliott School's nearly three-decades-old Space Policy Institute begins this book with a question fitting for a galactic field: Neil Armstrong took that "one small step for man, one giant leap for mankind," but what next? The Nixon administration's response including a reduction in scope of post-Apollo space programsrippled into the 21st century. While the decision to go to the moon is well understood, the book aims to bring the same clarity to the constellation of factors surrounding the policy shift away from it. -MW

1177 B.C.: The Year Civilization Collapsed (Princeton University Press, 2014)

Eric Cline, professor of classics and anthropology

Don't worry, civilization recovers from its 12th-century-B.C. collapse. But, being aware of history is the first step in not repeating it. The book—nominated by its publisher for a Pulitzer Prize—unspools the story of Egypt's Pyrrhic victory against the mysterious "Sea People," which ultimately led to the decline of all the Bronze-Age Mediterranean civilizations. "With their end," Dr. Cline writes, came "a period of transition once regarded by scholars as the world's first Dark Age." --MW

It's Been Beautiful: Soul! and Black Power Television (Duke University Press, 2015) Gayle Wald, professor of English and American studies

This book opens with Chester Higgins' photographer's note about giving "visual imagery to the black consciousness that arose out of the civil rights era and African studies." That's the book's aim, too, as it explores "Soul!"—one of the earliest black-produced TV shows, lasting five seasons from 1968 into the 1970s. No other show in U.S. history, the author writes, has so intently examined the "variety and vitality of black culture," yet it receives "scant mention" in broadcast histories. —*MW*





In the cold, turbulent waters off the coast of South Africa, researchers find the wreckage of a slave ship and pieces of a 200-year-old story. BY LAUREN INGENO





hackled and packed beneath the deck of a Portuguese slave ship, more than 400 Mozambican men and women left their homeland on Dec. 3, 1794. They were bound for Brazil, as fuel for the nation's growing sugar economy and as a test case for a new supply line in the trans-Atlantic slave trade: East Africa.

Two days after Christmas, winds rocked the vessel—the *São José-Paquete de Africa*— as it rounded the Cape of Good Hope. The ship struck submerged rocks and wrecked between two reefs about 110 yards from the coast of South Africa. The captain and crew made it to shore, as well as some 200 slaves, who were saved only from immediate peril; they would be resold in the Western Cape. The others perished in the sea.

For more than two centuries, the captain's deposition was the only account of the $S\bar{a}o$ José and its victims that prevailed above water. Now, more than 220 years later, an international team of researchers has resurfaced the story.

The team made headlines around the globe last June when it unveiled two artifacts from the shipwreck at a news conference in South Africa. Researchers presented iron bars of ballast used to balance the ship (since the weight of human cargo could fluctuate) and a wooden pulley block. Both will be loaned to the Smithsonian's new National Museum of African American History and Culture for an inaugural exhibition this year.

The findings will bring the public face to face with a chilling past that bridged continents and still divides communities. They will also help tell the slave-trade narrative from another perspective, says marine archaeologist Stephen Lubkemann, a GW anthropology and international affairs professor, who co-leads the research team that uncovered the items.

"It is, in the most literal sense, as close as we will ever get to the experience of the Middle Passage," he says, referring to the slaving leg of a trade route that sent European ships to Africa, the New World and

Maritime archaeologists Jaco Boshoff and Jake Harding, from the Iziko Museum in Cape Town, record findings at the site.

OSEIDO

COZA

BUC



to the Americas, where slaves were sold and sent

to work on plantations. The ships completed the

back to Europe.

guns, to trade for men, women and children in Africa. The enslaved Africans then endured a brutal journey ABOVE The triangular journey by transporting sugar, coffee and tobacco **Approximate location** of the São José wreck

trade route across

the Atlantic INSET



"IMAGINE TAKING A REALLY BIG PUZZLE AND STICKING IT INTO A BLENDER."

back to Europe. "The slave trade is one of the most important stories in modern history. It's a social process that has had ramifying impacts across the globe."

The four centuries of the African slave trade left behind the wreckage of 590 documented slave ships. Yet, material evidence has been collected from only four of these sites, mostly by treasure hunters who recovered the relics without care or organization. Moreover, not one of these wrecks involved a vessel in the actual slaving leg of the trade.

The *São José* excavation represents the first time archaeological evidence has been retrieved from a slave ship that went down with captives aboard, according to the researchers.

The discovery is a result of the Slave Wrecks Project—an ongoing collaboration between GW, the National Museum of African American History and Culture, the Iziko Museums of South Africa and other partners, including the U.S. National Park Service, the South African Heritage Resources Agency and Diving With a Purpose. Dr. Lubkemann leads the Slave Wrecks Project and co-directs the *São José* research with Jaco Boshoff of Iziko.

The project connects historians, archaeologists and students under a mission of locating, documenting and preserving artifacts from the global slave trade, says Paul Gardullo, PhD '06, a historian and curator at the Smithsonian's African American history museum.

"Part of the project is not just looking for individual wrecks, but helping to catalyze a field," he says. "We are trying to invest a sense of importance for these stories to be told in all parts of the world by different institutions."

