FALL 2017

COLLEGE OF COMPUTER, MATHEMATICAL, AND NATURAL SCIENCES

# ODYSSEY

# FIGHTING HUMAN DISEASE AT ALL SCALES

UNIVERSITY OF MARYLAND / FEARLESS IDEAS

# Meet Our Interim Dean

University of Maryland Biology Professor Gerald Wilkinson became interim dean of the College of Computer, Mathematical, and Natural Sciences (CMNS) on July 1, 2017.

Wilkinson joined UMD in 1987 as an assistant professor. He has served the department, college and campus in many capacities, including as chair of the Department of Biology from 2009 to 2013.

Wilkinson has been recognized with the UMD Distinguished Scholar-Teacher Award (1997), as well as the College of Chemical and Life Sciences' Faculty Research Award (2001) and Faculty Service Award (2007).

With publications in animal behavior, genetics and evolution to his credit, Wilkinson's research addresses a wide range of topics including sexual selection, communication, genomic conflict and speciation.

We sat down with Interim Dean Wilkinson to discuss some of his ideas and plans for the college.

**ODYSSEY: Why did you decide to take this job?**

**WILKINSON:** When I became department chair, I knew it would be an opportunity to give back to the institution. The same is true now. In both cases, I knew the experience would broaden my perspective. The scope of the college makes my jaw drop. From gravitational waves to the "Bug of the Week," we do so many different things.

I am not sure what I can accomplish in the next year before a permanent dean takes the helm, but I will still look toward the future. I am sure I will encounter situations where a decision will make someone unhappy. I will have to make the decisions that are the best for the college in the long term. And I can see the long term pretty easily because I've been here for so long.

**O: What is the most positive development you have seen in the college?**

**W:** I think the creation of CMNS in 2010 was a great move. It's good to put people in one unit who share a common idea of what science means. Science also happens elsewhere on campus, but the missions are different. We are the college of basic sciences. We strive for knowledge—that is our common bond.

**O: What would you like alumni to know about the current state of the college?**

**W:** We're a good investment! The quality of our faculty, staff and students in the college is very high. But we are competing with some of the best institutions in the country. Some faculty are being recruited by other institutions that can offer endowed professorships. We only have about two dozen such positions in the college, so our ability to counteroffer is greatly compromised. We experience similar issues recruiting undergraduate and graduate students, so providing scholarships and fellowships can make a huge difference. To have the very best at all levels, we need to supplement our state and research funding with strong support from our alumni and friends.

**O: What are your guiding principles and leadership style?**

**W:** Honesty and clear communication—which are very important in both science and administration—are big priorities for me. I plan to meet with everyone in the college and work as democratically as possible. This doesn't necessarily mean taking a vote, but getting input and weighing points of view before making a decision. My hope is to keep morale high. It only takes a few decisions to lead to outcomes with negative consequences. I prefer to focus on consensus building.

**O: What do you like to do in your free time?**

**W:** I love to swim, as do my wife and daughter (a UMD alumna), so we often exercise together at a local pool during the summer. My wife and I also like to travel. She enjoys art museums while I prefer natural history museums, but we frequently manage to do both. In addition, I'm an avid nature photographer, so we also enjoy exploring nature reserves wherever we go. When I'm not doing those things, I do a lot of science!



*Photo by John T. Consoli*

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*Margaret Scull (top) and Edward St. John Center (bottom) photos by John T. Consoli / Simon Levin (center) conducting fieldwork on Tatoosh Island, Wash. in 1974; courtesy of Carole Levin*


# ODYSSEY

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### ON THE COVER

Five researchers who are working to fight human disease: (From Top) Raymond St. Leger, Kan Cao, Margaret Scull, Jonathan Dinman and Lai-Xi Wang.

*Photos by John T. Consoli*
*Illustration by Faye Levine*

FEATURE

# FIGHTING HUMAN DISEASE AT ALL SCALES

## FROM MULTISPECIES TO SUBMOLECULAR

*BY MATTHEW WRIGHT*

Globally speaking, humans now enjoy longer, healthier lives than at any point in history. We have come a long way since Hippocrates first advocated logic as a way to understand disease. For two millennia, the doctors and researchers who followed him based their conclusions on what they could see with the naked eye.

The invention of the compound microscope in the 17th century changed everything, opening the door to the discovery of cells. Then, the advent of germ theory in the mid-19th century proved that microscopic invaders can infect our bodies. Decades later, the discovery of DNA and subsequent experiments revealed how diseases can lurk within our own genetic code. Recent advances in biochemistry illuminated the infectious power of rogue proteins, such as the prions that cause variant Creutzfeldt-Jakob disease—a form of "mad cow" disease that affects humans.

To understand disease is to appreciate that it works at a variety of scales. Fittingly, it is impossible to apply a one-size-fits-all approach to disease research. Scientists in the University of Maryland's College of Computer, Mathematical, and Natural Sciences are tackling the dynamics of infectious and hereditary diseases at all scales, from complex multispecies conditions, such as malaria, to whole-body aging disorders; from the flu with its organ-specific infection pathway to the submicroscopic structure of disease-causing viruses and disease-fighting antibodies.

Jonathan Dinman, professor and chair of the UMD Department of Cell Biology and Molecular Genetics, has explored disease at a variety of scales throughout the course of his career.

"Some scientists start on one thing and work on that thing for their entire career. Others go where the science takes them. That's what I've done," Dinman said. "I started with parasitology. Then I became interested in yeast, then virology, which brought me to the structural biology of gene expression and human disease. That's where I am now. I go where the interesting questions are."

Like Dinman, diseases adapt. Genes mutate. New strains of viruses and bacteria emerge. Antibiotics and other tried-and-tested treatments lose their effectiveness. For many life scientists, staying ahead of the curve means engaging in an arms race against deadly diseases.

"Diseases are always one step ahead of us. Take the flu, for example. The virus is constantly evolving, and although we have the technology to make effective vaccines, we have to stay on top of which new strains of the virus are circulating each year. This requires a concerted global effort," said Margaret Scull, an assistant professor of cell biology and molecular genetics. "Furthermore, as the world gets more populated and it gets easier to bounce around the globe, we'll continue encountering new pathogens we may never have seen otherwise."

From multispecies to the submolecular scale, UMD researchers are fighting human diseases on multiple fronts.

### A TALE OF SEVERAL SPECIES

Malaria is a notorious global killer, claiming nearly half a million lives every year according to the World Health Organization (WHO). Among researchers, the disease is also notorious for its complexity: any successful anti-malaria strategy must account for the biology of three organisms—humans, mosquitoes and the parasite *Plasmodium.*

"Studying the malaria pathogen by itself is like listening to one hand clapping," said Raymond St. Leger, a Distinguished University Professor in the UMD Department of Entomology who fully embraces the interdisciplinary nature of malaria research. "You need to understand all sides to make progress."

St. Leger's research adds a fourth layer of complexity: pathogenic fungi that specifically target insects. When these fungi come into contact with an insect's body, the spores germinate and penetrate the insect's exoskeleton, eventually killing the insect host from the inside out. Consequently, researchers have looked to these fungi as a way to control mosquitoes—and thus rates of malaria infection—in high-risk areas.

In collaboration with colleagues from Burkina Faso, a landlocked country in western sub-Saharan Africa, St. Leger's group zeroed in on the fungus *Metarhizium pingshaense*—a natural killer of disease-carrying mosquito species including

"Studying the **malaria pathogen** by itself is like listening to one hand clapping. You need to understand all sides to make progress."

–Raymond St. Leger

*Photos by John T. Consoli / Illustration by Faye Levine*

*Anopheles gambiae* and *Aedes aegypti*. To supercharge the killer fungus, the researchers genetically engineered it with several genes that express neurotoxins from spider and scorpion venom—both alone and in combination with other toxins. They published their results in June 2017 in the journal *Scientific Reports*.

Each engineered fungal strain killed wild-caught mosquitoes in Burkina Faso more quickly and efficiently than the unaltered fungus. But the most effective strain used a combination of two toxins already approved by the U.S. Environmental Protection Agency for insecticidal use: one derived from the North African desert scorpion *Androctonus australis* and another derived from the Australian Blue Mountains funnel-web spider *Hadronyche versuta*.


RESEARCHERS ESTIMATE THAT MOSQUITO-BORNE DISEASES MAY BE RESPONSIBLE FOR KILLING **HALF OF THE HUMANS WHO HAVE EVER LIVED.**

“Our most potent fungal strains, engineered to express multiple toxins, killed mosquitoes with a single spore and stopped mosquitoes from blood feeding,” said Brian Lovett, an entomology graduate student working in St. Leger’s lab and a co-author of the study. “This means that our fungal strains can prevent disease transmission by more than 90 percent of mosquitoes after just five days.”

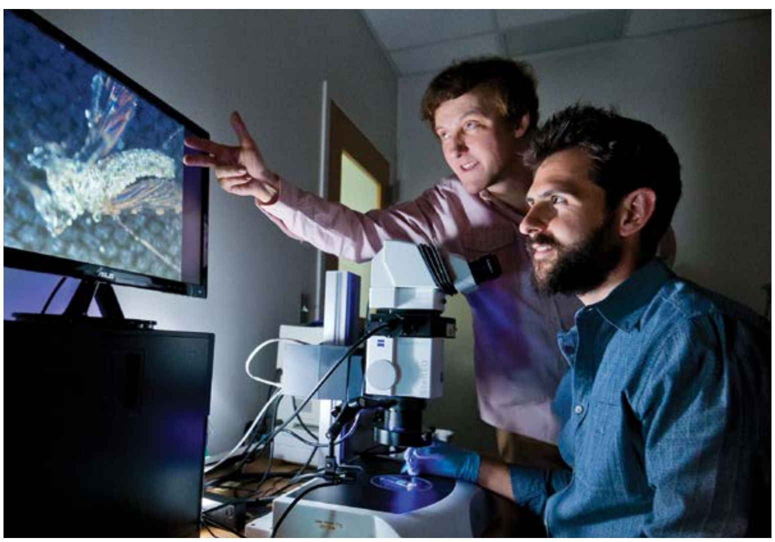
When St. Leger, Lovett and their colleagues inserted the toxin genes into *M. pingshaense*, they included a highly specific promoter sequence, or genetic “switch.” This fail-safe ensured that the toxin genes could only be activated in the blood of insects and could not be released into the environment. To further ensure the safety of non-target insect species, the researchers tested the engineered fungal strains on local Burkina Faso bees. After two weeks, no bees had died as a result of the toxin-boosted fungus.

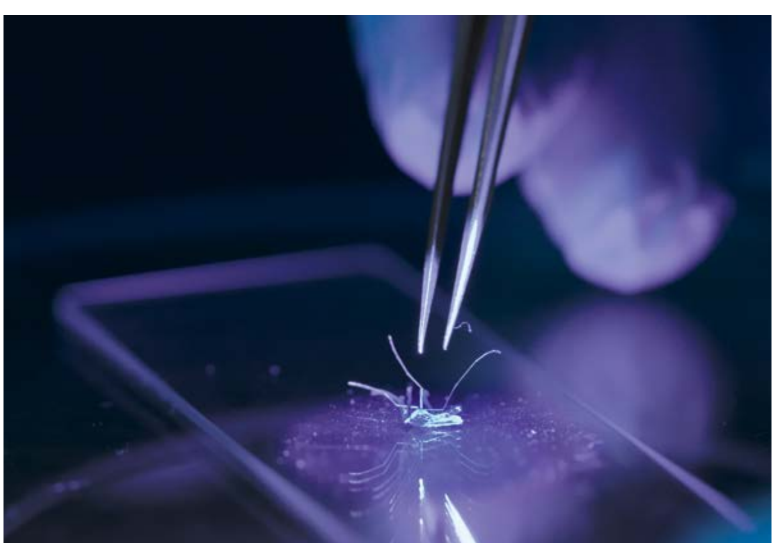
“The toxins we’re using are potent, but totally specific to insects. They are only expressed by the fungus when in an insect. Additionally, the fungus does nothing at all to bees and other beneficial species,” St. Leger said. “So we have several different layers of biosecurity at work.”

The need in Burkina Faso is dire: according to the WHO, malaria is omnipresent throughout the country and the parasite has grown resistant to the antimalarial chloroquine. The mosquitoes there have also grown resistant to traditional insecticides, according to local scientists.

“Many in Burkina Faso are very keen on this technology,” St. Leger said. “The WHO has identified insecticide resistance as the major threat to effective mosquito control, which is relevant not only to malaria but to a number of mosquito-borne diseases such as dengue and yellow fevers, viral encephalitis and filariasis. Unlike chemical insecticides that target only sodium channels, many spider and scorpion toxins hit the nervous system’s calcium and potassium ion channels, so insects have no pre-existing resistance.”

St. Leger and his collaborators plan to expand their on-the-ground testing regimen in Burkina Faso. One goal is to determine the best way to combine genetically engineered fungi with other interventions, including chemical insecticides, to prevent the evolution of resistance. Eventually, the team hopes to deploy their engineered fungal spores over a wide area to test their impact on malaria transmission.





**(TOP, L–R) RAYMOND ST. LEGER AND BRIAN LOVETT** EXAMINE A DEAD MOSQUITO INFECTED WITH A PATHOGENIC FUNGUS. (BOTTOM) SPORES OF THE FUNGUS ENGINEERED TO EXPRESS SPIDER AND SCORPION TOXINS ALSO EXPRESS FLUORESCENT PROTEINS TO INDICATE A SUCCESSFUL GENETIC ENGINEERING PROCESS.

*Photos by John T. Consoli*

"When we looked at cells treated with **methylene blue**, it was hard to tell that they were progeria cells at all. It's like magic."

–Kan Cao

## RACING AGAINST THE CLOCK

While malaria requires humans, mosquitoes and parasites to exert its deadly effects, a rare genetic disease called progeria requires only a single person. But it impacts every cell in that person's body.

Progeria mimics the normal aging process at an accelerated rate. Symptoms typically appear within the first year of life, and individuals with the disease develop thin, wrinkled skin; fragile bones and joints; full-body hair loss; and organ failure, among other complications. Most individuals with the disease do not survive past their teen years.

"Progeria affects nearly every system of the body at the cellular level," said Kan Cao, an associate professor of cell biology and molecular genetics at UMD who studies the disease. "It is especially hard on cardiovascular cells, and the skeleton never gets a chance to develop properly."

A defect in a single gene causes progeria. The gene produces a protein called lamin A, which sits just inside the nucleus of every cell in the body, under the nuclear membrane. Healthy cells snip off a small piece of each new lamin A molecule—a small edit that is necessary for lamin A to work properly. Cells with progeria, however, skip this important editing step. The defective lamin A interferes with the

*Photos by John T. Consoli / Illustration by Faye Levine*
*Water image by worker–Shutterstock.com*

nuclear membrane, causing the nucleus to form bulges and deformations that make normal functioning impossible.

