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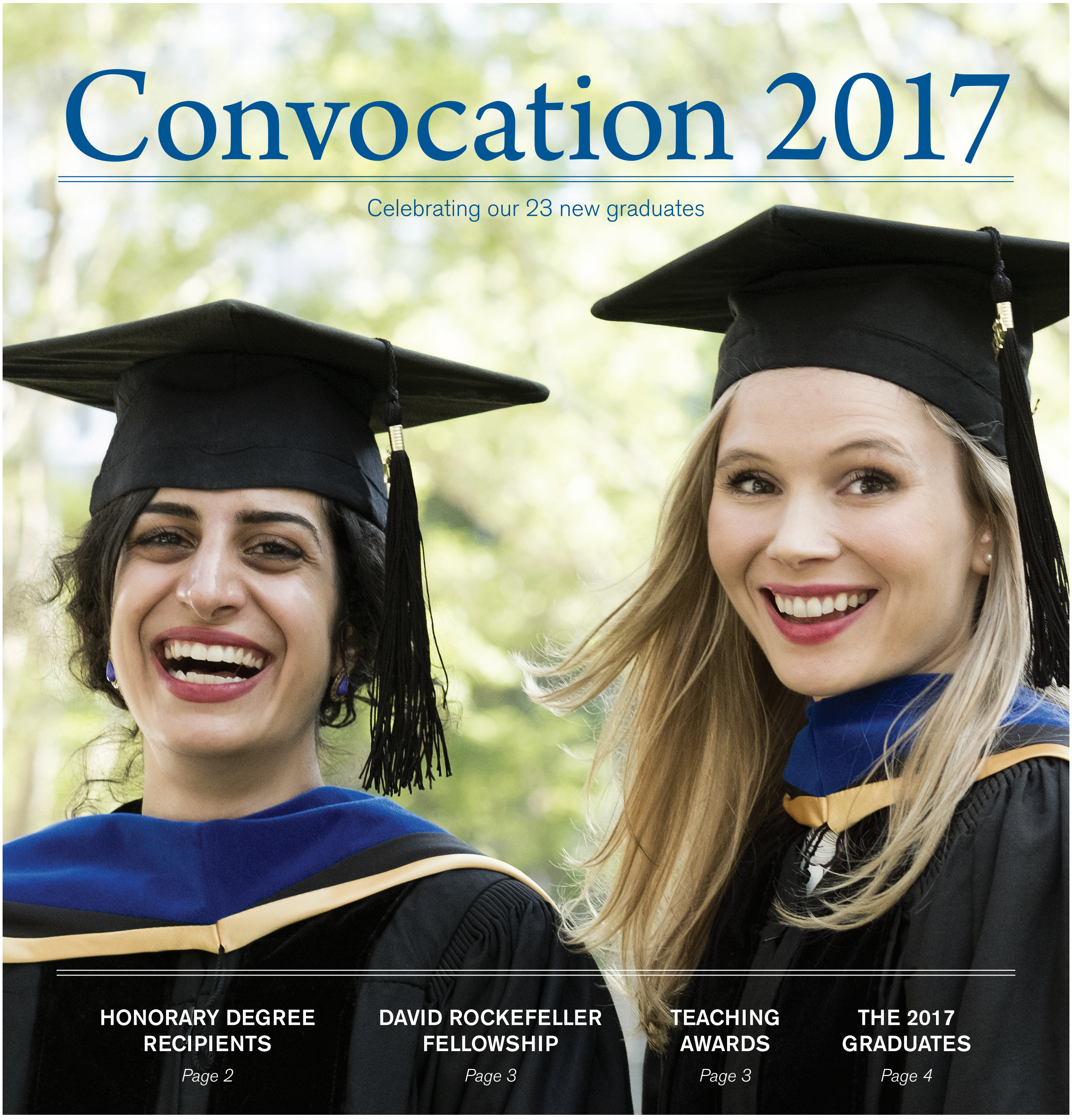
The Rockefeller University

THE ROCKEFELLER UNIVERSITY

Benchmarks

The community newsletter of The Rockefeller University

SPECIAL PRINT ISSUE



Convocation 2017

Celebrating our 23 new graduates

Photo: Mario Morgado

In 1959, there were five graduates at Rockefeller University's first Convocation. Today, 58 years later, 1,232 scientists have received Rockefeller University Ph.Ds.