The *São José* site is one of many on the team's research agenda; fieldwork is ongoing in Senegal, South Africa, the Virgin Islands, Mozambique, Cuba and Brazil. Eventually, the researchers hope to uncover artifacts from each of the major maritime slave routes, including the East African, trans-Atlantic and internal American slave trade. They are searching not only underwater but also on land in places like Brazil and South Africa—where they will trace the origins and final destinations of the enslaved people who survived the Middle Passage.

"We are just at the beginning," Dr. Gardullo says.

Lonnie G. Bunch III was on a mission in 2005.

As the founding director of the National Museum of African American History and Culture, which is slated to open in September on the National Mall, he hoped the new space would include remains of a slave ship.

"Part of the reason why I wanted something from a single ship is that I wanted to humanize the slave trade. Most of us think of the millions of people brought over, but that almost blunts the rough edges," Mr. Bunch says.

That goal would lead him and

IRON BARS OF BALLAST found at the shipwreck site were used to keep the vessel balanced, accounting for the fluctating **WEIGHT OF HUMAN CARGO.**



Dr. Gardullo on a four-year hunt filled with dead ends and disappointment.

"I thought there had to be pieces in museums," Mr. Bunch says. "I called institutions in England, in Stockholm, in France, in Portugal and basically came up empty. That's when I realized most of the slave ships are underwater."

So the historian changed direction. He learned about a potential slave ship—yet to be excavated—that left Rhode Island in the 1790s, picked up Africans in Ghana and sank off the coast of Cuba during its return. But after a few years of research and negotiations that seemed to be going nowhere, he abandoned the idea.

Then, fortune struck when Dr. Gardullo met GW's Dr. Lubkemann in 2009.

Dr. Lubkemann told Dr. Gardullo about what was, at the time, a smaller effort called the South African Slave Wrecks Project, which he was leading with Mr. Boshoff from the Iziko Museums of South Africa in Cape Town.

That project had begun a few years earlier when new interest developed around the São José. Treasure hunters discovered a trio of cannons at the site in the 1980s while diving near Camps Bay, an affluent Cape Town suburb. They believed the wreckage to be a Dutch vessel that sank in 1756. But new archaeological evidence suggested otherwise: Mr. Boshoff. Dr. Lubkemann and a team of divers had uncovered copper fastenings and sheathing at the site. These materials were not commonly used on ships until later in the 18th century.

Intrigued, the researchers began searching through archival records, hoping to find clues about the identity of the ship. In 2011, they hit the jackpot: a captain's account of the 1794 wrecking of the *Sāo José*. The document led the archaeologists to Portugal, Brazil and South Africa, where they continued to sift through



paperwork. The following year, they discovered the Sao José's manifest, which detailed its departure from Lisbon in 1794. The manifest included documentation that the Sao José had left Lisbon with 1,500 iron blocks of ballast—a small note that would soon reveal itself as an important clue.

Archival "references provide you with ways to narrow down the search," Dr. Lubkemann says. "But then, as you start to work on the site, you find artifacts that confirm you are on the site that you think you are."

It can be a long, difficult process. And recovering objects from the depths of the ocean has its own challenges.

The waters off the coast of Cape Town are cold and unpredictable. Storm surges batter the shore. Currents from Antarctica can create waves that are three stories high. At times, four-week archaeological expeditions are cut to a single day due to winds and low temperatures. "It's like diving into a washing machine," Dr. Lubkemann says. "This is one of the hardest sites I've ever worked on."

At some shipwreck sites, divers also face the challenge of searching through waters where many ships have wrecked in the same place, known as "ship traps."

"You have to identify one ship among many," Dr. Lubkemann says. And while people tend to think of shipwrecks as fading hulks, like the *Titanic*, he says, far less remains of most vessels. Since the São José wrecked so close to shore, much of its remains likely washed up on to the beach and eventually deteriorated. The rest of the ship is underwater, buried beneath more than 10 feet of sand. Once researchers locate a potential archaeological site, they use a magnetometer, a sort of metal detector, to search for hidden treasures.

"Imagine taking a really big puzzle and sticking it into a blender. Then take half of the pieces out, throw what is left into a bucket and cover it with sand," Dr. Lubkemann says. "We still don't know how much of the puzzle is out there."

In 2012, the archaeologists uncovered a key piece of that puzzle. The excavation of the iron ballast, which matched the items listed in the *São José* manifest, was the utmost confirmation of the shipwreck site.

For Dr. Lubkemann, the discovery was also a somber reminder of the callousness of the slave trade.

"The iron ballast literally stands in for the weight of people's bodies," he says. "These pieces, as unremarkable and plain as they may be, are profoundly symbolic in a way that is incomparable to anything else—how people were reduced to commodities."

The iron bars and other newly found relics contribute essential knowledge to the field, at least as important as what is written in captains' logs and even slave narratives, which were published by



LEFT The shell-adorned container filled with soil from Mozambique ABOVE Soil is poured over the water by divers (from left) Tara van Niekerk, an archaeologist with the South African Heritage Resources Agency; Yara de Larice, a graduate student at Eduardo Mondlane University in Mozambique; and Kamau Sadiki, a volunteer with Diving With a Purpose

European and American presses, he adds.