One of Cao's earliest efforts involved the drug rapamycin, an immune suppressor commonly used to prevent the rejection of transplanted organs. She and her collaborators found the drug capable of reversing some of the cellular-level symptoms of progeria, while clearing out some of the defective lamin A proteins. But the cells still retained many of the defects associated with progeria.

Next, the researchers identified another compound that showed even more promise for treating progeria symptoms: methylene blue. In a 2015 study in the journal *Aging Cell*, Cao and her colleagues suggested that this common, inexpensive and safe chemical once used to treat urinary tract infections and other conditions could also be used to treat progeria. Small doses of methylene blue reversed many of the most damaging cellular-level symptoms of progeria, including misshapen nuclei and mitochondria, the small organelles that produce energy for the cell.

"We tried very hard to examine the effect of methylene blue on all known progeria symptoms," Cao said. "It seems that it rescues every affected structure within the cell. When we looked at cells treated with methylene blue, it was hard to tell that they were progeria cells at all. It's like magic."

Cao and her team are moving quickly to complete the next crucial step: testing in animal models.

"So far, we have done all of our work in stem cell lines. It is critical to see whether the effect extends to whole animals," Cao explained. "Further down the line, other groups might begin human clinical trials."

Cao wants to extend her discoveries about progeria to the processes of normal aging. Here again, methylene blue shows promise. In a 2017 study in the journal *Scientific Reports*, Cao and her colleagues found that methylene blue could slow or reverse several well-known signs of normal aging when tested in cultured human skin cells and three-dimensional simulated skin tissue.

"Our work suggests that methylene blue could be a powerful antioxidant for use in skin care products," Cao said. "The effects we are seeing are not temporary. Methylene blue appears to make fundamental, long-term changes to skin cells."

Cao's team also developed a three-dimensional skin model system, which her team used for further testing of methylene blue. The results suggested that

"It might sound funny to say it, but **mucins are very dear to my heart**. There is so much more to them than you might think."

–Margaret Scull

*Photos by John T. Consoli / Illustration by Faye Levine*
*Microscopy courtesy of Margaret Scull*

methylene blue can increase skin's thickness and ability to stay hydrated, while causing little to no irritation, even at high concentrations. Encouraged by these results, Cao hopes to develop safe and effective ways for consumers to benefit from the properties of methylene blue.

"We have already begun formulating cosmetics that contain methylene blue. Now we are looking to create marketable products," Cao said. "We are also very excited to develop the three-dimensional skin model system. Perhaps down the road we can customize the system with bioprinting, such that we might be able to use a patient's own cells to provide a tailor-made testing platform specific to their needs."

## SENTRIES AT THE GATES OF THE HUMAN BODY

Relatively speaking, whole-body diseases like progeria are an exception to the rule, because most diseases affect a single organ or a few organ systems in the body. The flu, for example, exploits vulnerabilities in one organ system—the respiratory system—to find its way past human defenses.

UMD Cell Biology and Molecular Genetics Assistant Professor Margaret Scull, who joined the department in 2016, studies the defense mechanisms that the human respiratory system uses to exclude most invaders, including the flu virus.

The respiratory system is an impressive defender of human health. Simple at first glance, but complex and multifaceted on closer inspection, many of the respiratory system's defenses lie in the epithelial cells. These delicate cells line the inner surface of the lungs and form an interface between the external environment and the interior of the human body.

"The innate defenses present in our airway are fascinating to me," Scull said. "The airway's epithelial cells are an important barrier against—but also a target for—viral infection. When a virus invades your lung, epithelial cells can sense the intruder and sound the alarm, sending out biochemical signals to prepare neighboring cells for battle."

Airway epithelial cells also have physical mechanisms that help protect us. Cells with hairlike projections called cilia line our respiratory tract, and the orchestrated movement of these cilia creates an "escalator" that can clear unwanted visitors out of the airway.

"I'm very interested in how these biochemical and physical defenses play out under different conditions," Scull added.

It is difficult to study the dynamics of airway infection in living humans—the protocols would be far too invasive and the number of variables would complicate the analysis. Studies on cultured cells grown in the lab are also of limited value.

As a result, Scull uses a three-dimensional model of human airway epithelium, which allows her to investigate the activity of the ciliated cells that can physically force out invaders. The model can also highlight how different cell types in the epithelium respond to viruses. To construct the model, Scull begins with human lung cells grown in a plain cell culture dish. Next, she carefully arranges and treats the cells to encourage them to differentiate, or develop into the different types of cells that form the epithelium in human airway tissues.

"Years ago, this model was the top-of-the-line system, but there were limitations," Scull said. "For example, if you culture cells on plastic for too long, they lose their ability to differentiate."

Scull says that some newer systems use stem cells, the extraordinarily versatile cells that can differentiate to form any cell type in the body. Other techniques can reprogram adult lung cells to temporarily behave like stem cells and gain the ability to self-renew.

"Now we are getting to the point where we can knock out genes and pursue other more involved approaches," Scull said. "These new models have expanded our toolbox and enabled us to finally tackle some basic questions about how airway cells fight against the flu."

And not a moment too soon for Scull, who is eager to move on to more involved investigations. Her next target is the interaction between viruses and mucin molecules—relatively enormous proteins that form the protective mucus that coats our airway.

"It might sound funny to say it, but mucins are very dear to my heart. There is so much more to them than you might think," Scull said. "They are massive glycoproteins with lots of sticky ends. Some are released into the airway, but others are tethered to airway cells. They clearly have a role in physically clearing pathogens, but they also seem to impact inflammation. There is so much to uncover in how mucin molecules modulate the pathogen response to keep out diseases like the flu."

## TRANSLATING THE SOURCE CODE

For many hereditary diseases, researchers dive deeper than organ systems, directly targeting the defective genes in a person's DNA. But for Jonathan Dinman, professor and chair of the UMD Department of Cell Biology and Molecular Genetics, a person's RNA holds much more promise as a research target.

If DNA is the "hard drive" that contains all of our genetic information, then RNA—DNA's close cousin—is more like the files and programs that do the meaningful work. The simplified model goes something like this: DNA contains genes, which a cell copies into RNA molecules. Then the cell reads the RNA to create proteins.

"The cool thing about RNA is that it's very structurally dynamic. DNA is double stranded, which limits the possibilities," Dinman said. "RNA is single stranded and much more flexible. It can loop back in on itself. It can combine with other RNA molecules. It can interact with proteins. The combinatorial possibilities are much broader."

Much of Dinman's research centers on a clever mechanism called programmed ribosomal frameshifting (PRF), which allows RNA to pack more information into a single small molecule. By prompting the cell to read the RNA molecule two different ways, one RNA molecule carries the code for two proteins. In effect, it is much like the data compression algorithms that computers use to package large files.

*Lung X-rays by Stillwaterising (iPad) and Zhangzhugang (background)*

# A Tale of Two Bacteriology Alumnae

**BERNICE BEDRICK** in her 1938 senior yearbook photo.

**Bernice Bedrick,** B.S. '38, bacteriology, originally attended the University of Maryland partly out of necessity. At the time, Jewish women did not have many choices for pursuing higher education; UMD was one of the only places that would admit her.

Even though Bedrick excelled academically at Maryland, it still took her an extra year to graduate. Following the removal of Bedrick's appendix in 1936, Dean of Women Adele H. Stamp feared an infection could result and barred Bedrick from campus for a year.

"As a bacteriology major, I knew how to avoid an infection, but Dean Stamp kept me from graduating in 1937," recalled Bedrick.

After eventually graduating from Maryland, Bedrick earned advanced teaching degrees from Rutgers University and New York University. In the 1960s, NASA selected teachers from around the nation to write a junior high textbook about space. Bedrick was one of only two women chosen. She authored the book's chapter on wireless communications.

As a science teacher, a middle school principal and the director of science education in Linden Township, New Jersey, Bedrick encouraged her students to consider UMD for an outstanding science education.

"My days at Maryland were some of the happiest of my life," Bedrick said.

Now 101 years old and retired, Bedrick has made charitable donations to UMD to enable today's Terps to create happy memories of their own. She also donated a collection of memorabilia to the University Archives—relics of time well spent, even if it was more time than she had intended.

**JANET HARTLEY** in her 1949 senior yearbook photo.

**Janet Hartley,** B.S. '49, bacteriology, entered the University of Maryland just after World War II ended. She vividly remembers its impact on the students.

"Many students were older, had families and had experienced war," Hartley recalled. "There wasn't much frivolity."

Hartley led a serious life too, dividing her time between helping out at home and studying. When she decided to pursue a research career, Hartley's mentors at UMD recommended her for a fellowship at George Washington University that enabled her to earn a master's degree in 1951, leading to a Ph.D. in 1957—both in microbiology.

She joined the National Institutes of Health (NIH) in 1953, eventually becoming a section head in the National Institute of Allergy and Infectious Diseases' Laboratory of Viral Diseases. Thanks to the attitudes of her mentors and colleagues, Hartley does not recall gender hindering her career.

"I never felt that as a woman I was discriminated against, but I had friends who were," Hartley said. "I was very lucky."

During her career, Hartley authored more than 200 scientific papers on animal and human viruses. Her work on retroviruses in mice helped lay a foundation for future HIV research. After retiring in 1995, Hartley spent 16 years volunteering at NIH as a scientist emerita.

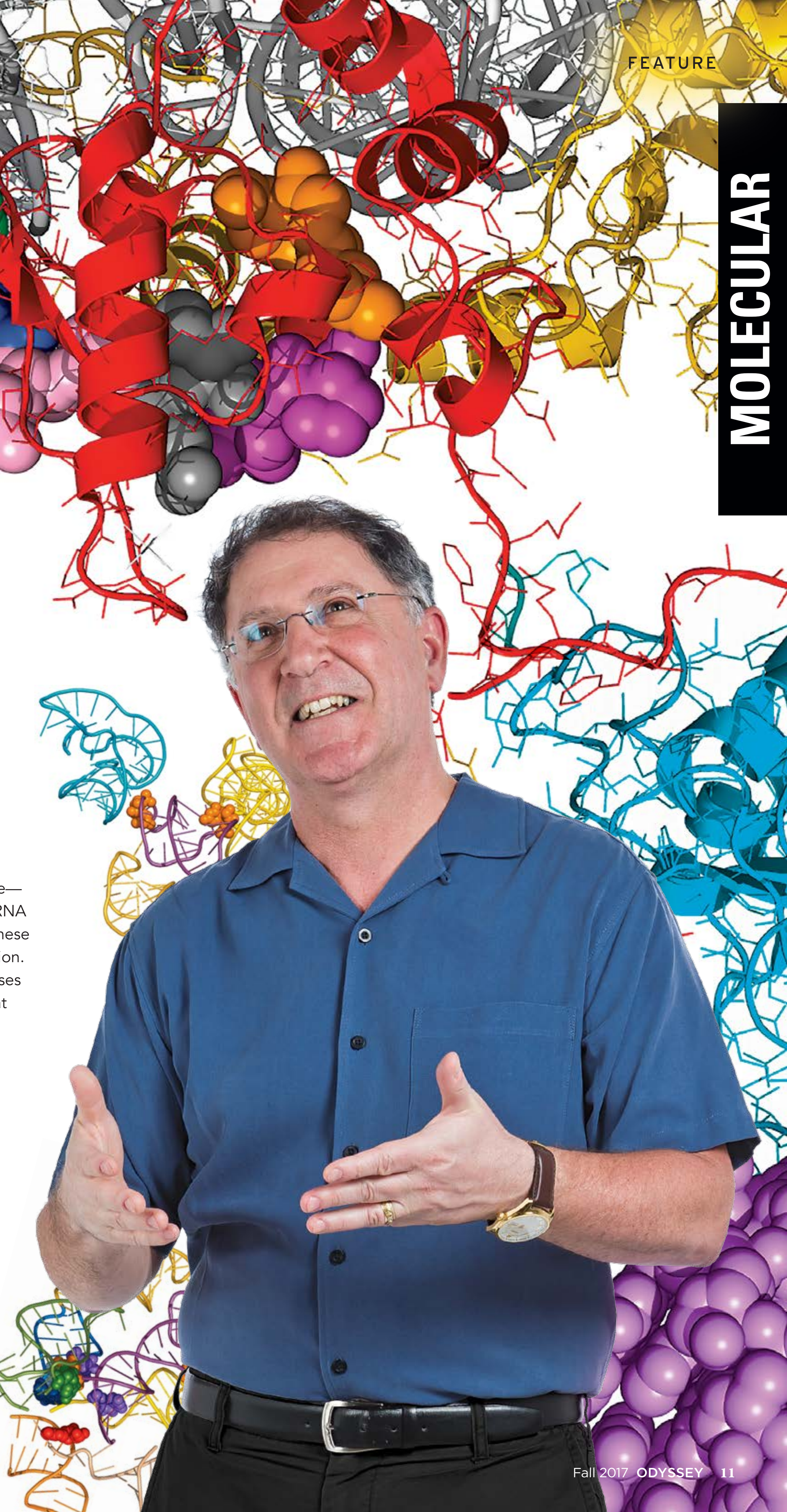
In 2009, Hartley passed the research baton by establishing the Wallace Prescott Rowe Memorial Award—named for her NIH mentor—to support outstanding graduate students in virology at UMD.

"I'm very grateful for all the opportunities and support I had at Maryland that ultimately led to my career," Hartley said. "I'm glad I can help out now." *—Z. IRENE YING*

(L-R) **BERNICE BEDRICK's TOY TESTUDO**, now in the University of Maryland Archives; **BOB HUBNER** with **JANET HARTLEY** at the NIH in 1960.

*Yearbook photos courtesy of the University of Maryland Archives / Toy Testudo photo by John T. Consoli / Hubner and Hartley photo courtesy of the U.S. National Library of Medicine*

# MOLECULAR



"Science is about finding needles in haystacks. **Smart scientists look in smaller haystacks**."

–Jonathan Dinman

Many viruses that cause human disease—including HIV, Zika and chikungunya—use RNA as their genetic material instead of DNA. These viruses also use PRF to carry more information. Dinman studies how PRF works in RNA viruses and whether PRF can be exploited to defeat certain diseases.

The simple answer appears to be yes. Dinman recently looked at PRF in the context of Venezuelan equine encephalitis virus (VEEV), which is an unforgiving killer of horses, donkeys and zebras. Mortality rates reach as high as 80 percent among animals infected with the virus, and the virus can also infect humans. The U.S. and Soviet Union both weaponized VEEV during the Cold War, prompting the Centers for Disease Control and Prevention and the National Institutes of Health to classify VEEV as a category B pathogen.