The day's festivities began with a graduate luncheon in the Great Hall of Welch Hall, followed by Rockefeller's traditional cap-and-gown procession of students and mentors across campus to the degree-granting ceremony in Caspary Auditorium. The graduates and their families gathered afterward at a campus celebration at the Peggy Rockefeller Plaza.

The 23 graduates of this year's class come from 12 countries: Austria, Canada, France, Ghana, Israel, Mexico, Myanmar, the Netherlands, Singapore, Slovenia, Thailand, and the United States. Sixteen Rockefeller labs were represented by the graduates, four of whom are members of the Tri-Institutional M.D.-Ph.D. program and will continue on to medical school. Others will begin careers in academia, industry, or other fields.

This special Convocation issue of Benchmarks salutes the Rockefeller University class of 2017. To view more photos from the day's events, visit rockefeller.edu/convocation.

Four distinguished leaders in science awarded honorary degrees at Convocation

by Alexandra MacWade, assistant editor

At this year's Convocation ceremony, honorary doctorate of science degrees were awarded to four distinguished scientific leaders: Anthony B. Evnin, partner at venture capital firm Venrock; Mary-Claire King, professor at the University of Washington; Matthew Meselson, professor at Harvard University; and Steven Weinberg, professor and department chair at The University of Texas at Austin.

"These four individuals are explorers of scientific landscapes, innovators, and humanitarians," said Richard P. Lifton, the university's president, who presented the degrees. "It is a great honor to recognize them."




Photos: Mario Morgado

Anthony B. Evnin, Mary-Claire King, Matthew Meselson, and Steven Weinberg

Evnin received his honorary degree for his role in shaping the modern biotechnology industry and his influence on the course of translational research. He began his career as a research scientist, then joined venture capital firm Venrock in 1974 to lead its first investments into biotechnology and the greater life sciences field. Evnin was also celebrated at the ceremony for supporting Rockefeller's mission for three decades, first as a member of The Rockefeller University Council, then as a member of the Board of Trustees, and since 2016 as a trustee emeritus.

"Tony's contributions to the development and growth of the biotechnology industry, and his years of leadership contributing to innovative research in basic science, have profoundly shaped the contemporary interface of academia and its translation in industry," said Lifton. "He is also a cherished member of our community."

"I am truly honored to receive this degree," Evnin said in his remarks. "But I am more honored to share this stage with three such distinguished scientists." Evnin, who holds a Ph.D. in chemistry from MIT, is also a director of Bridge Medicines, a drug-discovery initiative launched last year by Rockefeller and its Tri-Institutional partners.

King was recognized for her work both as a geneticist and as a human rights activist. Among other breakthroughs, she and her colleagues discovered that the DNA of humans and chimpanzees is more than 99 percent identical, and she was the first scientist to demonstrate that predisposition to breast cancer can be inherited, resulting from mutations in the gene *BRCA1*. King also pioneered the use of mitochondrial DNA sequencing and other genomic methods for human rights investigations, approaches that have been used around the world to identify victims of violence. In 2010, King, who is the American Cancer Society Professor at the University of Washington, was awarded Rockefeller's Pearl Meister Greengard Prize, given to honor women who have made extraordinary contributions to biomedical science.

"Mary-Claire's innovative and determined research has saved the lives of countless people worldwide," said Lifton. "And her use of DNA

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Third-year student Veronica Jove awarded 2017 David Rockefeller Fellowship

by Alexandra MacWade, assistant editor

As an undergraduate at Columbia University, Veronica Jove initially disliked her biology classes.

It wasn't until she started working in a lab that her feelings began to change. "I really enjoyed being in the lab, and I realized that I wanted to stick with it," she says. It turned out to be a good choice: Jove is now a third-year graduate fellow at Rockefeller, and she has been awarded the 2017 David Rockefeller Fellowship for demonstrating exceptional promise as a scientist and a leader.

The fellowship was established in 1995 by alumni as an expression of gratitude for David Rockefeller's role in founding the graduate program and for his commitment to its success. Rockefeller, who died at the age of 101 last March, served for more than 75 years on the university's Board of Trustees. He said that few honors meant as much to him as the creation of this award. Jove, who is in Leslie B. Vosshall's Laboratory of Neurogenetics and Behavior, received the award at a ceremony held during the Convocation luncheon.

Working with flies, mosquitoes, and human subjects, the Vosshall lab is interested in how sensory information is processed and perceived. Much of the lab's work is focused on how mosquitoes find and bite their hosts, ruining summer evenings and spreading tropical disease. Jove is at the center of this work, and is trying to figure out how mosquitoes know that they've found blood once they've landed on a person.