"The historical record tells a story of those who have the ability to write, which is usually people in power. And it's heavily managed. It certainly doesn't reflect the experience of those who didn't have a voice," Dr. Lubkemann says. "That's where archaeology steps in and provides a different perspective that may, in certain instances, be quite different from that of what's been written."

Meanwhile, back in Washington, Mr. Bunch waited hopefully for the researchers to confirm their discoveries.

"I felt like a train, saying, 'I think it's it, I think it's it,' But I wasn't sure," he says. "Then once Jaco [Boshoff] says he was convinced, I was elated."

Beyond their scholarly significance, the items from the *São José*, Mr. Bunch says, promise to offer museum visitors a personal entry point to a historical event that is massive in scope and scale.

At the museum, the ballast, the wooden pulley block, timber from the ship's hull and other items still undergoing conservation will be displayed in a dark, triangular room and soon will be joined, Mr. Bunch hopes, with new finds.

"What you hope is that anyone who goes through this exhibit will be changed, that they'll understand that the slave trade is not a black story; it's a global story," he says. "It's a great educational opportunity to help us wrestle with elements of race that have divided this country."

In June, Dr. Lubkemann, Mr. Bunch and Dr. Gardullo

traveled to Mozambique en route to Cape Town, where they planned to announce the findings from the *São José* site and hold a memorial service for the shipwreck's victims.

Though the former Portuguese trading post still bears architectural reminders of foreign rule and African exploitation, slavery is not a topic readily discussed in Mozambique. For its people, the nation's history is fraught with complicated memories that have cast a long shadow.

"The trade within the coast of Mozambique involves Africans who were buying and selling other Africans," Dr. Gardullo says. "That is sometimes a difficult history to face." During the visit, members of the Makua tribe—the largest ethnic group in the country— greeted the trio. Together they walked along the same path that hundreds of Makua people would have taken before boarding slave ships during the 18th century.

"You felt how it must have felt, walking down this ramp, stumbling in chains, trying to figure out what's going on," Mr. Bunch says.

The chiefs of the tribe then handed Mr. Bunch a small, lidded container decorated in white cowrie shells. A traditional symbol of wealth and power, the shells were often used as currency to buy slaves. Inside the container, a Makua chief placed soil from the coast of Mozambique. He charged Mr. Bunch with bringing it to South Africa and depositing the soil at the site of the shipwreck during the memorial ceremony, in memory of his tribe's ancestors.

"Please place it as close to the wreck as you can," the chief told the historian, "so that finally the souls of our people will rest in their own land."

In Cape Town, hopes for good weather at the beachside memorial were met with a heavy storm and roiling sea. Winds blew along the shoreline and swept up menacing waves.

"The sea was angry," Mr. Bunch says. "We understood what had happened in the water below us."

There was poetry and prayer and reflection. Attendees spoke of the lives lost on the ship, but also of those who survived, for whom the wreck was merely a traumatic speed bump in a ghastly transaction.

Finally, three divers—one each from the United States, South Africa and Mozambique—waded into the water. They poured the Mozambican soil into their hands and sprinkled it into the waves.

Then, as if on cue, the rain subsided. The group stood, speechless, as the sun peeked out from behind black clouds. GWR The more than 230 brains of the new National Chimpanzee Brain Resource are neatly stacked in a walk-in fridge in Science and Engineering Hall.

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BRAIN TRUST

As the National Institutes of Health prepares to send its research chimpanzees into retirement, a worldclass collection of brain tissue and data opens to the public to preserve and share a dwindling resource that offers unparalleled views into evolution and the mind.

STORY / SARAH ZIELINSKI

LOGAN WERLINGER



In a lab on the sixth floor of

GW's Science and Engineering Hall, Cheryl Stimpson is working with what looks like a small deli slicer covered in white ice crystals. On a tray sits part of a baboon's brain, frozen inside a preservative and kept cold with two small troughs of ethanol bubbling with dry ice.

A research associate in the lab of evolutionary neuroscientist Chet Sherwood, Ms. Stimpson methodically draws a sharp blade across the brain, creating a slice only 40 micrometers thick— "thinner than cheese," she quips which she lifts off with a small brush and places in a tube. She's been at this since 8 a.m. and will keep slicing throughout the day.

"This is a bit art," she says. She has to keep the brain cold, but not too cold. And she must pull the blade fast, but not so fast she tears the slice or cuts herself. It helps to have the right music playing, Ms. Stimpson notes, as the voice of Kermit the Frog comes through a nearby speaker.

When she is done, she'll place the neatly labeled tubes in one of the lab's freezers, where they'll rejoin the more than 650 mammal brains in Dr. Sherwood's collection. All have come from animals that died of natural causes in zoos or research centers. (There are no live animals here.) Some are from mammals far from the human branch of the evolutionary tree, such as tigers, elephants and kangaroos. But the prizes of the collection are the dozens of primate species, such as the baboon Ms. Stimpson is cutting, and, especially, chimpanzees, humanity's closest living relatives.