*Jonathan Dinman photo by John T. Consoli / Illustration by Faye Levine / RNA illustrations courtesy of Jonathan Dinman*

> "We can now look at how individual different **sugars affect the properties of antibodies.**"
>
> –Lai-Xi Wang

Dinman and his colleagues created a mutant version of VEEV with a disrupted PRF mechanism. Tests in cultured cells did not reveal a large difference in the rate of virus production. But when the researchers tested the mutant virus in mice, they saw a dramatic increase in the rate at which infected mice survived the disease. Dinman and his colleagues published the results in the *Journal of Virology* in November 2016.

"With some simple mutations, we compromised VEEV's ability to be virulent," said the study's lead author Joe Kendra, a biological sciences graduate student at UMD. "This result shows that PRF might be a therapeutic target for other viruses. If we can confirm that the mutant virus confers immunity—opening the door to a vaccine—that will be very exciting."

The possibility of using PRF to defeat a number of dangerous viruses encourages Dinman. He also strongly suspects that PRF is widespread among all life forms, noting that viral models provide the best opportunity to dig deeper.

"When you want to study basic mechanisms like PRF it's hard to do so in animals—there is so much going on. It's much easier in viruses because the signal-to-noise ratio is better. If we look at the history of discovery, these mechanisms are always found in viruses," Dinman said. "Science is about finding needles in haystacks. Smart scientists look in smaller haystacks."

## A SPOONFUL OF SUGAR (MOLECULES)

Lai-Xi Wang, a professor of chemistry and biochemistry at UMD, searches through even smaller haystacks. Much of his research program focuses on the role that molecules known as glycoproteins play in the body's defenses against disease. Antibodies, the foot soldiers of the immune system that identify invading viruses and bacteria, are complex and highly specific glycoproteins. An antibody's sugar groups play a large role in determining its function.

*Lai-Xi Wang photo by John T. Consoli / Illustration by Faye Levine*

## COLLEGE BOASTS FOUR NIH LIFE SCIENCE TRAINING GRANTS

The National Institutes of Health (NIH) recently awarded the University of Maryland's College of Computer, Mathematical, and Natural Sciences a new Ruth L. Kirschstein National Research Service Award Institutional Research Training Grant (T32) in virology and renewed the college's T32 training program in host-pathogen interactions (HPI) for another five years. The grants add to the college's other long-running T32 grants focused on the comparative and evolutionary biology of hearing (CEBH) and cell and molecular biology (CMB).

These training grants provide competitive stipends, health insurance, travel funds and other forms of support for trainees. They are typically graduate students or postdoctoral fellows funded for one year, with the possibility of extensions.

"This gives us a mechanism other than teaching assistantships for supporting students' research and allows us to place a lot of emphasis on supporting Ph.D. research at a time when it's really critical that the students focus on their projects," said Biology Professor Catherine Carr, co-principal investigator of the CEBH T32 grant that supports four graduate students and two postdocs.

The virology grant, led by Cell Biology and Molecular Genetics (CBMG) Professor Anne Simon, supports three graduate students and two postdocs. HPI supports four graduate students and is run by CBMG Professors Kevin McIver and David Mosser. Entomology Chair Leslie Pick directs the seven-year-old CMB training program, which supports six graduate students.

Trainees have published research findings in high-impact journals, including *Science,* the *Proceedings of the National Academy of Sciences (PNAS)* and *PLOS Pathogens.* They have also gone on to successful careers in academia, industry and health professions.

Sergey Sulima, Ph.D. '13, molecular and cellular biology, who was supported by the CMB training grant from 2010 to 2012, published a first-author paper in *PNAS* on a role ribosomal mutations play in cancer. Currently a postdoctoral scientist at the VIB Center for the Biology of Disease in Belgium, Sulima also co-authored papers in the journals *Nature, Blood* and *Nucleic Acids Research* with CBMG Chair Jonathan Dinman.

Due to subtle, yet important, differences in the structure of sugar groups, two otherwise identical antibodies might not be equally good at recruiting immune cells to kill an invading pathogen. To address this issue, Wang and his collaborators developed a method to modify an antibody's sugar group structure and create antibodies with consistent sugar groups.

In March 2017, Wang and his colleagues published a study in the *Proceedings of the National Academy of Sciences* that went a step further, determining which specific sugar combinations enhance or suppress an antibody's ability to signal the immune system to attack an invader. Even in antibodies currently used for disease therapy, a given dose might contain a wide variety of antibody variants, known as "glycoforms," distinguished by their sugar groups.

"Our first major step forward was to develop a method to produce homogeneous glycoforms," Wang said. "With this, we can now look at how individual different sugars affect the properties of antibodies. Until this study, we didn't have an efficient way to know how individual sugars in various glycoforms affect suppression or activation of the immune response."

The ability to engineer consistent glycoforms excites Wang because he says it will open a lot of doors to new therapies. Biochemists could generate highly specific therapeutic antibodies to target cancer cells and encourage the body's immune system to

**LAI-XI WANG'S LAB USES THIN-LAYER CHROMATOGRAPHY** TO SEPARATE MOLECULES WITH ADDED SUGAR GROUPS. THESE CHROMATOGRAPHY PLATES WERE USED TO MONITOR REACTIONS IN MAKING A THERAPEUTIC INHIBITOR THAT CAN PREVENT INFECTIONS IN THE HUMAN AIRWAY.

*Chromatography element photos by Faye Levine*

# DISEASE-FIGHTING ALUMNI


MICHAEL CANCRO


SOFIA MERAJVER


CARL DIEFFENBACH

**MICHAEL CANCRO**, B.S. '73, Ph.D. '76, zoology, began his trail to professor of pathology and laboratory medicine at the University of Pennsylvania Perelman School of Medicine in an unusual way—he dropped out of his undergraduate program at the University of Maryland.

When he returned to school, a microbial physiology course with Anthony MacQuillan inspired Cancro to pursue a medical research career. William Higgins, an associate professor emeritus of biology, and former zoology faculty member Audrey Barnett also mentored Cancro and supported his application for graduate school.

Cancro earned his Ph.D. with Michael Potter, a scientist at the National Institutes of Health who also held research faculty appointments at UMD. Then, Cancro became a postdoc at Penn, where he has remained.

"If it wasn't for the support I received at UMD, I'd probably be driving a cab right now," Cancro mused.

Instead, Cancro studies mechanisms that control the development and function of B cells, which produce antibodies to fight infections. His lab discovered several key B cell differentiation stages and characterized molecules that regulate B cell populations.

"B cells have good sides and bad sides," Cancro said. "They can save your life, but they can also turn on you with diseases like rheumatoid arthritis and lupus. I'm really interested in how the immune system maintains a balance that provides immunity while not attacking the body."

**CARL DIEFFENBACH**, B.S. '76, biochemistry, still remembers one pivotal lecture at Maryland. Richard Goldsby showed a comic book panel where a dose of interferon saved the life of comic strip hero Flash Gordon. That lecture led Dieffenbach to join Goldsby's laboratory and investigate the possibilities of interferon, which he continued to do as a graduate student at Johns Hopkins University. As a postdoctoral fellow and later as an assistant professor at the Uniformed Services University of the Health Sciences, he turned his focus to HIV.

"HIV being identified as the cause of AIDS changed my life. I remember reading everything about AIDS I could get my hands on because I had a personal connection with it," Dieffenbach said. "In 1982, my father's roommate at a Washington, D.C., hospital had AIDS, and I remember the lack of humanity with which the staff dealt with him. They wouldn't touch him, but there was something wrong with him, and I just felt so bad at my core that for that young man."

In 1992, Dieffenbach joined the Division of AIDS at the National Institutes of Health. There, he helped spur the development of medications including tenofovir, a crucial component of a pill to prevent HIV infection in people who do not have HIV but who are at substantial risk of infection. The World Health Organization includes both tenofovir and the combination pill on its model list of essential medicines.

Today, as division director, Dieffenbach continues to discover new molecules to combat HIV infection.

"Our ultimate goal is to end HIV and AIDS as a global pandemic," Dieffenbach said.

Flash Gordon would approve.

**SOFIA MERAJVER**, B.S. '73, mathematics education; M.S. '75, Ph.D. '78, physics; M.D. '87, University of Michigan, came to Maryland at age 19 from Argentina, where civil unrest disrupted her undergraduate studies.

After Merajver completed her bachelor's degree in math at UMD, she became a physics graduate student and the only woman in her entering class. Her Ph.D. advisor, Andrew De Rocco, inspired her to apply mathematics and physics to biology.

Now a professor of epidemiology and internal medicine at the University of Michigan, Merajver uses the physical sciences to find new cures for breast cancer. To uncover the molecular and metabolic regulators of aggressive breast cancers, her laboratory developed models such as a live-cell printing technology to study cancer invasion and a flow chamber to study cancer metastases.

Merajver also treats breast cancer patients. She never considers a case hopeless, believing there is always an opportunity to help. Helping these women and their families is one way Merajver honors those who assisted her along her path.

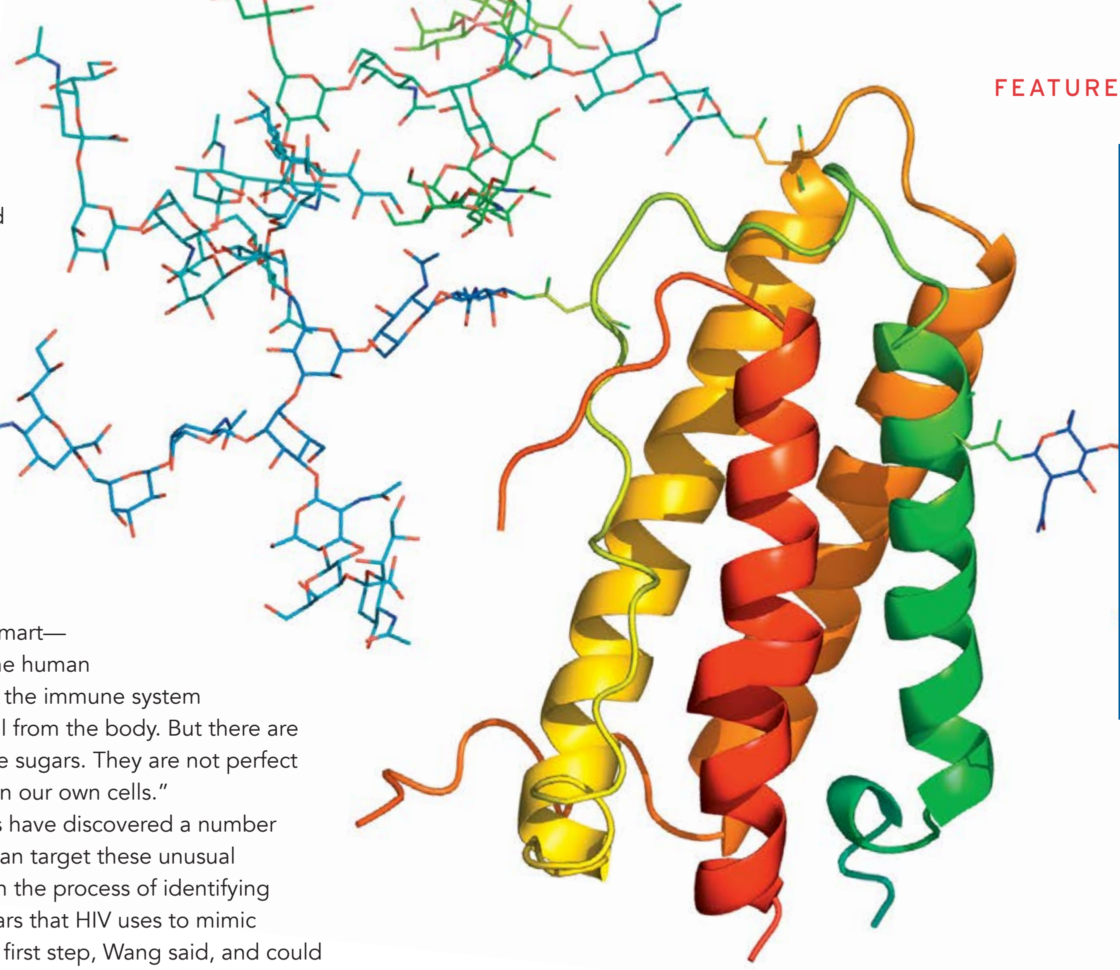
"I don't know what my career would be today if it hadn't been for the people at the University of Maryland who opened their doors to a newly arrived 19-year-old immigrant and gave her a chance," Merajver said. —*Z. IRENE YING*

*Michael Cancro photo by Andrea E. Morris / Sofia Merajver photo courtesy of same / Carl Dieffenbach photo courtesy of NIH, Medical Arts* kill off tumors. Erythropoietin—the hormone that prompts the body to generate new red blood cells—could be engineered to treat anemia more efficiently. And Wang's lab is already looking at one particularly high-profile application: the prevention and treatment of HIV.

"HIV has developed very strong defensive mechanisms. One of them is glycosylation, the chemical manipulation of sugar groups," Wang explained. "The virus is smart—it uses glycosylation to mimic the human body's own sugars, thus fooling the immune system into mistaking the virus for a cell from the body. But there are some unusual structures in these sugars. They are not perfect replicates of the sugars found on our own cells."

In recent years, researchers have discovered a number of neutralizing antibodies that can target these unusual sugar structures. Wang's lab is in the process of identifying structures like these on the sugars that HIV uses to mimic human cells. This is a necessary first step, Wang said, and could enable the design of custom antibodies capable of neutralizing the virus consistently and efficiently. This, in turn, may one day provide a template for vaccine design.

"Much HIV vaccine research has attempted to target the proteins on the surface of HIV. But proteins can evolve very quickly—this is another defense mechanism. All attempts to target proteins alone have failed so far," Wang said. "One exciting new direction in HIV vaccine and immunotherapy is to target the sugar-protein junction, called the glycopeptide epitope. Going without these sugars is not an option for the virus—it will not survive. So in theory, the virus won't be able to escape a line of attack that targets these sugars."



**LIKE ALL GLYCOPROTEINS, HUMAN ERYTHROPOIETIN** HAS A PROTEIN CORE (SPIRAL STRUCTURES) WITH SUGAR GROUPS (BRANCHING HEXAGONAL STRUCTURES) ATTACHED. BOTH COMPONENTS HELP DETERMINE THE MOLECULE'S FUNCTION.

## LOOKING AHEAD

UMD researchers are optimistic regarding the future of disease research. But the push and pull of conflicting forces in the arms race against disease leaves some room for uncertainty.