Female mosquitoes, the ones that bite, need the proteins from blood in order to lay eggs. Several decades ago, researchers discovered that only a few components of blood—specifically, the compound adenosine triphosphate, or ATP—are sufficient to trick a mosquito into thinking it has found blood. The identification of components of blood like ATP that are required to initiate blood-feeding, and the receptors used by mosquitoes to detect these components, could lead to the development of interventions that would curb mosquitoes from biting people.

Jove is looking at sensory neurons that reside in the stylet, the needle-like appendage that mosquitoes use to pierce their hosts' skin and pump out blood, to see what role they play in detecting and responding to ATP. Among other techniques, she is using live imaging to study the mosquitoes' neural activity to determine which specific receptors and neurons are involved.

Jove, who was drawn to Rockefeller because of its small size and collaborative atmosphere, is making the most of her time in New York City, frequently exploring museums and other cultural institutions. Looking ahead, she hopes to stay in both academia and in New York. "It's not a given by any means," she says. "I know it's really difficult to do, but that would be the dream."

Photo: Mario Morgado

Adriane Antler (right), an alumna of Rockefeller's class of 1986, presents Veronica Jove with the David Rockefeller Fellowship citation

Paul Bieniasz and Winrich Freiwald celebrated with teaching awards

by Alexandra MacWade, assistant editor

Paul Bieniasz, who co-teaches a course on virology, and Winrich Freiwald, who lectures on neuroscience, were honored at this year's Convocation luncheon with Distinguished Teaching Awards.

The annual awards were established in 2005 to recognize outstanding individual contributions to the university's educational environment. The winners, who receive a plaque and a monetary gift, are chosen by a committee that includes Rockefeller's scientific executive officers.

Bieniasz, who is professor and head of the Laboratory of Retrovirology and a Howard Hughes Medical Institute investigator, studies the biology and evolution of retroviruses. His course, which he teaches together with Charles M. Rice, features lectures from Rockefeller faculty and guests, who lead lively discussions about virology with an emphasis on the cellular and molecular biology of animal viruses. Several model systems are covered as well as virus structure, replication, viral vaccines, and resistance.

In Freiwald's course, Systems and Cognitive Neuroscience, students learn how the concerted action of neurons, organized at multiple scales, generates complex behaviors. The course explores how the brain gives rise to perception, internal representations, cognition, and action, and covers the structure and function of various neural systems. Freiwald, whose own work is focused on how the brain processes faces, teaches the course with Charles D. Gilbert.

"It's an honor to receive this recognition for my small contribution to the university's outstanding graduate training program," says Freiwald, who is associate professor and head of the Laboratory of Neural Systems. "I have learned and continue to learn how to teach Rockefeller students—who have such diverse backgrounds and training needs—from watching my wonderful colleagues, many of whom achieve complete mastery of the art of science communication and teaching."

The 2017 Graduates

During the Convocation ceremony, Rockefeller faculty commended their students for their scientific contributions, untiring work, and unique skills. Below are the highlights from congratulatory tributes given to each of the 2017 graduates, including students in the Tri-Institutional M.D.-Ph.D. Program (denoted with an asterisk).

Five students graduated in absentia: Julien Babak Azimzadeh, Deanna Belsky, Peter Insley, Supawat Thongthip, and Donovan Ventimiglia.*

Rene C. Adam

presented by Elaine Fuchs

Home Sweet Home: Epigenetic Paths of Stem Cells in and out of Their Niche

Every so often, a truly special young scientist comes to the laboratory and shines as a rising star. Rene Adam is such a student. For his thesis research, Rene became passionate about the stem cells of hair follicles, positing that the transcription factors specifically expressed by these cells might work together to control the critical genes that give these long-lived skin stem cells their remarkable ability to grow hair. He performed a technique known as high throughput chromatin immunoprecipitation and deep sequencing, or ChIP-seq, to identify which genes contained regulatory elements that were bound by the entire cohort of the hair stem cell transcription factors. Representing only approximately five percent of all the genes expressed by these stem cells, Rene's shortlist contained nearly every gene we and others knew to be important for hair growth in mice and in humans. The work was published in *Nature* to high acclaim. Rene's passion and talent at the bench are matched by his intellect and creativity. I'm delighted to have had the opportunity to mentor Rene over these years.