Through comparing species in

the collection, Dr. Sherwood and his team have made insights into brain evolution, and they are starting to tease out the qualities that make the human brain unique. Having access to so many brains is what makes this type of research possible—and it's why Dr. Sherwood's lab is one of the few places where these studies are done.

Traditionally, scientists have hoarded exclusive resources like these. But there is growing recognition that sharing may be in the broader interest, especially when materials have been developed with taxpayer dollars.

So Dr. Sherwood recently teamed up with two collaborators— William Hopkins of Georgia State University's Neuroscience Institute and Todd Preuss of the Yerkes National Primate Research Center at Emory University—to create the National Chimpanzee Brain Resource with the aid last year of nearly \$1 million from the National Institutes of Health.

The NCBR will be more than a collection of brains, though. Researchers worldwide also will have access to decades' worth of related data—brain MRIs, and observational and veterinary data from the chimpanzees.

"We're limited," Dr. Sherwood says. "We can investigate questions that we find interesting, but there are a vast number of other fascinating questions and innovative approaches that other labs and investigators might want to address using these resources."

Building this resource is "just best for science and for our progress in understanding chimpanzee neurobiology for its own sake as well as how humans compare with chimpanzees," he says.

When Dr. Sherwood talks

about his undergraduate years at Columbia University, he says he was "not on a path to becoming any kind of scientist. I didn't think I had any aptitude for it." He was a philosophy major who played in a punk band and worked at a radio station.

But a friend recommended he take a class in biological anthropology, which he thought sounded like one of his favorite sci-fi movies, *Planet of the Apes* (a poster from which now hangs in his office). He ended up captivated by a course that explored how human cognition has evolved through changes in brain structure.

He added classes and earned a PhD in anthropology, studying under the professor who taught that first course, Ralph Holloway, and Patrick Hof, of the Icahn School of Medicine at Mount Sinai, whose collection of mammalian brains became the backbone of Dr. Sherwood's catalog and of the NCBR.

Now director of the GW Mind-Brain Institute and a member of the Center for Advanced Study of Human Paleobiology, Dr. Sherwood has found a niche for himself straddling the realms of anthropology and neuroscience.

While anthropologists typically have studied the bones of our longdead ancestors—informing, for instance, how brain size changed in relation to body size over time neuroscientists have concentrated on how living brains develop and work, and the diseases that can occur when these things go wrong.

Dr. Sherwood is bridging the gap between them by using neuroscience techniques, like MRI scans and examining whole-genome transcription, to compare human brains to those of chimpanzees and other primates. He's aiming to elucidate the characteristics that make the human brain so capable of exceptional things as well as prone to neurodegenerative diseases, such as Alzheimer's disease and Parkinson's, that are not found in our close animal relatives.

He has shown that it's not simply brain size or structure that are important, but that other aspects of biology, such as the human lifespan, may also play roles in the development of brain diseases.

"Human longevity is
extraordinary," Dr. Sherwood says. Unlike most

animals, humans live long after their reproductive years end. But as a person ages, brain structures like the hippocampus and frontal lobe, which are responsible for emotion and memory, decrease in volume. That doesn't happen in chimpanzees, Dr. Sherwood and his colleagues reported in the Proceedings of the National Academy of Sciences in 2011. Even chimps near the end of their lives experience no declines in brain volume, they found.

"This is a unique part of brain aging in our species," he says. And it may be the price we pay for having such big brains and long lives.

Comparing human and chimpanzee brains can do more than just offer clues as to why one species gets sick and the other does not, Dr. Sherwood says. Such work

TOP Anthropology Professor Chet Sherwood BOTTOM Aida Gómez-Robles



might also scratch at the question of why a person can do something like read this article but even our closest-living relatives cannot.

Aida Gómez-Robles, a postdoctoral scientist in Dr. Sherwood's lab, holds two brightly colored 3-D printed models of brains in her hands. One is a human brain, which always seems somewhat smaller than our egos would like to think, but, at three pounds, is actually quite big for an animal our size. The other belongs to a chimpanzee, and it's about one-third the size.

There are more differences than

"WE'RE TRYING TO LOWER THE BARRIER SO MORE PEOPLE ARE ABLE TO ASK ... QUESTIONS"

just size, though, Dr. Gómez-Robles points out. The human brain has far more folds, for instance, and some areas, such as those responsible for language and problem solving, are even bigger than what would be expected from simply magnifying a chimp brain to the size of a human's. Humans also have more of the white matter that connects nerve cells. Such differences, she says, help explain the complex cognitive functions that a human brain can perform.

But for all their differences, humans and chimpanzees share a lot of similarities, including some 98 percent of their DNA. That's because we shared a common evolution up to about 6-8 million years ago.

For decades, this close

relationship made chimpanzees relevant research animals, especially in the biomedical field, where they have been important to research on deadly diseases such as hepatitis and Ebola. But over time, people have become less comfortable with using animals that have so many humanlike qualities—and have become so rare in the wild that they are now endangered—when other options may be available.

COLUMN DESIGN OF

In 1995, the National Institutes of Health stopped breeding chimpanzees for research, and, in 2013, the agency announced that it would retire most of the chimps it owned or supported, keeping only 50 animals in reserve.