"We have come so far in our ability to contain infection and create therapies, but new diseases and new epidemics emerge frequently," Wang said. But, he notes that the fight against disease—especially major epidemics like HIV—has many dimensions that can't be captured by one discipline alone. "HIV is not just a biomedical problem. It's a socio-economic problem. It has far-reaching effects on social stability and economics. So it's hard to address the issue using science alone."

St. Leger can relate to the socio-economic dimensions of disease research. Working to fight malaria on the ground in Burkina Faso, he realized that social and cultural considerations are important pieces of the puzzle as well.

"Some people don't want to use the cloth netting that we use to apply the spores inside their homes. Others are concerned they might be affected by the fungus," St. Leger explained. "We get a lot of feedback and want to make sure all parties are involved. We never downplay people's concerns. We listen and think about the best way to answer with evidence."

While climate change and increases in population and global mobility are widely expected to enhance the spread of disease, the research community stands well poised to counter with ingenious solutions at all scales, from multispecies to submolecular.

Dinman, for his part, is bullish on the future of disease research. He thinks that the rapid pace of technological innovation coupled with the advanced state of human knowledge has put the human race in a good position.

"I think we are at a tipping point when it comes to human disease. We've now amassed the tools and understanding to do meaningful bioengineering," Dinman said. "We've also become adept at making new tools very quickly. Tackling a disease might one day be as simple as walking into a hardware store to get what you need for a renovation project." ■

*Illustration by Qiang Yang*

# College Researchers Send Three Experiments to Space

EUN-SUK SEO

(L-R) GARSHASB SOROOSH, AARON SOLOMON, YANIV KAZANSKY

Three scientific experiments developed by researchers in the College of Computer, Mathematical, and Natural Sciences flew aboard SpaceX capsules to the International Space Station (ISS) this summer.

In August, UMD Physics Professor Eun-Suk Seo and members of her lab sent instruments they designed and built to detect cosmic rays—high-energy particles that bombard Earth from beyond the solar system. Scientists believe cosmic ray particles could help solve one of today's most elusive scientific puzzles: determining the nature of dark matter.

Following seven successful high-altitude balloon experiments in Antarctica using similar equipment, Seo and her team are using their three-year ISS-CREAM (Cosmic Ray Energetics and Mass) mission to observe incoming cosmic rays, unimpeded by atmospheric interference. Back on Earth, postdocs and students will monitor operations around the clock, taking shifts to ensure the instruments are properly calibrated and collecting the maximum amount of data.

"ISS-CREAM had to survive a violent rocket launch and has to continue working without repairs for years," Seo said.

The same August flight contained an experiment developed by bioengineering major Stacey Mannuel and physics, chemistry, and biological sciences triple degree candidate Colton Treadway. The experiment explored the effect of microgravity on biofilms, which are slimy layers of bacteria that adhere to each other and to virtually any surface.

Biofilms show much greater tolerance to antibiotics than individual bacteria, and NASA has found evidence that biofilms grow more readily in microgravity. Biofilms pose serious threats to astronauts' health because they are associated with bacterial infections that can lead to death.

Mannuel and Treadway sent a multi-chamber tube containing bacteria, a growth medium and a tin- and platinum-based silicone wafer. Their experiment tests the antimicrobial properties of platinum-based silicone, which is commonly used to reduce biofilm formation on Earth, under the microgravity conditions of space.

"Our research is important for long-term space travel or future colonization because biofilms pose health risks," Treadway said.

The students' research project was the second UMD experiment selected for the Student Spaceflight Experiments Program (SSEP), run by the National Center for Earth and Space Science Education. SSEP is enabled through a strategic partnership with DreamUp PBC and NanoRacks LLC, which are working with NASA under a Space Act Agreement as part of the utilization of the ISS as a National Laboratory.

The first UMD SSEP experiment, which spent the month of June at the ISS, also aimed to expand understanding of how bacteria behave in microgravity—and ultimately how to safeguard space travelers.

Yaniv Kazansky, Aaron Solomon and Garshasb Soroosh—May 2017 graduates with bachelor's degrees in biological sciences—sent dormant spores of a common bacterium to the ISS, where astronauts activated them and allowed them to grow and divide. The team is currently comparing the samples sent back from the ISS with identical control samples grown on Earth to determine whether and how microgravity causes the samples' genes to behave differently.

This research has significance beyond the ISS, according to the students, as SpaceX aims to send a human voyage to Mars as soon as 2024 with NASA following suit in the 2030s.

"There's nothing like fulfilling a childhood dream of flying to space—even if it's by proxy of an experiment," Solomon said.

*Photos by Faye Levine / Andromeda Galaxy background courtesy of NASA, ESA, J. Dalcanton, B.F. Williams, L.C. Johnson (University of Washington), the PHAT team and R. Gendler*

## Airborne Ammonia "Hotspots" Found Over Major Agricultural Areas

The first global, long-term satellite study of airborne ammonia gas revealed "hotspots" of the pollutant over four of the world's most productive agricultural regions. Increased atmospheric ammonia is linked to poor air and water quality.

A University of Maryland-led research team recently discovered steadily increasing ammonia concentrations from 2002 to 2016 over agricultural centers in the United States, Europe, China and India. Although the underlying causes varied, increases in ammonia were broadly tied to crop fertilizers, livestock animal waste, atmospheric chemistry changes and warming soils that retain less ammonia.

"Measuring ammonia from the ground is difficult, but the satellite-based method we have developed allows us to track ammonia efficiently and accurately," said Juying Warner, an associate research scientist in atmospheric and oceanic science at UMD and lead author of the study. "We hope that our results will help guide better management of ammonia emissions."

In the troposphere—where weather takes place and people live—ammonia gas reacts with nitric and sulfuric acids to form nitrate-containing particles that contribute to dangerous aerosol pollution. Ammonia gas can also enter waterways, where it contributes to harmful algal blooms and "dead zones" with dangerously low oxygen levels.

"Little ammonia comes from tailpipes or smokestacks. It's mainly agricultural, from fertilizer and animal husbandry," said Russell Dickerson, a professor of atmospheric and oceanic science at UMD and a co-author of the study. "Here in Maryland, ammonia from the atmosphere contributes as much as a quarter of the nitrogen pollution in the Chesapeake Bay, causing eutrophication and leading to dead zones that make life very difficult for oysters, blue crabs and other wildlife."

In all regions, the researchers attributed some of the total ammonia increase from 2002 to 2016 to climate change. Ammonia vaporizes more readily from warmer soil, so as the soils warmed year by year, their contribution to atmospheric ammonia also increased. Population increase also adds pressure to agricultural regions.

"As the world's population grows, so does the demand for food," Dickerson said. "This means farmers and ranchers need more fertilizer, which makes it harder to maintain clean air and water. Wise agricultural practices and reduced greenhouse gas emissions can help avoid adverse effects."

## Ancient Earth's Fingerprints Found in Young Volcanic Rocks

Earth's mantle is made of solid rock that circulates slowly over millions of years. Some geologists assume this slow circulation would have removed any geochemical traces of Earth's early history long ago.

A University of Maryland-led study describes volcanic rocks that recently erupted from volcanoes in Hawaii and Samoa. Despite their relative youth, these rocks contain surprising geochemical anomalies—the "fingerprints" of conditions that existed shortly after the planet formed about 4.5 billion years ago.

"It was especially exciting to find these anomalies in such young rocks," said Andrea Mundl, a postdoctoral researcher in geology and the lead author of the study. "We don't yet know how these signatures survived for so long."

The anomalous signatures are found in the ratios of key isotopes of two elements: tungsten and helium. The important tungsten ratio is tungsten-182 to tungsten-184. The stable, heavier isotope—tungsten-184—has existed since the planet first formed. Tungsten-182, however, results from the decay of hafnium-182, which is highly unstable. All naturally occurring hafnium-182 decayed within the first 50 million years of Earth's history, leaving tungsten-182 in its place.

Tungsten and hafnium behaved very differently during the planet's first 50 million years. Tungsten associates with metals, so most of it migrated to Earth's core, while hafnium stayed in Earth's rocky mantle and crust. Most rocks on Earth have a similar ratio of tungsten-182 to tungsten-184, and this ratio serves as a global baseline.

Mundl and her colleagues observed an unusually low amount of tungsten-182 in some of the volcanic rocks from Hawaii and Samoa.

"Lower levels of tungsten-182 are rare and resemble what we might expect to see deep beneath the surface, in or near the planet's metallic core," Mundl said.

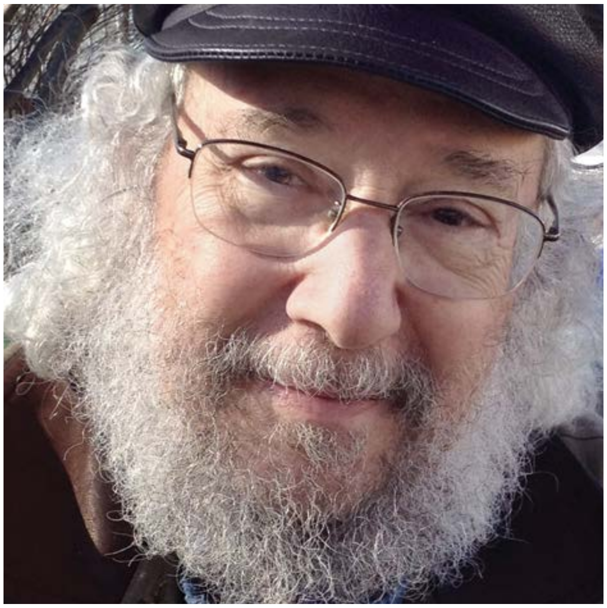
The researchers also found that the same rocks contained a higher-than-normal ratio of helium-3 to helium-4—a signature of very old rocks.

"Rocks with high helium-3 to helium-4 ratios have commonly been speculated to contain 'primitive' mantle material, but how primitive was not known," said Richard Walker, professor and department chair of geology at UMD and a co-author of the paper. "Our tungsten data show that it is very primitive indeed, with the source region most likely forming within the first 50 million years of solar system history."

LAVA ERUPTS FROM HAWAII'S KILAUEA IKI CRATER ON DECEMBER 5, 1959. TWO ROCK SAMPLES FROM THIS ERUPTION CONTAIN GEOCHEMICAL ANOMALIES THAT COULD DATE BACK 4.5 BILLION YEARS, SHORTLY AFTER EARTH FIRST FORMED.

*Photo courtesy of United States Geological Survey*

EDWARD "JOE" REDISH (FRONT, CENTER) WITH CURRENT AND FORMER STUDENTS, POSTDOCS AND COLLABORATORS.



# JOE REDISH: WALKING THE WALK

## OF PHYSICS EDUCATION

*On March 31, 2017, more than 150 people gathered on campus to celebrate University of Maryland Physics Professor Edward "Joe" Redish's 75th birthday and his nearly 50 years with the Department of Physics. They represented five continents and five decades of Redish's impact as a colleague, teacher, mentor, father and friend. They honored Redish with stories from his past and shared presentations on how students learn physics and science—a research area Redish helped pioneer. To honor his contributions to the field and their lives, dozens of alumni and friends also contributed to the E.F. Redish Endowed Professorship in Science Education at UMD, which Redish and his wife established in 2011 to support a continued emphasis in the field.*

BY **ELLEN TERNES**



*Group photo by Michael Fripp / Joe Redish photo courtesy of Ginny Redish*

Michael Wittmann, M.S. '96, Ph.D. '98, physics, clearly recalls his first encounter with Joe Redish. "I asked Joe what he did, and he described something about studying how students learn physics. He handed me some data to show that many students weren't really understanding the subject. I thought he was just full of it, just wrong."

After several more meetings and what became a routine of respectful disagreement, the light went on for Wittmann.

"In that one set of conversations, Joe converted me from a distracted, arrogant student who was thinking about how the world should be to someone who recognized the value of evidence and looking at the world as it is," said Wittmann.

Wittmann went on to join Redish's first cohort of students in UMD's Physics Education Research Group. Today, as a professor of physics at the University of Maine, Wittmann is a leading member of its Physics Education Research Laboratory. He is one of the hundreds of faculty members around the world who use the data Redish and his colleagues have collected to shape their own physics teaching.

"Joe wants students to learn to apply conceptual laws to fundamental problems," said Distinguished University Professor of Physics Jordan Goodman, one of Redish's early collaborators in physics education. "It's something a lot of people haven't done before, but that's what science is all about."

Redish came to UMD in 1968 and conducted research in theoretical nuclear physics. In 1981, he became intrigued by the potential that personal computers offered for educating physics students. Soon after, Redish agreed to become chair of the Department of Physics (the third largest in the country at the time), in part to increase the department's efforts in innovative physics teaching. For 10 years, he led projects that broke new ground, placing Maryland among the first universities to integrate computers into physics instruction.

"The idea was that students could write code to understand equations they couldn't mathematically follow at that point," said Goodman. "Joe took that turn to physics education."

In 1992, Redish decided to concentrate on physics education. It was a move that would help make UMD a leader in science education research.

"Students came in thinking they needed to memorize, not understand," said Redish. "We wanted to change that attitude."

Looking at things in a different way is something Redish has always loved about science. Redish's son, David, a professor of neuroscience at the University of Minnesota, said, "I grew up with the idea that you're always exploring something new."

Several speakers at the golden anniversary event in March described energy-filled late nights when colleagues and students would gather in the Redish home to argue about science and eat homemade chocolate chip cookies. Even as kids, David and his sister, Deborah Redish Fripp, were in the thick of the academic conversations.

"Dad would also take discussions back to the university that he and I would have when I was taking physics in high school," said Fripp, a zoologist and president of the research consulting and data analysis company Darwin's Ark. "There would be something I didn't understand, and the next thing I know, he's going into his class and saying 'My daughter has this issue and this means I need to explain this in a completely different way.'"

Redish's research and work with other UMD physics faculty members, including Jack Wilson, John Layman and David Hammer, started to attract interest. College Park Professor of Physics S. James Gates Jr. volunteered to help with some of the first observation sessions that included instructors and students.

"Joe was beginning to look at physics education with the idea that the same sort of scientific approach he used in the study of the nucleus ought to be able to lend insight into the effective teaching and learning of physics," Gates said.

In 2010, the Howard Hughes Medical Institute awarded UMD a National Experiment in Undergraduate Science Education (NEXUS) grant that would take Redish's work in yet another new direction.