Amma Ami Asare*

presented by Elaine Fuchs

Investigating Differentiation: A Role for Organelle Inheritance in Epidermal Growth

Amma hits on all cylinders—she is smart, creative, and independent, but at the same time has excellent hands at the lab bench and outstanding interactive skills. Her thesis research was aimed at elucidating how the epidermis develops and maintains the skin's barrier that keeps harmful microbes out and retains body fluids. She devised a system that allowed her to identify the earliest changes in gene expression that occur as a proliferative epidermal stem cell stops dividing and begins its program to create the protective dead cells at our skin surface. She then set up a clever genetic screen in mice that allowed her to sift through these many changes and figure out which ones were the most important. She discovered a novel mechanism that proliferative cells use to make sure each daughter cell gets its fair share of its parents' organelles, work that was published in *Science* earlier this year. Amma is quite simply one of the brightest and most impressive aspiring physician-scientists I've ever known.

Matthew Dornfeld

presented by George N. Reeke Jr.
on behalf of Marcelo O. Magnasco

The Physics of Rodent Ultrasonic Vocalizations

Matthew joined the Magnasco lab with an interest in computational neuroscience, and quickly became intrigued by the field of rat ultrasonic vocalizations. The voices of animals have long been the subject of much interest in biology. Matthew undertook a study in which he automatically tracked a huge number of rat vocalizations and analyzed them for sudden frequency jumps, gathering massive statistics. He quickly discovered that very little was known about what mechanisms produce which jumps. He later studied the physical mechanism that could generate statistics like in those jumps, and this led him down a path in which he got himself into some seriously deep and brain-boggling hydrodynamics. Matthew's work beautifully exemplifies the unpredictability of the scientific enterprise, where you start looking at one phenomenon, and as you try pulling threads out, you are led far astray, into alien uncharted territory. Matthew unflinchingly followed the science far away from his starting point, wherever it led him, just to get to the bottom of the question.

Jonathan Green

presented by Gaby Maimon

A Neuronal Circuit Architecture for Angular Integration in Drosophila

I first met Jonathan when he stopped by my office a few years back to discuss a possible rotation. He was immensely creative, even from day one. In his thesis work, Jonathan discovered that tiny fruit fly brains, remarkably, contain several classes of head-direction-like compass cells, which provide flies with a sense of orientation. He further described how these compass cells form an interconnected circuit, which explains how flies update their sense of orientation based on how fast they are turning left or right. Because the circuit by which mammals update their sense of orientation is still not known, Jonathan's work in flies provided the first glimpse of how any brain computes angular heading. His insights may help us better understand how the mammalian orientation system works—perhaps even the human orientation system—sooner than one might think. Jonathan was the first student to join my lab, and his technical and biological insights were truly phenomenal. His scientific work will impact the trajectory of my group for many years to come.

Josh S. Greene*

presented by Cori Bargmann

Density-dependent Foraging in Caenorhabditis elegans

How do animals detect each other and incorporate this information into behavior at the biological level of genes and the brain? In his Ph.D. work, Josh unraveled this mystery beginning with a discovery

that different wild-type individuals of the species we study, *C. elegans*, behave differently. Some modify their behaviors as animal density increases. Others initially appeared oblivious, although Josh later found that they knew more than they let on. Josh discovered that this difference in behavior results from genetic differences affecting two adjacent genes. He also found that different kinds of animals are more or less successful depending on what other animals are around, and how much food is present. This result fits the evolutionary prediction from game theory, which posits that the best strategy depends on what other animals are doing. Josh's own behavior has been more than optimal, resulting in exciting discoveries in areas far beyond those that we expected: molecular neuroscience, population genetics, evolutionary fitness. He has excelled in his creativity and intellectual mastery of deep biological questions.

Elizabeth Hubin

presented Seth A. Darst

Structural and Functional Studies of Mycobacterial General Transcription Factors RbpA and CarD

In our laboratory, we study how cells make RNA from the genetic information encoded in DNA. Much of our focus is on a molecular machine responsible for this process, called the RNA polymerase. The paradigm within which we understand the process has been developed from studies of *E. coli*. It's been assumed that what we learn from *E. coli* applies to other bacteria as well. Lizzy's work has shown that this assumption is wrong. Elizabeth Campbell, who is leading research in our lab to understand the transcription program in *Mycobacterium tuberculosis*—which causes tuberculosis and infects one-third of the world's population—and Lizzy worked closely together to forge major advances in our understanding of the mycobacterial transcription process, including determining the first and most detailed structure of a mycobacterial transcription initiation complex, containing six proteins, DNA, and RNA. Lizzy has left the lab but her influence persists: We're now building on her work to learn how antibiotics block the mycobacterial RNA polymerase and how the RNA polymerase in turn develops resistance.