Then last year, the U.S. Fish and Wildlife Service listed captive chimpanzees as endangered under



the Endangered Species Act. The listing meant that any research with the animals would be limited, and to get a permit to keep captive chimps, organizations would need to show that their work benefits chimpanzees in the wild or is critical to understanding human disease. Several months later, NIH announced that it would retire all of its remaining research chimps and no longer support invasive research on the primates.

The NIH decision, which has been controversial among researchers, means that chimp brains will become a rare resource after these soon-to-be-former research chimpanzees reach the end of their natural lives. Zoos may still donate brains, but the chimps that have been extensively studied in research facilities are especially significant to scientists, Dr. Sherwood says. The ancestry, behavior and biology of research chimps are often well-documented. The animals may have had MRI scans of their brains while they were alive. The depth that all this extra information adds to the brain itself is "really powerful," he says.

When an animal dies at a zoo or research facility, a veterinary pathologist performs a necropsy the animal version of an autopsy. Organs are removed for testing. The brain might be cut into pieces for analysis. The institution completes its study and, often, the process ends there. Although Dr. Sherwood and his NCBR partners are the Association of Zoos and Aquariumsendorsed recipients of brains,

there's no requirement or guarantee a brain will end up with them.

And yet, each year dozens of brains do reach Dr. Sherwood's lab, and he anticipates the NCBR could receive 10 or so chimpanzee brains per year. So the group is working with veterinary pathologists to create a recommended standard for how zoos, the National Primate Research Centers and the federally supported Chimp Haven sanctuary in Louisiana could best handle a chimpanzee's brain after death.

Brains typically arrive in one of two forms—preserved in formalin or flash-frozen at -80 degrees Celsius—joining the 230 or so chimp brains already in the collection.

Frozen material preserves proteins and RNA, so these brains are better for studies that

Chimpanzees, BY THE NUMBERS



The number, roughly, of genetic differences between humans and chimpanzees, despite being so closely aligned

8.8 Percentage, roughly, of DNA shared between humans and chimpanzees

30-40 YEARS

Lifespan in the wild and captivity, though some captive chimpanzees are in their 60s and perhaps 70s

150,000-300,000

Estimated population of wild chimpanzees, which all live in Africa; according to some, the number may be as high as 430,000

1976

Year chimpanzees were listed as "threatened" by the U.S. Fish and Wildlife Service; in 1990, it reclassified wild chimpanzees as "endangered" while keeping "threatened" status for captive chimpanzees

Sources: American Museum of Natural History; Smithsonian National Museum of Natural History; Chimp Haven; International Union for Conservation of Nature; World Wildlife Fund; U.S. Fish and Wildlife Service → examine which genes are active within cells, called gene expression, as well as protein expression. Many biologists are now interested in these types of studies, Dr. Sherwood says.

But the brains fixed in formalin are useful, too. They are perfect for slicing for further study, such as the baboon brain that Ms. Stimpson was cutting up into hundreds of pieces. That material was being prepared for an ongoing crossspecies study, but the slices will also be saved for later use.

As the brains are sliced, every 10th piece is stained to illuminate a feature, like neurons or synapses, and put onto a slide. The group of slides creates something of a brain atlas that can be used to direct researchers to the tubes with specific slices they need for a study. The slides also will be scanned and made available online in a zoomable format.

"It's a method that we're using to maximize the usage of the brains," Dr. Sherwood says, "because we expect them to be an incredibly limited resource."

Each brain also will be photographed when it enters the collection, with the photos to be combined into a 3-D image. At Emory University, brains will undergo high-resolution MRI scans as well as diffusion tensor imaging, a technique for measuring connections between parts of the brain. From both imaging efforts, the team will build online databases of grey and white matter volumes and of brain connectivity.

These types of images have already proven their worth. For example, a team led by Dr. Gómez-Robles used similar images in a study published last year in the *Proceedings of the National Academy of Sciences* to show that the shape of a human brain depends more on environmental factors than genetics, while for a chimp brain it's the opposite.

Also included in the NCBR will be behavioral data and a brain template, based on the MRI data. While this type of information



As each brain is being sliced for preservation, a representative set is put aside for staining and mounting on a slide. Together, the slides serve as an atlas for the whole brain.

has been around for years, gaining access often required going to multiple research centers that each had different requirements and different protocols. With the NCBR, Dr. Sherwood says, "we're trying to lower the barrier so more people are able to ask the questions they want to ask."

Mary Ann Raghanti, a comparative neuroanatomist and biological anthropologist at Kent State University, says the "repository is invaluable." If researchers like her weren't able to study chimpanzee brains and make comparisons with those of humans, she says, "then our understanding of humans, not only in terms of evolution, but also in terms of potential susceptibility to neurodegenerative processes—all of that disappears."

Dr. Sherwood opens the

door to one of his lab's freezers, revealing hundreds of plastic containers in stacks on green wire shelves. Each contains a mammalian brain, some whole, some in pieces. Primates may dominate the collection, but he points to some oddities, like the giant anteater and rock hyrax. The sheer range of materials in the collection have allowed him and his team to make unique insights into brain evolution and the basic biology of the mammalian brain. They've shown, for instance, that the structure of neurons, once assumed to be similar in all mammals, instead could vary from species to species.