"NEXUS was an effort to develop an entirely new physics course for life sciences students—one that builds on their knowledge of biology and chemistry and gives them unparalleled preparation for their future careers in science and medicine," said Kaci Thompson, assistant dean for science education initiatives in the College

**"In that one set of conversations, Joe converted me from a distracted, arrogant student who was thinking about how the world should be to someone who recognized the value of evidence and looking at the world as it is."**

Michael Wittmann
M.S. '96, Ph.D. '98, physics


*Michael Wittmann photo by Andrea Cipriani Mecchi Photography / Book photos by Kstudio–Freepik and MYeBook*

**"Joe is why I am in the field of physics education research. ... Respecting and valuing the ideas of my students and being a teacher who thoroughly enjoys partnering with my students on education reform is something I learned from Joe."**

Mel Sabella
M.S. '97, Ph.D. '99, physics

Ginny and Joe Redish

of Computer, Mathematical, and Natural Sciences. "This was an extraordinary feat. There was nothing else like it—no textbook, no syllabus, no existing curriculum. It was born out of vigorous—sometimes contentious—discussions among biologists, physicists, chemists and mathematicians. Joe's leadership and guidance were instrumental."

The NEXUS project was ultimately a success, and materials developed for it will form the core of a teaching resource being curated by the American Association of Physics Teachers (AAPT). Todd Cooke, professor of cell biology and molecular genetics and director of the Integrated Life Sciences program in the university's Honors College, agrees with Thompson that NEXUS started out with some vigorous discussions.

Cooke first met Redish at an event to honor faculty teaching excellence. "I responded to a physicist sitting next to me with the snarky comment, 'You know, you guys do a great job teaching physics, but my biology students can't use it in their biology classes,'" said Cooke. "Across the table was Joe, who had, unbeknownst to me, already devoted a decade to studying how biology students learn introductory physics. If I were Joe, I would have reached across the table and smacked me across the side of the head. But Joe is more wily and devious than me, so he invited me to lunch to start arguing about how to teach physics. And that was the start of our collaborative efforts."

Redish's legacy extends well beyond College Park and through multiple generations.

"Joe is why I am in the field of physics education research and the reason I developed such a passion for this field of study," said Mel Sabella, M.S. '97, Ph.D. '99, physics, now a professor of physics at Chicago State University and vice president of AAPT. "Respecting and valuing the ideas of my students and being a teacher who thoroughly enjoys partnering with my students on education reform is something I learned from Joe."

Today, at 75, Redish still shows his love of teaching. He walks through every row of the large lecture hall where he teaches physics to biology students. He knows all of the students' names, giving them questions to debate in small groups. "Find someone to talk to," he insists. He's excited about the student collaboration and teaching possibilities available in the new Edward St. John Learning and Teaching Center.

"Science is not just about science; it's about learning to have scientific conversations," said Redish. "In science, learning to talk the talk is learning to walk the walk." ■

*Black-and-white photo courtesy of the University of Maryland Archives; color photo courtesy of Ginny Redish / Ginny and Joe Redish photo by Thai Nguyen / Mel Sabella photo by Brent Jones*


# AN AUGMENTED EXPERIENCE

ON SUNDAYS AT 5 P.M., you can find University of Maryland computer science major Cameron Payton inside the WMUC radio studio on the top floor of the South Campus Dining Hall. There, he co-hosts the hip-hop and underground music show "In the Creases" alongside Jordan Weber, a UMD criminal justice and criminology major.

Last year, Payton and Weber had the opportunity to interview musician and Prince George's County native Jay IDK (the stage name of Jason Mills) on their show.

"Two weeks after our interview, we found out Jay was opening for a national tour," Payton said. "It's great watching someone's career take off and feeling like you were a part of it."

Outside the studio, Payton enjoys working with the university's Black Student Union (BSU) and coding.

"Both music and programming are extremely creative activities," he said.

Payton, who only programmed in the Java language when he arrived at UMD, embraced opportunities to learn new skills. In summer 2016, he interned at VeriSign, using the JavaScript programming language to code an application that collected information on internet domains.

"It was a challenge because I was new to web development and programming in JavaScript," said Payton. "But now I love 'web dev,' and JavaScript is one of my strongest languages."

Earlier this year at UMD's annual spring Bitcamp hackathon, Payton challenged himself to work on an augmented reality project. With four Terp teammates, Payton built an augmented reality pong game where human players' bodies served as virtual "paddles." The project won an award for most creative user interface/user experience. But for Payton, the best prize was catching the attention of alumnus Brendan Iribe, co-founder of the virtual reality company Oculus VR and lead donor for the new facility for computer science and innovation that bears his name and is under construction on campus.

"Brendan came over to play our game and asked how it worked. We were all amazed," Payton said.

During the fall 2017 semester, Payton is working as a teaching assistant for CMSC 389O: "The Coding Interview." The class prepares students for coding interviews in which job applicants write or analyze code without a computer.

When he graduates, Payton may pursue a career in web development, which he hopes would enable him to bring the power of internet technology to as many people as possible. But he is open to other opportunities.

"If there's one thing I've learned thus far," Payton said, "it's that life almost never goes exactly according to plan."

For instance, he did not expect to join the BSU or serve as the organization's freshman council president, presidential cabinet member or vice president of administrative affairs.

"The BSU wasn't something I thought about before college," Payton explained. "But once I was here, I joined because I felt at home with the other members, and because I wanted to help address relevant issues."

Such an issue arose recently on campus, when a white UMD student was arrested and charged with killing 2nd Lt. Richard Collins III, a black Bowie State University student. UMD's Black Student Union issued a statement asking campus leadership to act against hate speech.

"Our response was recognized by UMD President Wallace Loh, who later outlined a plan to combat hate speech and crimes at Maryland," said Payton. "I'm glad I could be a part of that." ■ *–Z. IRENE YING*

"...LIFE ALMOST NEVER GOES EXACTLY ACCORDING TO PLAN."

*Photo by Faye Levine*

# A Career at the Interface

## SIMON LEVIN FUSES SCIENCE, SOCIETY AND POLICY

**BY KIMBERLY MARSELAS**

**IN THE GRACEFUL MOVEMENTS OF BIRDS IN FLIGHT, SIMON LEVIN, PH.D. '64, MATHEMATICS, SEES PRINCIPLES OF FLUID DYNAMICS AT WORK.**

In bees and their unfailing devotion to their queen, he finds lessons on economic cooperation.

The flu virus, creating variations to thwart human immunity for millennia, underscores for Levin the importance of incorporating flexibility into the most highly regulated of industries.

After more than 50 years applying mathematics to ecology, epidemiology and economics, Levin remains fascinated by nature and the light it sheds on human responses to threats and stressors. His life's work has been identifying biological and behavioral processes in diverse ecological settings, all of them offering potential solutions for man-made problems.

In bestowing Levin with the 2014 National Medal of Science, President Barack Obama praised his ability to straddle ecology and applied mathematics to promote conservation in an era of climate change. He called Levin an international leader who has made an "impact on a generation of environmental scientists (with) his critical contributions."

Today, Levin works at Princeton University, where he holds the James S. McDonnell Distinguished University Professorship in Ecology and Evolutionary Biology and leads a research lab with more than 20 members.

Since 1999, he has focused on the management of public goods and lessons in economic cooperation that can be gleaned from microbes, plants and animals that willingly share resources. He points to bacteria that signal one another to exchange biological favors and bees and termites that often sacrifice their own fitness to protect their social unit.

"How do we manage the commons we live in?" Levin asks. "How do we cooperate in this world we share?"

A pioneer in the development of theoretical ecology, Levin was instrumental in launching the field of spatial ecology in the 1970s. He used mathematical analysis to examine, in an evolutionary context, the mechanisms underlying natural patterns of dispersal and movement across geographic areas, looking at everything from seeds to wildebeest herds.

Levin's attempts to answer critical questions about resource sharing in marine settings, forests and beyond have earned him praise around the world.

In 1988, he won the Ecological Society of America's Robert H. MacArthur Award that honors significant contributions to ecology by a mid-career scientist. He was named the Kyoto Prize Laureate in Basic Sciences in 2005, the same year the eponymous emission-reducing protocol first went into effect. His Kyoto lecture on global change outlined the clash between individual and collective behavior for an audience of the world's most renowned environmental researchers and policymakers.

"Cooperation is widespread in the animal kingdom, especially in human societies," Levin said in the lecture. "But the tribes and societies and cultures we build become devices for conflict among groups, and too often it is that conflict and competition that strengthens the membership bonds. When groups come together, it is often because there is a common enemy. ... We must recognize that we have a common enemy, and that enemy is the extinction that awaits us if we do not change our ways."

Levin insists his current line of work examining economic systems isn't a dramatic departure from his many contributions to ecological research. Like the biosphere, socio-economic systems also require some safeguards for the common good, he said.

Looking at cellular and vertebrate evolution, Levin found several examples where organisms evolved robustness that could be copied by those who govern modern markets.

Take for example the vertebrate immune system. It can't predict when or which dangers will befall an individual, so built-in defenses like the skin protect while immune system cells broadly attack and develop antibodies in response to specific threats.

"It's a great model for the markets," Levin said. "Our societies should have built-in protections and responses that are generalized, while we develop specialized adaptive responses."

The ability to shut down markets to avoid a free fall, he said, needs to be paired with flexible solutions that sustain a nation's economy through a crisis.

Regardless of subject area, many of the mathematical underpinnings of Levin's research are based in game theory, which models conflict and cooperation between decision-makers, or dynamic systems theory, which seeks to understand behavior in fluid settings.



*Birds by Ihnatovich Maryia–Shutterstock.com / Composite by Faye Levine*

"The math is quite similar," Levin said. "But the process of creating and then selecting evolves. You can't be satisfied with the solutions you've worked out because the environment is always changing. We have to be continuously innovating."

Levin's interdisciplinary approach and his willingness to work with researchers who may not come from the same school of thought are keys to the success of his projects.

"You really have to find people who are interested in learning outside their expertise," he said. "I've been lucky to have chosen great partners."

Interacting with leaders like the late Nobel prize-winning economists Kenneth Arrow and Thomas Schelling, MIT economist Andrew Lo, former head of the National Oceanic and Atmospheric Administration Jane Lubchenco, and UMD infectious disease expert Rita Colwell, Levin continues to reach across fields to find meaning. This is a lesson he traces to his days as a doctoral student in UMD's Institute for Fluid Dynamics and Applied Mathematics.

Levin's advisor, UMD Mathematics Professor Monroe H. Martin, encouraged Levin's desire to use math to answer biological questions. Martin suggested Levin pursue postdoctoral work at the University of California, Berkeley, with operations researcher George Dantzig, B.S. '36, mathematics. Dantzig was the son of Martin's former colleague, UMD Mathematics Professor Tobias Dantzig.

"George Dantzig convinced me you can work on whatever interests you the most," Levin said. "Any problems I've worked on since have given me insights on how to look at new problems."

Today, Levin offers this same advice to a new generation of researchers. Like those termites and bees, he wants to see more researchers working toward the common good, even if it means stretching across cultural or political lines.

"These opportunities are really important for academic programs, and they're exactly why I'm committed to multidisciplinary research," he said. "Collaboration is more important than ever." ■

*Simon Levin will deliver the Dr. Erik B. & Mrs. Joyce D.C. Young Lecture at the University of Maryland's annual Bioscience Day event, which will be held on Thursday, November 16, 2017. Visit **bioscienceday.umd.edu** for more information.*

*Simon Levin photo courtesy of Princeton University*

# New Labs Catalyze Chemistry

***The Edward St. John Learning and Teaching Center is a beacon for progress. From its cornerstone—the first new one laid on McKeldin Mall in 50 years—to its two green roofs, the building provides an atmosphere dedicated to collaboration and exploration. It also shines a welcome spotlight on chemistry.***

A new generation of students will learn chemistry here, in laboratories outfitted with the latest technology and spaces that encourage their curiosity and burgeoning professional interests.

"Typically, chemistry labs are tucked away in some remote space," said Janice Reutt-Robey, professor and chair of the Department of Chemistry and Biochemistry. "Placing these labs at the heart of campus puts chemistry out front and makes it much more appealing to students."

The brick-and-glass building is named for Edward St. John, B.S. '61, electrical engineering, a real estate developer and philanthropist who launched the project with a $10 million leadership gift. Inside the beautiful structure that opened in May, a 187,000 square-foot floor plan comes alive with well-designed discussion spaces and rooms dedicated to active and group learning.

Nine chemistry labs serve some 4,000 undergraduate students—most of them freshmen and sophomores—each year. These workspaces are meant to inspire multidisciplinary projects and promote interest in modern subjects including "green" chemistry.

The labs are stocked with brand new equipment including refrigerated microcentrifuges to separate and concentrate biomolecules, sensitive fluorimeters to detect chemical complexes, spectrophotometers for quantitative analysis of chemical samples, and new analytical balances.

On the first floor, students study biochemistry using DNA and other biological samples and focus on measurement-intensive projects that train them in precise data collection and data management methods.

Space on the second floor is devoted to introductory lab courses that ground students as they begin work in chemistry, as well as bioanalysis lab courses.

"These new labs are inviting and bright," Reutt-Robey said. "The environment is a real switch from the Chemistry Building, and the new labs set the stage to move education forward even further."

University of Maryland alumni have joined the mission to advance chemistry education in the Edward St. John Learning and Teaching Center, pledging support to specific labs and classrooms for the foreseeable future. Their vision for maintaining this state-of-the-art space will have long-term impacts for current and future Terps.

*Photo by John T. Consoli*

# Learning

By KIMBERLY MARSELAS

## DOUGLAS KENT SHAFFER TEACHING LABORATORY

Having set up a lab for the U.S. Bureau of Immigration and Customs Enforcement, Douglas Kent Shaffer, B.S. '72, chemistry, knows how quickly small expenses add to a department's bottom line. That's why he endowed a new fund that allows staff to replace consumables and outdated lab equipment as needed. It's the second time Shaffer has made such a gift to the University of Maryland.

"The expense of chemistry supplies is just incredible," Shaffer said. "But you can't do anything without them. That's why I'm perfectly happy to help get the lab running and keep it up to speed."

A career chemist, Shaffer has worked with big names in the biomedical, materials science and law enforcement fields. He has analyzed asbestos, toxic biofilms and forensic crime-scene evidence ranging from gunshot residue to inks and papers.

Throughout his career, he turned to the techniques he mastered while an undergraduate at Maryland. He fondly remembers studying with the likes of Kenneth Henery-Logan—a professor in the department from 1960 until 1990 who had worked on the first team to synthesize penicillin.

"The professors at Maryland didn't just teach us chemistry, they taught us how to solve problems," Shaffer said.

He believes the Edward St. John Learning and Teaching Center's focus on collaboration will give today's students the same opportunities to explore their passions for science.