Saša Jereb

presented by Robert B. Darnell

Deconvoluting Cell-type Specific 3'UTR Isoform Expression in the Adult and Developing Cerebellum

Saša is interested in doing creative science that can be applied, using state-of-the-art technology, for the good of humankind. Her education here has underscored these interests. She has taken courses ranging from chromatin biology and epigenetics to neural systems, and a survey course in RNA given by my father, James Darnell, a Rockefeller professor emeritus. He wrote to Saša, after reviewing her final course paper, "Your paper proves you are a biologist in the modern world." For her thesis, Saša studied the brain at a previously unprecedented level of detail. Working with a postdoctoral fellow, Hun-Way Hwang, she applied an entirely new platform technology to understand cell-specific neuronal biology. She developed ways to study how choices are made in generating mRNA copies from genes—alternative polyadenylation—in specific cell types in the adult cerebellum and during its development. Saša's work provides a breakthrough in what is emerging as a hot area of interest—a new approach to understanding all of the differences in the trillions of cells in our bodies.

Roos Karssemeijer

presented Titia de Lange

Pathways of Non-homologous End Joining at Dysfunctional Telomeres and Their Resolution

When Roos came to Rockefeller, she was solidly committed to immunology. In the fall of 2013, however, she joined my lab to work on our project on the interface between the DNA damage response and telomere biology. Her experimental prowess allowed her to make this shift swiftly and successfully. Roos received a fellowship from the German Boehringer Ingelheim Fund and was supported by a *Women & Science* Graduate Fellowship. She has co-authored seven peer-reviewed publications with at least one more to come. Roos's scientific achievements are matched by her remarkable athletic abilities: She has run several marathons, including a 54-kilometer ultra-marathon on Mont Blanc in the French Alps, a race that includes a change in elevation of 12,000 feet. Roos was born to run, and she is now running around Boston, where she works at McKinsey & Company. The lab misses seeing Roos at the bench in her running gear, rarely breaking a sweat either while pounding the pavement or hammering out data.

Kenneth Lay

presented by Elaine Fuchs

Transcriptional Governance of Hair Follicle Stem Cell Quiescence and Niche Maintenance in Long-term Tissue Regeneration

Elected into Singapore's prestigious "ASTAR" program for the best and brightest students, Kenneth decided to go to Imperial College of London, where he received his undergraduate degree. The experience was a sea change. In Kenneth's words, "My newfound appreciation for science and its self-perpetuating quality, which generate an endless quest for knowledge, cemented my goal to obtain a Ph.D. and become a full-fledged explorer of nature." For his thesis research, Kenneth became passionate about FOXC1, a transcription factor expressed in resting hair follicles. Kenneth "woke up" these hair follicles in mice by removing their *Foxc1* gene. After that, the hair follicles spent no time at all at rest. They just kept cranking out cycles of hair growth. At first, it seemed as though Kenneth may have stumbled into the Fountain of Youth. But as the mice aged, their hairs got grey and sparse. Kenneth showed that when hair stem cells are used constantly, they run out of gas. The story is a beautiful one, and Kenneth's thesis defense was mesmerizing. Motivation is something that you cannot teach. Kenneth has it, and he has applied it well.

Tamara Ouspenskaia

presented by Elaine Fuchs

Mechanisms of Stem Cell Specification during Organ Morphogenesis

When Tamara began her Ph.D. studies, she was already at ease with asking bold questions, developing hypotheses, and testing her ideas at the bench. For her thesis project, she wanted to know how progenitor skin cells make hair follicles. She discovered that a special signaling pathway, called WNT, is essential. When skin cells receive this WNT signal, they cluster. Then they divide perpendicularly to the skin surface to make a hair bud. This division angle imparts different fates to the daughter cells: a WNT-high daughter cell remains where its parent is, but the WNT-low daughter cell is expelled. It turns out that kicking the kid out of the house is what it needs to develop the special skills that make it a long-lived stem cell. Survival of the fittest in its prime! Tamara is genuinely intrigued by science, and she is one of the most upbeat students I ever had the pleasure to mentor. I miss her laugh, as her bench was right next to my office. Her joy for science filled the lab.