But the brains of great apes, in particular, fill a gap in neuroscience research, says Katerina Semendeferi, a comparative neuroscientist at the University of California, San Diego.

In that realm, scientists mostly have focused on invasive research in animal models, such as rodents, or used imaging techniques on humans. The NCBR, she says, serves an important role "in terms of translating the model findings ... to the human-imaging studies."

The endeavor is perhaps equally about legacy. The scientists, of course, feel pride in amassing and creating this vast public resource ("We accumulated a lot more materials than we ever thought we would," says Dr. Hopkins, the NCBR co-founder at Georgia State). And standing with Dr. Sherwood in the cold, surrounded by brain tissue, the group's reverence for the lives and service of the chimpanzees is palpable. The jars and boxes are labeled not by number, but namethe names by which the chimps were known in life to a generation or two of zoogoers, veterinarians, scientists and graduate students.

In death, Dr. Sherwood says, "we're trying to just add as much value [as we can] to the lives that they lived."

For more on the National Chimpanzee Brain Resource, visit chimpanzeebrain.org

'GOOGLE MAPS' OF THE MINUSCULE

LEFT AS HIV infection becomes a chronic illness, rather than a terminal one, "the major clinical problem is not death from opportunistic infection, but actually cardiovascular disease," says microbiology Michael Bukrinsky. Using images like this one, of an HIV-infected macrophage (a type of immune cell), he's able to see that HIV causes the high cholesterol that leads to cardiovascular disease. RIGHT Macrophages that have fused into a single, giant cell, spurred by HIV infection

A NEW IMAGING FACILITY BRINGS THE NANOMETER AND ATOMIC WORLDS INTO STUNNING FOCUS.

BY DANNY FREEDMAN



ABOVE Instead of looking for the usual indicators of sperm health—concentration, motility and shape—epidemiologist Melissa Perry turns instead to DNA for her studies into the effects of chemical exposure. Sperm nuclei are labeled red, the sex chromosomes X and Y are green and orange, respectively (each nucleus should have just one), and the blue dots are chromosome 18, which each cell should have and is used here to ensure the color probes are working.

OPPOSITE TOP An image of the crystalline structure of arsenic, which chemist Michael Wagner is studying as a high-capacity storage material for batteries OPPOSITE BOTTOM Dr. Wagner's lab is working to control the size of gold nanoparticles, the properties of which can change widely as the element is scaled. It could have use in cancer treatment or in magnetic refrigeration, he says.



THE NEW SUITE IS "GOING TO MAKE A HUGE DIFFERENCE IN PRODUCTIVITY ... IT'S HARD TO BE A CARPENTER IF YOU DON'T HAVE A HAMMER." **michael wagner**





IN A BASEMENT BELOW A BASEMENT,

inside a room with its own electromagnetic field, six-inch-thick steel walls and a concrete floor that runs three feet deep, electrons are blasting nerve cells from a mouse. Cross-sectional images, in slices that are 10 billionths of a meter, slowly populate a monitor beside the microscope.

"Pretty much what you do is, you sit down and you build Google maps," says Anastas Popratiloff, the director of the imaging suite in the new GW Nanofabrication and Imaging Center, as he putters with the incoming data.

And it's an apt analogy. The imaging lab deals in richly detailed molecular landscapes, at times on the level of individual atoms. A flick of the controls might zoom you inside, say, a tuft of neurons, for a 360-degree gander. There are microscopes that build 3-D maps of the concentrations of various atoms in a sample, and those that analyze individual pixels across all wavelengths of light, giving materials—from paint pigments to body tissues—a unique signature. They're the kinds of machines that bore into the infinitesimal and turn out gigabytes by the dozen.

At the time, in March, the universitywide facility in Science and Engineering Hall had been online only about a month and, for the moment, it's quiet. But still the center is cranking out images as quickly as researchers can be trained on the new equipment. As one group of seven leaves an afternoon training, Dr. Popratiloff says another seven will be following soon behind.

The center occupies a brightly lit and white-walled 4,000-square-foot space down the hall from a slightly larger nanofabrication suite. Both were built into bedrock in order to dampen vibrations from the subway, which has a station a block away. And some rooms, like the one with the scanning electron microscope, have specially constructed shielding to protect experiments from the electromagnetic field produced by the passing trains.

"The space is unique," Dr. Popratiloff says. "There's nothing like it, probably, at another private institution on the East Coast."

Its five new microscopes obtained through partnerships with manufacturers including FEI, Leica and Raith—offer researchers a leap in resolution, sensitivity and speed. They augment an older fleet of three microscopes in the School of Medicine and Health Sciences.

The new tools mean that "with the same effort, [researchers] can gather 10 times more data, and much-better-quality data," Dr. Popratiloff says.

The bump in microscopes also means simply more machine hours. And several of the microscopes can be programmed to run autonomously day and night. ("If you buy a \$2.5 million thing, it has to work nonstop," Dr. Popratiloff says.) He's hoping the lab's capacity and central location—close to



So far, it's attracting a wide range of GW researchers.