## GARY AND SUE CHRISTIAN CHEMISTRY TEACHING LABORATORY

Gary Christian, M.S. '62, Ph.D. '64, chemistry, and Sue Christian, B.A. '62, English, met as students at the University of Maryland. Together, they went on to develop technologies in analytical chemistry and were recognized extensively for their work. Among the couple's accolades, Gary received the American Chemical Society's Award in Analytical Chemistry.

Gary enjoyed a successful career at the University of Washington, where he remains a professor emeritus of chemistry. But it almost wasn't to be. He came to UMD to pursue a career as a high school teacher. Chemistry Professor William Purdy, the man overseeing his research, convinced him to stay on for a doctorate.

"Education changed our lives, and we try to share that opportunity as broadly as we can," Gary said.

The Christians, who previously created a graduate award in the Department of Chemistry and Biochemistry, wanted to support the new building because of its analytical capabilities. They broadened their giving to endow an operational fund to replace equipment as it becomes obsolete.

"The technology for laboratory equipment such as spectrometers and analytical balances keeps improving, and the equipment is so heavily utilized that these items have a useful lifetime of five to seven years," explained Reutt-Robey.

The equipment fund will also allow instructors to introduce new energy- or biochemistry-themed experiments that might require additional tools such as electrochemistry meters or polarimeters.

"We recognize that this gift has the potential of being a benefit to students in perpetuity," Gary said.

## JON GRAFF CHEMISTRY TEACHING LABORATORY

Jon Graff, B.S. '66, Ph.D. '71, chemistry, funded a teaching lab in recognition of the role research played in his education and career.

Graff started his career as a biochemistry, virology and cell biology researcher, authoring 17 scientific papers. Later, he worked with computer technology, developing secure digital communications as a cryptographic architect.

*Student lab photos by Faye Levine / Edward St. John Center architectural photos by John T. Consoli*

In his second career, he authored additional papers and a book on cryptography and e-commerce, designed secure communication systems for Fortune 500 companies, and was awarded a patent in digital communications.

"I have pursued a life of acquiring knowledge, enjoying learning new things and learning how we know those things," he said.

He traces much of his curiosity and success to his days at Maryland. He said his gift is given in gratitude for the assistance of UMD's chemistry and microbiology departments and the Bureau of Biologics at the National Institutes of Health in Bethesda, Maryland. All three helped facilitate research for his dissertation.

## NATHAN DRAKE LABORATORY

Organic chemist Nathan Drake joined the Department of Chemistry in 1926 and worked tirelessly to build the university's program. An anonymous alum has named a second floor lab after Drake to honor his efforts to take the department "from good to great."

Drake created the Institute for Molecular Physics at UMD and served as department chair from 1940 until his death in 1959. He was recognized by colleagues and students as a tremendous mentor, researcher and educator.

Drake oversaw the department during dramatic ups and downs. Declining enrollment during World War II gave way to a post-war spike that sent the number of university students soaring from 2,235 in 1945 to more than 13,000 in 1950. The chemistry faculty more than doubled during Drake's tenure.

During that time, the department outgrew its home in Sylvester Hall and moved into three temporary buildings. The first two wings of the Chemistry Building were finished by 1952, and lecture halls that opened there in 1960 were named for Drake. Now, his name graces an Edward St. John Learning and Teaching Center laboratory built for the next generation.

## EDWARD ST. JOHN LEARNING AND TEACHING CENTER OUTDOOR CLASSROOM

Henry David Thoreau once wrote, "This world is but a canvas to our imagination."

Those words greet all who enter the third-floor outdoor classroom, a green roof where students will be able to investigate chemistry's role in, and influence on, organic materials, agriculture and architectural design.

What they'll be able to study—and the solutions they can envision for today's pressing environmental questions—is limited less by budget than by the bounds of their own creativity.

That's thanks in part to The Bresler Foundation, which aims to encourage students and faculty to use landscape art, natural features, local plantings, wildflowers and wildlife habitats to create a tranquil environment for the pursuit of academic excellence.

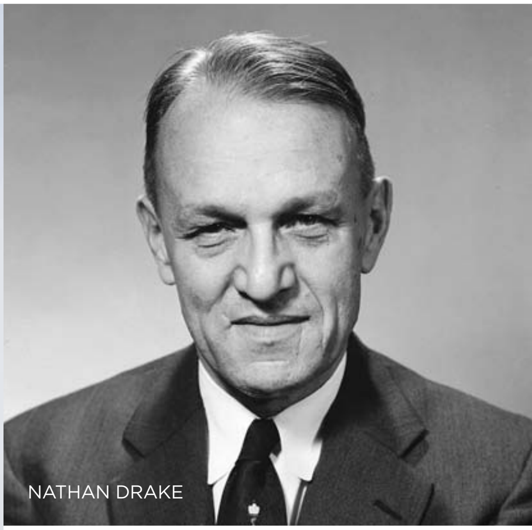
"This area in particular is ripe for collaboration," said Reutt-Robey.

Students will be able to test their measurement skills and hypotheses in a real-world setting, seeing how the decisions they make impact what grows and how it fares under varying conditions.

"We're hoping to direct innovative experiments here, to build a better understanding of that research relationship," Reutt-Robey said. ■

*Five laboratories in the Edward St. John Learning and Teaching Center still need support! If you would like to advance chemistry education for Terp students, please contact Andrea Morris at 301-405-4572 or aemorris@umd.edu.*


JON GRAFF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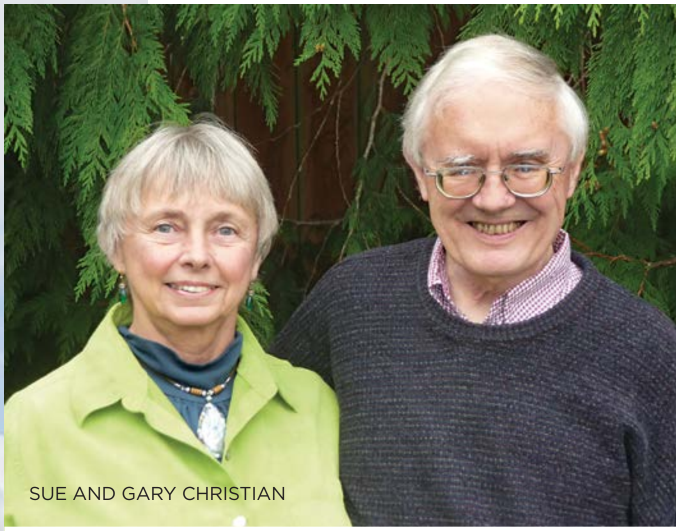

SUE AND GARY CHRISTIAN


DOUGLAS KENT SHAFFER

*Jon Graff photo by Faye Levine / Nathan Drake photo courtesy of the University of Maryland Archives / Sue and Gary Christian photo courtesy of same / Douglas Kent Shaffer photo by Thai Nguyen*

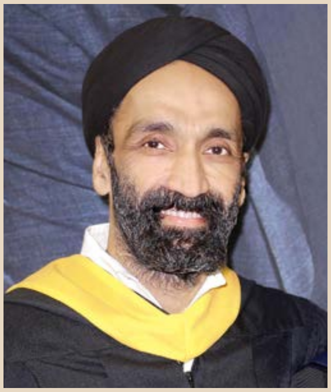
# Colwell and Singh Headlined Recent Commencements

RITA COLWELL

Rita Colwell and Jagdeep Singh gave the commencement addresses at the College of Computer, Mathematical, and Natural Sciences ceremonies in December 2016 and May 2017, respectively.

Colwell is a Distinguished University Professor at UMD and at the Johns Hopkins University Bloomberg School of Public Health. She also serves as global science officer and chairman of CosmosID, Inc., and as senior advisor and chairman emeritus of Canon U.S. Life Sciences. Previously, she served as the 11th director of the National Science Foundation from 1998 to 2004.

Colwell's research focuses on global infectious diseases, water and health. She is currently developing an international network to address emerging infectious diseases and water issues, including safe drinking water for both the developed and developing world, in collaboration with Safe Water Network.



JAGDEEP SINGH

Singh, B.S. '86, computer science and economics, is an entrepreneur and technologist based in Silicon Valley. He is the co-founder and CEO of QuantumScape Corporation, a startup developing a new class of energy storage devices.

Prior to founding QuantumScape, Singh worked at Hewlett-Packard and Sun Microsystems before launching several companies of his own. He was the co-founder and CEO of Infinera, developer of the world's first large-scale photonic integrated circuits and optical communications systems. The company's products now generate $800 million in annual revenue and are deployed by major communications carriers worldwide. He also co-founded and served as CEO for Infinera Corporation, Lightera Networks, OnFiber and AirSoft.

Singh is a member of the college's Board of Visitors and a strong supporter of the Brendan Iribe Center for Computer Science and Innovation, which is currently under construction on campus.

# Seven Professors Retire in College

This past spring, seven professors in the College of Computer, Mathematical, and Natural Sciences announced their retirements.

Michele Dudash, biology, joined UMD as an assistant professor of botany in 1989. Her research focuses on the ecological and genetic factors responsible for a population's persistence or demise. Her lab also collects data that may be used to help form successful conservation and restoration management plans for threatened taxa.

Charles Fenster, biology, joined UMD as an assistant professor of botany in 1989. His lab aims to elucidate the evolutionary process, using plants as model organisms. He uses statistical, ecological, and quantitative genetic- and molecular marker-based techniques to answer questions about the evolutionary process.

S. James Gates Jr., physics, joined UMD as an associate professor in 1984. Gates was named a Distinguished University Professor, a University System of Maryland Regents Professor and the John S. Toll Professor of Physics. He is world-renowned for his pioneering work in supersymmetry and supergravity, areas closely related to string theory. He received the National Medal of Science from President Obama in 2013. Gates has served on the U.S. President's Council of Advisors on Science and Technology, the National Commission on Forensic Science, and the Maryland State Board of Education.

Sergei Novikov, mathematics and the Institute for Physical Science and Technology, joined UMD as a visiting professor in 1992 and became a professor in 1996. He was named Distinguished University Professor in 1997. Since 1971, his scientific work has played an important part in building a bridge between modern mathematics and theoretical physics. Among many honors, he received the Fields Medal in 1970 and the Wolf Prize in 2005.

David O'Brochta, entomology and the Institute for Bioscience and Biotechnology Research (IBBR), joined UMD in 1989 as an assistant professor in entomology and the Center for Agricultural Biotechnology. Since 2009, he has led IBBR's Insect Transformation Facility. There, O'Brochta develops genetic technologies to study the physiological genetics of mosquitoes, with a special focus on disease vectors.

Ben Shneiderman, computer science and the University of Maryland Institute for Advanced Computer Studies (UMIACS), joined UMD in 1976 as an assistant professor in the Department of Information Systems Management. In 1983, he became founding director of the university's Human-Computer Interaction Lab, a position he held until 2000. Much of Shneiderman's research has focused on finding the most efficient and user-friendly strategies for humans to use computers, particularly in making them more visually and graphically appealing. As an educator and textbook author, Shneiderman transferred knowledge to both established experts in the field as well as the next generation of human-computer interaction and information visualization specialists. He was named Distinguished University Professor in 2013.

V.S. Subrahmanian, computer science and UMIACS, joined UMD as an assistant professor in 1989 and accepted an appointment to UMIACS in 1994, serving as its director from 2003 to 2010. Subrahmanian has established numerous scientific collaborations worldwide, using machine learning and other methods of big data analytics for predictive modeling on topics such as identifying malicious users and activities on social media, forecasting leadership changes in terrorist organizations, and determining the location of IED weapons caches in Iraq and Afghanistan.



*Rita Colwell photo courtesy of NIST / Jagdeep Singh photo by Faye Levine*

## New Scholarship to Help STEM Majors Educate the Next Generation

William J. Balser, B.S. '61, business and public administration, described his late wife, Rona Kushner Balser, B.S. '61, biological sciences, as a "teacher's teacher."

A bright and curious student who brought flashcards to Terp football games, Rona taught biology at Patterson High School in Baltimore before raising a family. She stayed active in education afterward, teaching art classes at home and volunteering to teach science to her grandsons' classes, for which she earned the nickname "Science Grandma."

"She loved teaching. She loved biology. She loved her students," said William, who met Rona when they were UMD students and was married to her for 54 years. "We need teachers like Rona."

A new $100,000 gift from William to UMD in memory of his wife will help make that possible. The Rona Kushner Balser Memorial Terrapin Teachers Endowed Scholarship will provide funds for students who are actively participating in the Terrapin Teachers program in the College of Computer, Mathematical, and Natural Sciences. The goal is to support students who are apprentice-teaching and majoring in and intending to teach biology.

The Terrapin Teachers program is meant to produce an expanded pipeline of highly qualified teachers in science, technology, engineering and mathematics (STEM) subjects. Students receive a bachelor's degree in math or science along with a certification to teach in middle or high schools.


WILLIAM J. AND RONA KUSHNER BALSER

Many of the students in the program also work to help pay for their education and this gift will provide critical financial support when they are interning in classrooms, according to Terrapin Teachers Associate Director Anisha Campbell.

William, who was on scholarship at UMD along with his wife, said this is a way to "reach a hand back and help someone up."

"I can't think of anything better," he said.

## Andrew Harris Named Chair of Astronomy

University of Maryland Astronomy Professor Andrew Harris became chair of the Department of Astronomy in July 2017. Harris joined UMD in 1997 as an associate professor and was promoted to professor in 2007. In 2010, he was also named an affiliate professor in the UMD Department of Electrical and Computer Engineering.

The main goal of Harris' research is to understand the energetics and physical conditions within galaxies and their nuclei. Part of this effort involves developing instrumentation for radio observations over wide bandwidths and wide fields of view at the Green Bank Observatory and other sites. Harris' work also involves spectroscopy of individual high-redshift galaxies and of the integrated molecular emission from clusters of galaxies.

Closer to home, Harris uses data from the Herschel Space Telescope and the Stratospheric Observatory for Infrared Astronomy (SOFIA) airborne observatory to probe our galactic center, to understand the physical conditions in this complex region and to extrapolate these observations to more distant galaxies.

Since joining UMD, Harris has served on the University Senate, where he sat on the Executive Committee and served two terms as chair of the Programs, Curricula, and Courses Committee. He has been a visiting scientist at the University of Cologne in Germany, the National Radio Astronomy Observatory and CalTech. He is a member of the American Astronomical Society, the International Union of Radio Science and IEEE.

ANDREW HARRIS

Harris earned his M.A. and Ph.D. in physics from the University of California, Berkeley, and his bachelor's degree in electrical engineering from the University of California, Davis. Upon completion of his doctorate, Harris spent eight years as a research physicist at the Max Planck Institute for Extraterrestrial Physics in Garching, Germany, before accepting a position as associate professor at the University of Massachusetts Amherst.