Jennifer Carol Peeler

presented by Thomas P. Sakmar

Isopeptide and Ester Bond Ubiquitination Regulate Degradation of the Human Dopamine Receptor 4

Jenny made such a positive impression at the end of her rotation in my lab that I was confronted by a group of other students and postdocs, who implored me to convince her to join our group. That has only happened once in 25 years. Jenny's thesis work broke new ground in elucidating how an interesting receptor, called the D4 dopamine receptor, is transported and then degraded in neurons. Genetic variations in the D4 receptor are thought to be responsible for thrill-seeking personality traits in humans. So much so, that an advertisement once featured a BMW with a license plate labeled D4R8—the thrill seeker's genotype. Jenny showed that a new type of chemical modification involving ubiquitin was linked to D4R to enhance its turnover, work that won her a prestigious National Science Foundation fellowship award. She also mentored high school and college students here at Rockefeller and designed and taught a new course in biology for non-science majors at Marymount College. Jenny plans to pursue academics and teaching, and her passion will certainly inspire a new generation of scientists.

Violeta Rayon Estrada

presented by F. Nina Papavasiliou

APOBEC1-mediated RNA Editing in Monocytes Contributes to Genetic Heterogeneity and Modulates Monocyte Activity and Development

RNA editing was first described in the 1980s as a curiosity that affected the transcript that encodes glutamate receptors. Now, in part because of Violeta's work, we know that editing is far more frequent than anyone had anticipated, and that it is used by a variety of cells and organisms to drive informational diversity. But when Violeta first started in the lab, the field of epitranscriptomics, which describes RNA editing and modification events as they impact transcript fate, did not exist. It wasn't easy to be at the forefront of a field that was not yet a field. Experiments were not always straightforward—in fact, they were often at the cutting edge of what was experimentally possible. But Violeta persisted, and her work has helped frame a field and move it from cataloging editing events to attempting to understand the functional relevance of epitranscriptomic changes for the transcript, the cell, and eventually the organism itself. Violeta plans to continue her work in the field whose parameters she helped frame, now in the context of human disease.

Carlos Rico

presented by Thomas P. Sakmar

Single Molecule Ligand Binding Studies on CCR5 by Fluorescence Cross-correlation Spectroscopy

The story of Carlos Rico is an American success story. He first came to the U.S. at age 12 from Mexico. He entered the L.A. public school system without speaking English, and accepted a scholarship to Hamilton College. Carlos came here with an ambitious research program to study G protein–coupled receptors that control targeted cell migration. He was able to measure, for the first time, using a novel single-molecule fluorescence method, the ultra-high-affinity binding of a chemokine to its receptor. Working with Thomas Huber, Carlos invented a new type of drug-screening chip called a Zepto-Array that can carry out 68,000 simultaneous single-molecule experiments. Carlos is serious, scholarly, hard-working, and focused. He has worked with disadvantaged students in East Harlem and cares about giving back to the community. He will go on to medical school and become a physician-scientist. Carlos has one of the most amazing life stories of any student I have met. He has literally worked his way up—step-by-step—from immigrant roots to a Ph.D. in chemical biology from The Rockefeller University.

Irit Shachrai

presented by Hermann Steller

Compromising the 20S Proteasome Activates a Quality Control Pathway to Mitigate Proteotoxic Stress

Irit joined my lab to investigate the regulation of programmed cell death, but soon turned her attention to a new line of research that had just emerged: how the controlled degradation of intracellular protein is regulated. Defects in protein degradation are associated with many human diseases, in particular age-related pathologies and neurodegenerative diseases, such as Alzheimer's and Parkinson's. At the heart of the protein degradation pathway are sophisticated little nano-machines called proteasomes. Irit used a genetic approach to advance our understanding of proteasomes by taking advantage of the powerful genetic tools available in *Drosophila*. Her findings have many important and exciting implications, as they reveal a new mechanism for proteasome stress adaption through modified assembly. Eventually, a detailed understanding of these mechanisms may provide the basis

for developing novel drugs to modulate proteasome activity, which may offer new treatments for human diseases, including cancer. Irit has performed her work with a remarkable degree of independence, and has been fearless, creative, hard-working, and stubborn in pursuing the right answers.