Michael Wagner, a materials scientist and chemistry professor, has used the facility to image gold nanoparticles, which he studies for their potential use in medical applications, and hollow carbon nanospheres that he synthesizes in his lab. He's using the latter to build a new type of lithium ion battery like those found in phones—that charges to just over 20 percent in around 7 seconds.

Until recently, though, he had to travel to the University of Maryland for his microscopy work.

The new suite is "going to make a huge difference in productivity night-and-day difference," he says.

" ... It's hard to be a carpenter if you don't have a hammer."

Similarly, epidemiologist Melissa Perry, whose lab investigates how exposure to chemicals affects male ABOVE In the lab, a sample like these mouse neurons, imaged by a confocal microscope, can be changed from a uniformly labeled image to individually colorized cells, which then can be explored in 3-D to isolate a specific cell for deeper study on a scanning electron microscope.

fertility—which means examining the nuclei of tens of thousands of sperm cells—found the balance of resolution and processing power that her lab "desperately needed to advance this work."

It's providing crisp images "but it's also giving us the capacity to detect these abnormalities using an automated system," she says.

Michael Bukrinsky is studying how HIV infection leads to high cholesterol and, eventually, cardiovascular disease. His team has been using the facility to confirm and demonstrate what it has proven biochemically: that the protein chiefly responsible for moving cholesterol out of cells is blocked when cells are infected with HIV. For reviewers of journal papers and grant applications, the images show "that this is really true," he says. "They can see it with their own eyes."

And as activity ramps up and datasets mount, Murray Loew, a professor in the Department of Biomedical Engineering, sees opportunities for his work in image analysis, including developing techniques for aligning images and for autonomous analysis of changes across a video or a series of images.

The burden of discovery still rests with the brain, though, Dr. Popratiloff says, even if technology is the V-8 engine driving the process. "The technology brings people together with common interests, and they start communicating in a very focused way," he says. "... But at the end of the day, you really need the people."

> For more on the GW Nanofabrication and Imaging Center, visit nic.gwu.edu

RESEARCH NEWS



MEDICINE

FOR TYPE 2 DIABETES, A SOUND WAVE 'MASSAGE' HOLDS PROMISE

By Menachem Wecker

Scientists think they may have found a new treatment for Type 2 diabetes by modifying a tool that's already used in hospitals and medical offices every day: ultrasound.

The team of GW researchers says its preliminary tests suggest that sound waves could be used to stimulate the pancreas to secrete the hormone insulin, which regulates glucose, or sugar, in the bloodstream. In patients with Type 2 diabetes—by far the most common form—the pancreas secretes too little insulin and the body is resistant to it, leading to elevated blood glucose levels.

While ultrasound is perhaps best known as a medical imaging tool, the researchers say their technique uses sound waves that are slightly higher in intensity than what's used for imaging, more similar to ultrasound therapies used to foster bone healing after fractures.

The researchers on the project, which they're calling SonoInsulin,

ultimately hope to translate the science into wearable technology. It would be applied after meals or it could be synced wirelessly to a continuous glucose monitor, and the device could be calibrated to deliver patient-specific insulin dosages.

"Although much development work remains to be done, it's a very creative approach that would add a completely new dimension to treatment of this disorder, and possibly other disorders as well," says Joshua Cohen, a GW endocrinologist and professor of medicine who recently joined the team.

The project was started in 2013 by biomedical engineering professor Vesna Zderic and biology professor Aleksandar Jeremic, and includes, in addition to Dr. Cohen, biomedical engineering doctoral student Ivan Suarez Castellanos, BS '10, MS '12, and undergraduate students Tania Singh and Bogdan Balteanu.

In 2014, the researchers were

awarded more than \$150,000 from the National Institutes of Health, and they won a spot that year at the National Science Foundation's D.C. Innovation Corps, a business boot camp for scientists. Most recently, in February, the group applied for a patent on the technology.

In the lab, the team has found that ultrasound can stimulate pancreatic beta cells to release up to four times the amount of insulin than they otherwise would, all without damaging the cells. Now they're trying to elucidate how it works, including whether the ultrasound might "massage" pancreatic beta cells to stimulate insulin release, says Mr. Suarez, the doctoral student.

Whatever's happening on a molecular level, it's complicated, says Dr. Cohen.

"One of the very interesting questions is: In what precise fashion does the energy imparted into the cells by the ultrasound stimulate the release of insulin, and what are the steps in the process?" he says.

In the past 25 years, diabetes cases worldwide have quadrupled to 422 million adults, according to the World Health Organization. While the WHO data didn't distinguish between the two types, the report noted that weight is strongly linked to Type 2 diabetes and that more than 1 in 3 adults is overweight. In the U.S., nearly 10 percent of the population has diabetes, according to government figures, and Type 2 is estimated to account for 90 percent to 95 percent of adult cases.

"Clearly, not just the United States but the entire world is in the midst of a diabetes epidemic," Dr. Cohen says.