*William J. and Rona Kushner Balser photo courtesy of Gloria Southerland / Andrew Harris photo by Faye Levine*

## National Socio-Environmental Synthesis Center Renewed for $28.5M

The National Science Foundation (NSF) renewed its support for the National Socio-Environmental Synthesis Center (SESYNC) at the University of Maryland with a new five-year, $28.5 million grant.

SESYNC supports cutting-edge research that accelerates scientific discovery at the interface of human and ecological systems. Located in Annapolis, Maryland, SESYNC serves as a unique resource for the academic, management and policy communities.

"Creating sustainable environments for future generations, while meeting the needs of diverse populations today, is an urgent issue that requires innovative, interdisciplinary research," said UMD Provost Mary Ann Rankin. "The University of Maryland and SESYNC researchers have made real progress in addressing these challenges and will continue to do so for years to come with the NSF's renewed support."

Established in 2011 with a five-year, $27.5 million grant—the largest NSF award ever received by UMD—the center brings together diverse groups in interdisciplinary collaborations to provide data-driven solutions to society's most challenging and complex environmental problems.

"SESYNC was founded on the premise that progress toward a sustainable future requires new knowledge that arises from close collaborations across many disciplines and sectors, including the natural and social sciences, nongovernmental organizations, and government agencies," said SESYNC Director Margaret Palmer, who is a Distinguished University Professor of Entomology at UMD. "Such collaborations and the involvement of knowledge users create a research portfolio with the potential to identify solutions and inform decisions."

Since its inception, SESYNC has funded 131 research projects and its researchers have authored more than 200 peer-reviewed publications. Each year, over a thousand participants take part in research meetings at the center, with nearly one-quarter hailing from outside the United States and one-fourth coming from non-academic organizations.

At UMD, 97 faculty members have participated in SESYNC programs, 45 graduate students received research assistantships through SESYNC and 67 undergraduate students conducted summer interdisciplinary research projects with UMD mentors through SESYNC.

With this renewal, the center will continue its pursuit of actionable science at the intersection of social and environmental systems.

## UMD and NASA Sign Two Cooperative Agreements Totaling $152M

In March 2017, NASA approved the Center for Research and Exploration in Space Science & Technology (CRESST II), a five-year, $87.5 million cooperative agreement with the University of Maryland, College Park; the University of Maryland, Baltimore County; and their three partners: Catholic University of America, Howard University and the Southeastern Universities Research Association.

First created as CRESST with an initial 10-year cooperative agreement in 2006, CRESST II will continue to facilitate collaborations between researchers at NASA's Goddard Space Flight Center and CRESST II partner institutions. CRESST II's science priorities include observational, experimental and theoretical research to study the solar system, stars, galaxies and the universe at large.

CRESST II scientists will work to increase the involvement of minority and women scientists in space science research and to facilitate student participation in active research projects.

"CRESST II continues a partnership that strengthens the ability of NASA Goddard and the universities to achieve their core missions and to foster the future of space science and science in general," said CRESST II Director Lee Mundy, a professor of astronomy at UMD. "It is terrific to be able to engage the diverse next generation in the exciting science enabled by NASA."

Also in March, NASA approved a new five-year, $64.8 million cooperative agreement for continued support of the Earth System Science Interdisciplinary Center (ESSIC), a joint center of UMD and NASA Goddard. Established in 1999, ESSIC supports research, teaching and career training in Earth system science.

The new ESSIC award enables UMD and NASA Goddard to continue building on a legacy of nearly two decades of world-class research in meteorology, oceanography, terrestrial physics, hydrology, atmospheric chemistry, ecosystem science and satellite Earth observations.

The broad goal of ESSIC is to understand the relationships between Earth's atmosphere, oceans, land masses and biosphere, with an eye to the influence of human activities on Earth's coupled systems.

"An understanding of our planet has never been more important, and ESSIC is well-placed to address some of the most pressing questions in Earth system science," said Fernando Miralles-Wilhelm, interim director of ESSIC and a professor of atmospheric and oceanic science at UMD who serves as the cooperative agreement's principal investigator. "We look forward to the next five years of collaboration with NASA Goddard and our many other academic and government research partners."

## Juntti Named First William J. Higgins Assistant Professor of Biology

Scott Juntti joined the University of Maryland in July 2017 as the first William J. Higgins Assistant Professor of Biology. The position honors Higgins, now an associate professor emeritus of biology, who has inspired thousands of students during his nearly 45 years of teaching, advising and mentoring.

"My gift is a simple gesture to honor the professor who took both a personal and professional interest in all of us," said oral surgeon Julius Hyatt, B.S. '80, zoology, who created the Dr. William J. Higgins Scholar-Teacher Fund in 2007.

Hyatt is just one of nearly 100 donors—70 percent of whom are alumni—who contributed $682,000 to the fund, which is the department's first endowed professorship.

"Giving to the Higgins Fund helped secure the legacy of my physiology professor and allows many more generations of students to be enriched by his unique mentoring skills, as I was," said endocrinologist Jeffrey Mechanick, B.S. '81, zoology, who also chairs the college's Board of Visitors.

Juntti studies cichlid fish social behaviors, such as mating, parenting and aggression. At UMD, Juntti aims to use genetic approaches to uncover entire networks of genes that control such behaviors. In addition, he will teach mammalian physiology—the same course that Higgins once taught—in spring 2018.

As a postdoctoral fellow at Stanford University, Juntti used genetic methods, including the gene-editing technique CRISPR, to identify neurons and genes that control social behavior in cichlids. He also helped guide the next generation of researchers. Juntti mentored 10 undergraduate students, including three who completed honors theses and one who received Stanford University's best undergraduate thesis award.

"Mentoring is one of my favorite things to do," Juntti said. "There's nothing better than having conversations with students and helping them to develop scientific hypotheses and create the experiments that will allow us to drive science forward."

Juntti earned his B.S. in zoology and psychology at the University of Wisconsin-Madison and his Ph.D. in neuroscience from the University of California, San Francisco.

After meeting Juntti, Higgins said, "I was blown away by Scott's scientific research, and I am excited for our students who will be so fortunate to enroll in his courses. Scott's personality, academic background and interest in teaching make him the ideal person for this position."

*Additional donations to the Higgins Fund can be made at go.umd.edu/higgins.*

SCOTT JUNTTI

MATTHIAS ZWICKER

## Zwicker Joins Computer Science as First Hahne E-Nnovate Professor

Matthias Zwicker joined the Department of Computer Science and the University of Maryland Institute for Advanced Computer Studies (UMIACS) in March 2017 as the first Reginald Allan Hahne Endowed E-Nnovate Professor in Computer Science.

"I am very excited to be at a major university with lots of great students and where research in graphics with virtual and augmented reality is on the cutting edge," Zwicker said.

In 2015, Elizabeth Iribe established the endowed professorship to honor Hahne, her son Brendan Iribe's high school computer science teacher. Elizabeth's donation received an equal match from the state's Maryland E-Nnovation Initiative Fund, which aims to spur private donations to universities for applied research in scientific and technical fields by matching such donations.

Zwicker's research focuses on efficient high-quality rendering, signal processing techniques for computer graphics, data-driven modeling and animation, and point-based methods—all of which are needed to create next-generation platforms for virtual reality (VR) and augmented reality (AR).

In exchange for accepting the state's matching funds, Zwicker will work at least one day each week in support of entrepreneurial activities at VisiSonics, a UMD startup founded by Ramani Duraiswami, a professor in the UMD Department of Computer Science and UMIACS. VisiSonics is an industry leader in interactive 3-D sound capture and reproduction for applications in VR and AR.

"Collaborating with VisiSonics and Ramani Duraiswami will be interesting as sound and visual elements are important for complete immersion in a VR environment," Zwicker said. "The work is an interesting extension of what I'm doing."

Zwicker earned his Ph.D. in computer science from ETH in Zurich, Switzerland, in 2003. After completing postdoctoral research at MIT, Zwicker served as an assistant professor at the University of California, San Diego, from 2006 to 2008 before joining the faculty at the University of Bern. There, he served as a professor of computer science and head of the computer graphics group at the Institute of Computer Science.

*Scott Juntti photo by Faye Levine / Matthias Zwicker photo courtesy of same*

**MICHAEL A'HEARN**, astronomy, died May 29, 2017. During his more than 50 years at UMD, he studied comets using ground-based observatories, space telescopes such as the Hubble Space Telescope, and spacecraft such as Deep Impact. A Distinguished University Professor, he was most widely known as the principal investigator of the NASA Deep Impact mission.

**RANDOLPH BADEN**, B.S. '05, mathematics; B.S. '05, M.S. '08, Ph.D. '12, computer science, died October 14, 2016. After graduation, he worked as an engineering and physical sciences researcher at the Laboratory for Telecommunication Sciences.

**GEORGE BEAN**, cell biology and molecular genetics, died August 25, 2016. He began his 47-year career at UMD in 1968, studying toxic fungi and molds that occur in human food and animal feed.

**NEIL GEHRELS**, astronomy, died February 6, 2017. In addition to being a College Park Professor, he served as chief of the Astroparticle Physics Laboratory at NASA's Goddard Space Flight Center. Gehrels was a pioneer in the study of gamma-ray bursts—high-energy radiation blasts that come from deep space.

**JACOB GOLDHABER**, mathematics, died on October 7, 2016. He served as department chair from 1968 to 1977 and 1981 to 1982.

**HARRY HOLMGREN**, physics, died on September 29, 2016. He joined UMD in 1961 and retired in 1993 as professor emeritus. He was director of the UMD Cyclotron Laboratory for 13 years and served as president of the Southeastern Universities Research Association from 1980 to 1987.

**KENNETH LUDLAM**, M.S. '65, Ph.D. '71, entomology, died June 7, 2017. He was the superintendent of the Plymouth County Mosquito Project in Kingston, Mass., from 1983 to 2002. Prior to that, he worked at the Maryland Department of Agriculture for just over a decade.

**FARHAD SIDDIQUE**, biological sciences major, died September 28, 2016.

**ROBERT SINGLETON**, B.S. '51, pre-med, died September 12, 2016. He worked from 1980 until retirement in 1991 at the University of Maryland School of Medicine, where he specialized in cardiac catheterization. The university named the cardiac interventional laboratory in his honor in 1988.

**C.V. VISHVESHWARA**, Ph.D. '68, physics, died January 16, 2017. Known as the "black hole man of India," he made seminal contributions to astrophysicists' understanding of black holes. He also gave lectures, wrote popular books and drew cartoons to educate people about the consequences of Einstein's theory of gravitation.

**LUCIE YANG** B.S. '94, chemistry; MBA '12, died December 24, 2016. She was director of the Division of Quality Management Systems at the Food and Drug Administration.

## FACULTY & STAFF HIGHLIGHTS

**IAN APPELBAUM**, physics, was named fellow of the American Physical Society.

**E. HUGO BERBERY**, Earth System Science Interdisciplinary Center, received the Argentine Ministry of Science, Technology and Productive Innovation's RAICES Award for International Cooperation in Science, Technology and Innovation.

**DENNIS BODEWITS**, astronomy, had an asteroid named for him by the International Astronomical Union (10033 Bodewits).

**RITA COLWELL**, University of Maryland Institute for Advanced Computer Studies, received the 2017 Vannevar Bush Award from the National Science Board and the Prince Sultan Bin Abdulaziz International Prize for Water. She was also elected fellow of the National Academy of Inventors.

**MICHAEL CUMMINGS**, biology, received the 2017 Global Impact Award from visual computing technology company NVIDIA.

**SANKAR DAS SARMA**, physics, made Clarivate Analytics' 2016 list of highly cited researchers.

**BONNIE DORR**, computer science, was elected fellow of the Association for Computational Linguistics.

**TOM GOLDSTEIN**, computer science, was named a 2017 Sloan Research Fellow.

**JORDAN GOODMAN**, physics, received the 2017 Yodh Prize from the Commission on Astroparticle Physics of the International Union of Pure and Applied Physics.

**DANIEL LATHROP**, physics, was elected vice chair of the American Physical Society Topical Group on Statistical and Nonlinear Physics.

**ZHANQING LI**, atmospheric and oceanic science, was elected fellow of the American Meteorological Society.

**NICK MAGLIOCCA**, National Socio-Environmental Synthesis Center, received an award for the best presentation by a junior researcher at the 2017 Agent-Based Modeling Symposium.

**JOHN MATHER**, physics, was named honorary member of The Optical Society.

**THOMAS MURPHY**, Institute for Research in Electronics and Applied Physics, was elected fellow of The Optical Society. He was also re-appointed as director of the institute for a three-year term.

**EDWARD OTT**, physics, received the Lewis Fry Richardson Medal from the European Geosciences Union and the Jürgen Moser Award from the Society for Industrial and Applied Mathematics. He was also named a 2016 Thomson Reuters Citation Laureate in physics.

**WILLIAM PHILLIPS**, physics, was inducted into the Mexican Academy of Sciences as a corresponding member.

**ALESSANDRO RESTELLI**, Joint Quantum Institute, was named a 2017 ambassador of The Optical Society.

**PATRICIA SHIELDS**, cell biology and molecular genetics, received the 2017 Carski Foundation Distinguished Undergraduate Teaching Award from the American Society for Microbiology.

## FACULTY & STAFF HIGHLIGHTS

**BEN SHNEIDERMAN**, computer science, and **CATHERINE PLAISANT**, University of Maryland Institute for Advanced Computer Studies, jointly received a Test of Time Award at the IEEE VISualization Conference. Shneiderman also received a second Test of Time Award at the conference.

**WENXIA SONG**, cell biology and molecular genetics, was one of 12 distinguished Kansas State University alumni honored as 2017 Alumni Fellows.

**ARAVIND SRINIVASAN**, computer science, was elected fellow of the European Association for Theoretical Computer Science.

**RAYMOND ST. LEGER**, entomology, received the American Society for Microbiology's 2017 Promega Biotechnology Research Award.

**ARIANA SUTTON-GRIER**, Earth System Science Interdisciplinary Center, received the Innovation in Sustainability Science Award from the Ecological Society of America.

**DENNIS VANENGELSDORP**, entomology, made Clarivate Analytics' 2016 list of highly cited researchers.

**JAMES YORKE**, mathematics, was named a 2016 Thomson Reuters Citation Laureate in physics.

## ALUMNI HIGHLIGHTS

Four alumni were named 2017 Sloan Research Fellows.