Anupriya Singhal[*]

presented by Gaby Maimon
on behalf of Shai Shaham

IR Laser-induced Gene Expression for Tracking Development of Single Embryonic Neurons and Glia in Caenorhabditis elegans

When Anu joined my lab, we had been interested in studying the early stages in the development of the nervous system, and had employed the embryo of the roundworm, *C. elegans*, to address this question. An important stumbling block had been the lack of specific ways to label individual neurons and glial cells, the main components of the nervous system, to follow their early development. Anu took on this challenge, and began to devise a setup based on previous attempts to get the technology to work. By using mathematical modeling of heat diffusion, and delving into the critical minutia of microscope and laser optics, she uncovered key roadblocks in previous implementations of the method, and was able to overcome them using methodical experimental approaches. Anu developed an exciting method for single-cell gene expression that is now ready for prime time, and which allowed her to make a number of exciting biological findings, which she has recently published. I hope Anu will pursue academic science—she has all the necessary talents, and we want her on our team.

Mya Thandar

presented by Vincent A. Fischetti

Lysin-based Antimicrobial Peptides Against Acinetobacter baumannii

Consider the scenario that you've had a serious accident, which resulted in burns covering 25 percent of your body. You're treated using state-of-the-art procedures. By day two your prognosis is good, but by day three your burns have become infected by *Acinetobacter baumannii*, a common soil organism frequently found in hospitals and burn centers, capable of becoming resistant to all known antibiotics. Only 70 percent of *Acinetobacter*-infected patients survive. In our lab, Mya worked on a project to develop a non-antibiotic molecule to kill *Acinetobacter*. She identified a peptide that killed the organisms under laboratory conditions and showed that it could kill more than 99.999 percent of *Acinetobacter* on contact—even the deadly ones that were resistant to multiple antibiotics. To test whether it would work in vivo, Mya developed a mouse model of *Acinetobacter* skin infection. By adding the active peptide to the infected skin, she was able to significantly kill the *Acinetobacter*. A startup company has realized the implications of her published findings, and the peptide is currently in development to be used to treat burn patients with *Acinetobacter* infections.

Michael Wheelock

presented by Hironori Funabiki

Regulated Recruitment of the Chromosomal Passenger Complex to Chromatin and Microtubules Promotes Accurate Cell Division

Each time a cell divides, the complete set of chromosomes must be equally distributed to two new cells. After each chromosome is replicated, a pair of chromosomes must attach to dynamic polymers called microtubules. When chromosomes fail to attach to these microtubules in the right orientation, cells sense this error and activate a cascade of signals, called the checkpoint, which inhibits cell division. Mike tackled the question of how the checkpoint is activated upon treatment with the cancer drug taxol by analyzing the chromosomal passenger complex. He demonstrated that direct microtubule binding of this complex plays a critical role in the checkpoint activation, a discovery that urges the field to reconsider the mechanism by which the checkpoint is regulated. Mike is talented and a man of curiosity. He is also never afraid to learn new things, from how to write a code in a stylish and scientific way, which we called Wheelock plot, to how to write and speak Chinese, and how to deal with a stubborn Japanese mentor who has no sense of humor.

Maryam Zaringhalam

presented by F. Nina Papavasiliou

High Throughput Detection of Pseudouridine: Caveats, Conundrums, and a Case for Open Science

We are taught that messenger RNA is built from four bases: adenosine, guanosine, cytidine, and uridine. But uridine has a twin called pseudouridine, and locating it in mRNA is like trying to tell identical twins apart. Telling uridine and pseudouridine apart was the focus of Maryam's thesis. While Maryam and her colleagues were generating tools and fine-tuning their methods, so were others, who ended up publishing four high-profile papers before us. Rather than being discouraged, Maryam reanalyzed the data from those papers and found that from the thousands of targets they reported, they had in common exactly one. Her resulting paper suggested ways to improve and standardize methodologies in the future. Maryam was recently awarded a prestigious AAAS fellowship with which she is moving to D.C. to continue her data-driven work for our benefit as scientists, and as citizens. In Maryam, Rockefeller is sending one of our best and brightest to policy and perhaps one day into public life. I fervently hope that she succeeds in her future endeavors for all our benefit.

Four distinguished leaders in science awarded honorary degrees *(continued from page 2)*

forensics for social justice and humanitarian purposes is an inspiration to us all."

King encouraged the graduates to use their scientific expertise for social good. "It's a matter of having our minds open and our hearts open to opportunities that, when presented, allow us to say, 'I might be able to solve that,'" said King, who received her Ph.D. in genetics from the University of California, Berkeley.