If successful, the research could provide an alternative to medicines currently on the market that aid in the production of insulin, the team says. (It wouldn't, however, replace insulin shots, which supplement insulin when the pancreas loses its insulin-producing beta cells in the later stages of the disease.) The advantage would be a tailored treatment that targets only the pancreas. And since it doesn't enter the bloodstream, it wouldn't interact with medicines for other conditions. Current drugs for Type 2 diabetes also appear to lose effectiveness over time, Mr. Suarez says, and the team hopes that won't be the case for ultrasound.

"The earliest it would get out there is probably 10 years," says Dr. Zderic, the biomedical engineering professor. For now, the next step is to continue testing to understand the mechanisms behind the treatment and its potential health impacts.

ENTREPRENEURSHIP

A FRESH WAY To farm

New Venture Competition awards top honor and \$60,000 cash to ecofriendly produce business, among \$250,000 worth of cash and in-kind prizes.

By Ruth Steinhardt

At HomeGrown Farms, the farmers are more likely to wear lab coats than muddy overalls.

Rather than the wide sky and ranging fields of the bucolic imagination, HomeGrown exists like a leafy, high-tech Narnia inside a 320-square-foot shipping container in New Jersey. Kale, spinach, arugula, fresh herbs and other greens grow year-round under LED lights in baths of nutrient-rich water.

All this results in a farming model that uses 90 percent less water and 80 percent less fertilizer than traditional farms, said Parth Chauhan, BA '13, founder and CEO of HomeGrown, which won big at GW's New Venture Competition finals in April. And since it is a closed system, safe from insects and contaminants, HomeGrown uses no herbicides or pesticides and produces no environmentally harmful runoff, said Mr. Chauhan.

"What would normally take a football-field-sized area to [yield], we can actually do in a space smaller than this stage," he said, standing at the helm of the Jack Morton Auditorium where he and his team presented.

Mr. Chauhan grew up in the New Jersey community where HomeGrown now is based and has known teammates and fellow farmers Raghav Garg and Zeel Patel since middle school. GW senior Pranav Kaul, the fourth founder, met Mr. Chauhan at the university.

The company, which has been in operation since last year, took first place overall in the competition and won nine supplemental cash and inkind prizes—a total winnings value of more than \$74,000, including \$60,000 in cash.

"[HomeGrown] has the great combination of meeting a need, resonating with people and they've worked out the technology. They've engineered a successful system," said Lex McCusker, director of the New Venture Competition. "And like every good social venture, it holds up financially, as well."

Businesses addressing social needs made a strong showing in the finals, with three of the four overall top-placing teams coming from the GWupstart Social Innovation Lab prize track: Along with HomeGrown Farms was second-prize winner Mental Health Promotion, a nonprofit that integrates mental health education into existing high school health classes across the country, and Rooftop Tea Company, the fourthplace winner, which empowers women tea growers in the Middle East and offers transparency about the provenance of their brew.

Rounding out the top four: Represently, a digital platform for communication between voters and lawmakers, took third place.

The New Venture Competition, now in its eighth year, is organized by the Office of Innovation and Entrepreneurship within the Office of the Vice President for Research and is the fifth-largest collegiate entrepreneurship competition in the United States. This year, awardees took home \$130,000 in cash and \$140,000 in in-kind prizes.

RESEARCH NEWS

CLOCKWISE FROM TOP RIGHT Leah Farrar of RightDate; Anna Wu and Eman Mirdamadi of Seamless Color; and (left to right) Zeel Patel, Parth Chauhan, BA '13, and Pranav Kaul of HomeGrown Farms

2016 G

THE FINALISTS

Abdicare: Developer of a once-daily e-cigarette/inhaler to help smokers quit the habit via aversion therapy Led by: Khameini Ali, School of Medicine and Health Sciences graduate student

HomeGrown Farms: Indoor, hydroponic farming for year-round local produce Led by: Parth Chauhan, BA '13

Lucrant: Collaborative, web-based financial research platform for institutional investors

Led by: Jacob Learned, Columbian College of Arts and Sciences senior

Mental Health Promotion: A

curriculum designed by and for students, intended to supplement materials in existing high school health-education classes Led by: Kyrah Altman, Columbian College of Arts and Sciences freshman

Project Dream Miles: An app that logs a user's runs and initiates a 10¢ donation to a local charity for each mile, made possible via targeted marketing services

Led by: Yeshwant Chillakuru, Columbian College of Arts and Sciences junior

Propisor: An online marketplace connecting homeowners with home-improvement professionals Led by: Veer Taneja, School of Business senior Represently: Constituent relationship management software for voters and legislators Led by: Kevin Connell, School of Business senior

RightDate: A dating app for volunteer-minded singles, in which users are invited on dates to volunteer or participate in nonprofit activities

Led by: Leah Farrar, School of Law student

Seamless Color: Color-customized 3-D printing material for artists and designers

Led by: Anna Wu, School of Business sophomore

Staff U: Connects college students in search of flexible, short-term paid work with businesses in search of help Led by: Colin McFaul, BA '15 SUPPORT STUDENTS ENHANCE ACADEMICS BREAK NEW GROUND



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