- **AMIR ALI AHMADI**, B.S. '06, mathematics; B.S. '06, electrical engineering, is an assistant professor in the Department of Operations Research and Financial Engineering at Princeton University.
- **BRYAN DICKINSON**, B.S. '05, biochemistry, is an assistant professor of chemistry at the University of Chicago.
- **KATHERINE MACKEY**, B.S. '02, biological sciences; B.S. '02, agricultural engineering, is an assistant professor of earth system science at the University of California, Irvine.
- **SURIYANARAYANAN VAIKUNTANATHA**, Ph.D. '11, chemical physics, is an assistant professor of chemistry at the University of Chicago.

Two alumnae received 2017 National Science Foundation Graduate Research Fellowships.

- **DELILAH GATES**, B.S. '15, physics; B.S. '15, mathematics, is a graduate student at Harvard University.
- **ELIZABETH SPENCER**, B.S. '15, mathematics; B.A. '15, French, is a graduate student at Boston University.

Three alumnae received 2017-18 Fulbright Scholarships.

- **SARAH BLUMBERG**, B.S. '16, biological sciences; B.A. '16, Spanish, is teaching English in Spain.
- **ANNA LIEBERMAN**, B.S. '16, biochemistry, is teaching English in Taiwan.
- **MEGHAN MURPHY**, B.S. '15, biological sciences, is conducting research in Botswana on the impact of drug and alcohol use on HIV treatment.

Two alumni received 2017 NASA Earth and Space Science Fellowships.

- **LYNN MONTGOMERY**, B.S. '16, atmospheric and oceanic science, is a graduate student at the University of Colorado Boulder.
- **NICHOLAS ZUBE**, B.S. '15, astronomy; B.S. '15, physics, is a graduate student at the University of California, Santa Cruz.

**JON BALLOU**, Ph.D. '95, zoology, received the Devra Kleiman Scientific Advancement Award from the Association of Zoos and Aquariums. He is a research scientist emeritus at the Smithsonian's National Zoo and Conservation Biology Institute.

**ALAN BRAUN**, B.S. '01, computer science, was promoted to CEO of interactive content creator Scrollmotion.

**JAMES BREMER**, B.S. '01, computer science; B.S. '01, mathematics, received a Chancellor's Fellowship from the University of California, Davis, where he is an associate professor of mathematics.

**FRANCIS BUSTOS**, B.S. '10, biological sciences, was inducted into the Alpha Omega Alpha Honor Medical Society. He was one of six students from the Virginia Tech Carilion School of Medicine's Class of 2017 selected for this honor.

**MARY CHANG**, B.S. '01, biological sciences, became senior editorial manager of the *Journal of Immunology* and *ImmunoHorizons,* the peer-reviewed journals of the American Association of Immunologists.

**GERALD COMBS**, B.S. '69, zoology, joined the Board of Trustees at Briar Cliff University. He is a professor emeritus in the Division of Nutritional Sciences at Cornell University and an adjunct senior scientist at Tufts University.

**SHARON CROOK**, M.A. '91, Ph.D. '96, applied mathematics, was elected vice president of the Organization for Computational Neurosciences. She is an associate professor in the School of Life Sciences at Arizona State University.

**JOHN DEGNAN**, M.S. '70, Ph.D. '79, physics, was elected fellow of The Optical Society. He is chief scientist at Sigma Space Corporation.

**CHARLES FEFFERMAN**, B.S. '66, mathematics, jointly received the 2017 Wolf Prize in Mathematics. He is a professor of mathematics at Princeton University.

**GREG FURROW**, B.S. '82, M.S. '84, chemistry, was hired as vice president of quality and compliance at Southern Research.

**CELSO GREBOGI**, M.S. '75, Ph.D. '78, physics, was named a 2016 Thomson Reuters Citation Laureate in physics. He is the Sixth Century Chair in Nonlinear and Complex Systems at the University of Aberdeen in Scotland.

**KARLA HEIDELBERG**, Ph.D. '99, marine estuarine environmental sciences, was promoted to professor of teaching in biological sciences and environmental studies at the University of Southern California and received the 2017 Associate's Award for Excellence in Teaching.

**MATTHEW HIRN**, Ph.D. '09, mathematics, received a 2016 Young Faculty Award from the Defense Advanced Research Projects Agency. He is an assistant professor in Michigan State University's Department of Computational Mathematics, Science and Engineering.

**DI-WEI HUANG**, Ph.D. '16, computer science, jointly received the OpenCog Foundation Prize for Best Student Paper at the Ninth Conference on Artificial General Intelligence.

**THOMAS HUEBNER**, B.S. '05, biological sciences, was named senior physician at Natural Transplants Maryland, a hair restoration clinic.

**JUDITH IRIARTE-GROSS**, B.S. '81, M.S. '84, chemistry, received the American Chemical Society's Award for Encouraging Women into Careers in the Chemical Sciences. She is a professor of chemistry and director of the Women in Science, Technology, Engineering and Mathematics Center at Middle Tennessee State University.

**VANITHA KHETAN**, B.S. '95, computer science, received a Modern-Day Technology Leader Award during the 2017 Becoming Everything You Are Science, Technology, Engineering and Math Conference. She is a principal systems engineering and technical leader in MITRE's Enterprise Strategy and Transformation Technical Center.

**GEORGETTE KISER**, B.S. '89, mathematics, was named a 2017 Premier 100 Tech Leader by *Computerworld*. She is chief information officer at The Carlyle Group.

**VIPIN KUMAR**, Ph.D. '82, computer science, received the 2016 IEEE Computer Society Sidney Fernbach Award. He is a Regents Professor and William Norris Endowed Chair in the Department of Computer Science and Engineering at the University of Minnesota.

**KHALID KURTOM** B.S. '97, biological sciences, a neurosurgeon in Easton, Maryland, traveled to Jordan in April 2017 with four members of his practice to perform free brain and spine surgeries on Syrian refugees.

**BRAD LERNER**, B.S. '80, zoology, was named president of Chesapeake Urology Associates.

**ALIZA LICHT**, B.S. '96, biological sciences, became executive vice president of brand marketing and communications at designer clothing company Alice + Olivia.

**BRYAN LOEFFLER**, B.S. '01, biological sciences, partnered with another hand surgeon at OrthoCarolina in Charlotte to complete the first surgery to allow for a prosthetic hand with individual finger control on an amputee patient.

**DOROTHEA LUNDBERG**, M.S. '11, Ph.D. '17, marine estuarine environmental sciences, received the Lipman Research Award for student research in volcanology and petrology from the Geological Society of America.

**WILLIE MAY**, Ph.D. '77, chemistry, received the American Chemical Society's 2017 Award for Public Service. He is director of major research and training initiatives at the University of Maryland's College of Computer, Mathematical, and Natural Sciences.

**MICHAEL MAYO**, B.S. '85, computer science, joined Wells Fargo Securities' equity research team.

**JASON MEYENBURG**, B.S. '04, biochemistry, was named chief commercial officer of Vtesse, a company developing medicines to benefit patients with ultra-rare, life-threatening diseases.

**CURTIS MOBLEY**, Ph.D. '77, meteorology, received the 2016 Jerlov Award from the Oceanography Society. He is vice president for science at Sequoia Scientific.

**SHRUTI NAIK**, B.S. '05, biological sciences, was awarded one of five 2016 L'Oréal USA For Women in Science fellowships. She is a postdoctoral scientist in immunology and stem cell biology at Rockefeller University.

**MOSES NAMARA**, B.S. '16, computer science, received a Facebook Emerging Scholar Award. He is a Ph.D. student in human-centered computing at Clemson University.

**DAVID NGUYEN**, B.S. '97, biochemistry; B.S. '97, computer science, received the Montgomery County Chamber of Commerce Chairman's Award. He is founder and CEO of United Solutions.

**SAM NOH**, Ph.D. '93, computer science, was named editor-in-chief of the Association for Computing Machinery's journal *Transactions on Storage*. He leads the School of Electrical and Computer Engineering at the Ulsan National Institute of Science and Technology in Korea.

**DJ PATIL**, M.A. '99, Ph.D. '01, applied mathematics, received the Department of Defense Medal for Distinguished Public Service in November 2016. Patil served as U.S. chief data scientist from 2015 to 2017.

**ROBERT PLESS**, Ph.D. '00, computer science, was named George Washington University's Patrick and Donna Martin Endowed Professor.

**DAVID POWELL**, Ph.D. '00, zoology, joined the Saint Louis Zoo as director of research.

**DIANN PROSSER**, Ph.D. '12, marine estuarine environmental sciences, received a Presidential Early Career Award for Scientists and Engineers. She is a research wildlife ecologist at the U.S. Geological Survey's Patuxent Wildlife Research Center.

**CHARLES REYL**, Ph.D. '96, physics, joined hedge fund Select Equity Group in New York as a quant consultant.

**DANIEL RYAN**, M.A. '71, mathematics, received the James R. Wade Service Award from cyber-security membership organization $(ISC)^2$. He is currently practicing law. Prior to that, he was a professor at National Defense University.

**BARNA SAHA**, Ph.D. '11, computer science, received a Faculty Early Career Development (CAREER) award from the National Science Foundation. She is a professor in the College of Information and Computer Science at the University of Massachusetts Amherst.

**HO SHIN**, B.S. '90, biological sciences, was named executive vice president and general counsel at the global location data management company Yext.

**JENNIFER SMITH**, B.S. '12, biological sciences, joined iFrog Digital Marketing as vice president.

**ROBERT SMITH**, M.S. '06, Ph.D. '12, entomology, was hired as a tenure-track assistant professor in the biology department at Lycoming College.

**KATIE STEPHENS**, M.C.L.F.S. '04, life science, is now the principal at Bernheim Middle School in Shepherdsville, Kentucky.

**SEEMA VERMA**, B.S. '93, biological sciences, was appointed by President Donald Trump to serve as administrator of the Centers for Medicare and Medicaid Services.

**DONALD WELCH**, Ph.D. '98, computer science, was named Penn State's chief information security officer.

**EMILY WORSHAM**, Ph.D. '16, geology, received the 2017 Nininger Meteorite Award from the Arizona State University Center for Meteorite Studies.

Four graduate students received National Science Foundation Graduate Research Fellowships.

- **ANDREW GUO**, physics
- **HANNA KAHL**, entomology
- **MILOD KAZEROUNIAN**, computer science
- **ELISSA REDMILES** (B.S. '13, computer science), computer science

*Redmiles was also named a 2017 Facebook Fellow.*

Four undergraduates received National Science Foundation Graduate Research Fellowships.

- **KATHERINE CORDWELL**, mathematics and computer science major
- **EMILY GARHART**, astronomy and physics major
- **GREGORY RIDGWAY**, mathematics, physics and music major
- **JONATHAN FRANCISCO SAN MIGUEL**, physics and computer science major

*Garhart also received the 2016 Universities Space Research Association's Thomas R. McGetchin Memorial Scholarship Award.*

Three undergraduates were named 2017 Goldwater Scholars.

- **CHRISTOPHER BAMBIC**, physics and astronomy major
- **ELIOT FENTON**, physics major
- **PRAYAAG VENKAT**, computer science and mathematics major

*Venkat also received an honorable mention Computing Research Association Outstanding Undergraduate Researcher Award.*

Three graduate students received 2017 NASA Earth and Space Science Fellowships.

- **JAMES JUNO**, physics
- **THOMAS RIMLINGER** (B.S. '14, astronomy; B.S. '14, mathematics), astronomy
- **JOSEPH SCHOOLS**, geology

Two undergraduates received National Oceanic and Atmospheric Administration Ernest F. Hollings Undergraduate Scholarships.

- **ANNA LOWIEN**, environmental science and policy major
- **EMMA THRIFT**, biological sciences major

A team of four undergraduates won the Johns Hopkins University biannual HopHacks event in February.

- **KEVIN CHEN**, computer science major
- **L. RICKY HAN**, mathematics and computer science major
- **JOHANN MILLER**, computer science major
- **JASON ZOU**, mathematics and computer science major

A team of students in the Maryland Cybersecurity Center earned second place honors in *The Economist*'s case study competition on cybersecurity issues related to digital voting.

- **SPENCER CHEN**, computer science and mathematics major
- **SAURAV DAS**, computer science and mathematics major
- **WILLEM WYNDHAM**, computer science graduate student

The University of Maryland student team advanced to the world finals of the **ASSOCIATION FOR COMPUTING MACHINERY'S INTERNATIONAL COLLEGIATE PROGRAMMING CONTEST**. The team's advisor, Computer Science Professor Mohammad Taghi Hajiaghayi, received a coaching award.

A University of Maryland team, named **UMD LOOP**, won the Performance in Operations Award and placed fifth at the first SpaceX Hyperloop Pod Competition held in January 2017. The team placed in the top six at the second competition in August 2017.

Biological sciences graduate student **DANIEL AYRES** received the 2017 Global Impact Award from visual computing technology company NVIDIA.

**ERNIE BELL**, a geology graduate student, received a 2016 Lunar and Planetary Institute Career Development Award.

Biology graduate student **LEANN BIANCANI** received a Big 10 Academic Alliance Smithsonian Institution Fellowship for 2017.

**ZACHARY ELDREDGE**, a physics graduate student, was awarded an endowment fellowship by the Achievement Rewards for College Scientists Foundation.

Computer science graduate student **AHMED ELGOHARY** received a 2017-18 IBM Ph.D. fellowship. He also won a best paper award at the 42nd International Conference on Very Large Data Bases.

Biological science majors **AUSTIN FENG** and **ALEKSANDER FUKSENKO** received Exceptional Summer Student Awards from the National Institutes of Health.

**AUSTIN GION**, a geology graduate student, received the Preservation Award from the Kansas Geological Foundation.

Computer science graduate student **GARRETT KATZ** jointly received the OpenCog Foundation Prize for Best Student Paper at the Ninth Conference on Artificial General Intelligence.

**DANA LOUIE**, an astronomy graduate student, won an East Asia and Pacific Summer Institutes Fellowship to conduct research in Japan.

Biological sciences major **ELFADIL OSMAN** was named a 2017 Gates Cambridge Scholar.

Entomology graduate student **SAMUEL RAMSEY** won the American Bee Research Conference's student competition. He also took first place in the university's Three-Minute Thesis Competition earlier this year and will represent UMD in the international competition in October.

Biochemistry major **NAGEEN SHERANI** was awarded a Fulbright Scholarship to teach English in Indonesia.

Biological sciences major **AARON SOLOMON** was named a 2017 Marshall Scholar.

Computer science graduate student **ASHTON WEBSTER**, B.S. '16, computer science, received an honorable mention Computing Research Association Outstanding Undergraduate Researcher Award.

## ALUMNI NOTES ARE WELCOME.

Please send them to Odyssey, CMNS Dean's Office, University of Maryland, 2300 Symons Hall, College Park, MD 20742.

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