Meselson's insights in molecular genetics laid the groundwork for the study of DNA replication, recombination, and repair. With his colleagues, he showed how DNA strands combine when they're replicated, proving a theory known as semi-conservative replication: As one DNA strand becomes two, each copy contains one of the original strands and one new strand. Meselson also helped establish the existence of messenger RNA, and found and characterized the first of a class of DNA-cutting molecules called restriction enzymes, which became vital tools in biomedical research. For more than 50 years, he has also been an effective advocate of measures to prevent the exploitation of biology for hostile purposes such as biological and chemical warfare.

"Matt has made seminal discoveries of monumental importance in the understanding of how life works in all its forms on our planet, and he's been a champion for reducing the inhumanity and insanity of warfare," Lifton said. "He is nothing less than a giant in the history of molecular biology."

Meselson, who received his Ph.D. from the California Institute of Technology and is the Thomas Dudley Cabot Professor of the Natural Sciences at Harvard, paraphrased the ancient Greek philosopher Epictetus in his remarks, advising the graduates to "take some time off to think about what kind of life you want to lead and what kind of person you want to become."

Weinberg, who is the Josey Regental Chair in Science at The University of Texas at Austin, was honored for his contributions to the Standard Model of particle physics, which helps explain how the fundamental forces of the universe govern elementary particles. In 1979, he shared the Nobel Prize in Physics for his work on the unification of electromagnetism and the weak nuclear force. Weinberg's explorations of the cosmological constant problem—a disagreement in physics about the value of energy density in the vacuum of space—provide some support for the prediction of a multiverse, or parallel universes with different laws of physics. A prolific author, he was awarded Rockefeller's Lewis Thomas Prize for Writing about Science in 1999.

"Steven Weinberg is widely regarded as the preeminent theoretical physicist of our generation," said Lifton. "A man who has helped to fathom the forces of nature, he is himself a force of nature."

Weinberg, a Ph.D. alumnus from Princeton University, spoke at the ceremony about the current "unprecedented level" of the public's distrust in science, particularly when it comes to global warming. "It's generally foolish to bet against the judgment of science," he said, "and in the case of global warming, when the planet is at stake, it's insane."

Coming soon to the David Rockefeller Graduate Program

As the graduating class of 2017 moves on to the next stages of life and career, the Rockefeller community welcomes the incoming group of graduate fellows. This year, the program received 786 applications, the second-highest number ever. After careful consideration by the admissions committee, 76 applicants were offered admission to the university, and 27 accepted. The incoming students are from 11 countries: Austria, Belgium, Chile, China, Denmark, Germany, India, the Netherlands, Peru, South Africa, and the United States. Their alma maters are: Albert Ludwig University of Freiburg; Barnard College; Centre for Excellence in Basic Sciences, Mumbai; Hunter College; Medical University of Graz; New York University; Northeastern University; Ohio State University; Pontifical Catholic University of Chile; Pontifical Catholic University of Peru; Princeton University; University of California, Berkeley; University of California, Davis; University of California, Los Angeles; University of Cambridge; University of Cincinnati; University of Leuven; University of Michigan; University of Nevada, Reno; University of Oxford; University of Pennsylvania; University of Rochester; Utrecht University; Williams College; Yale University; and Zhejiang University.

Honoring David Rockefeller

At this year's graduation ceremony, one person's absence was deeply felt. David Rockefeller, the university's friend and benefactor, died in March at the age of 101. David, who established the graduate program in 1955, remained engaged with its students throughout his life and rarely missed Convocation.

The youngest grandson of the university's founder, David was a central figure in Rockefeller's graduate program since the very beginning. In the early 1950s, as chairman of the board of what was known as The Rockefeller Institute for Medical Research, David worked closely with then-president Detlev Bronk to lead the institute through a visionary transformation into The Rockefeller University. The endeavors of training future generations of scientific leaders, and encouraging students to tackle complicated biomedical problems, became integral to the university's mission. David's gifts to support science over the years have been extraordinarily generous. Most recently, he contributed $75 million to the construction of the expansive Stavros Niarchos Foundation–David Rockefeller River Campus, which will open in 2019.

"While it is impossible to imagine the university without David, he will live on in every scientific advance and breakthrough made in our laboratories, in every young Ph.D. candidate fortunate enough to participate in the David Rockefeller Graduate Program, and in the incredible beauty of our campus," says Richard P. Lifton, the university's president.

Benchmarks

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Richard P. Lifton

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