

**CASW** Council for the  
Advancement  
of Science Writing

Fifty-Third Annual Briefing

# New Horizons in Science

HOSTED BY KNIGHT SCIENCE JOURNALISM  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

PART OF

**SCIENCEWRITERS2015**

**CAMBRIDGE, MASSACHUSETTS    OCTOBER 9–13, 2015**

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#SCIWR15



## FRIDAY

OCTOBER 9

Hosted event, trip or tour

NASW workshop registration required

11 a.m. – 5 p.m. **NASW Board Meeting**

noon – 5 p.m. **Check-in** Hyatt Regency Cambridge lobby

1 – 5 p.m. **How to make awesome science video: A hands-on workshop**  
Thomas Paine Room, Hyatt Regency Cambridge

**Nonfiction book proposals: A hands-on workshop**  
Charles View Ballroom, Hyatt Regency Cambridge

6 – 9 p.m. **Knight Science Journalism welcome reception**  
MIT Walker Memorial, 142 Memorial Drive  
*Buses depart from Hyatt*

**Check-in**  
MIT Walker Memorial

9 – 10:30 p.m. **Diversity Mixer**  
Paul Revere Room, Hyatt Regency Cambridge

## SATURDAY

OCTOBER 10

7:30 a.m.–5:30 p.m. **Check-in** Hyatt Regency Cambridge lobby

7:30 a.m.–6 p.m. **National Association of Science Writers meeting and workshops**  
Hyatt Regency Cambridge

6:30 – 9 p.m. **Awards reception**  
President's Ballroom, Hyatt Regency Cambridge

# New Horizons in Science

AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

**SUNDAY**

**OCTOBER 11**

**7 – 8:15 a.m.**

Kresge Lobby

**Continental breakfast**

**7:30 – 11 a.m.**

Kresge Lobby

**Check-in**

**8:15 – 9:30 a.m.**

Kresge Auditorium

**Opening plenary**

**Welcome**

**Maria Zuber**

*vice president for research, MIT*

**Lighting up biology: The quest to see every molecule in every cell**

It may seem that 21st-century biologists have a fantastic array of tools for probing the workings of molecules, cells, and organisms. But optogenetics pioneer Ed Boyden won't be satisfied until there are ways to map all the molecules in every cell of the body, simulate their dynamics and learn the "native language" of all cell types. His lab is coming up with new kinds of microscopy in the quest for a complete map of the molecules in an organism. In "expansion microscopy," they apply fluorescent tags to molecules in a cell, infuse the cell with a superabsorbent polymer, and add water. The expanding polymer stretches the cell itself by a hundredfold in volume so that a light microscope can image the cell in 3D with nanoscale precision. Boyden's group's techniques for activating neurons with light are now being used to control cells in experiments and possible therapies.

**Edward Boyden**

*associate professor of biological engineering and brain and cognitive sciences, Media Lab and McGovern Institute, MIT*

**9:30 – 10:30 a.m.**

Kresge Auditorium

**Concurrent Sessions**

**Pluto's close-up: The latest from the New Horizons mission**

In July, after a nine-year, 3 billion-mile journey, the New Horizons spacecraft reached the Pluto-Charon dwarf-planet system and the outer reaches of the solar system—the first NASA mission to reach an unvisited planet since Voyager more than 30 years ago. The mission's

@eboyden

#EveryMolecule

@AlanStern  
@NewHorizons2015  
#Pluto

instruments were designed to capture and transmit to Earth abundant data about not just Pluto but also the mysterious icy objects of the distant Kuiper Belt, the comet-generating “third zone” of our solar system. As science writers gather for New Horizons in Science, the spacecraft is expected to be sending final data from the flyby and preparing to head into the Kuiper Belt while analysis of the Pluto data continues. Principal Investigator Alan Stern will share fresh insights from the historic encounter.

### Alan Stern

*associate vice president for research and development, Space Science and Engineering Division, Southwest Research Institute*

9:30 – 10:30 a.m.

La Sala de Puerto Rico

### The tiny cell with a big gene “app store”

Technology inventors could learn a thing or two from *Prochlorococcus*. Long before smartphones came along, the smallest and most abundant photosynthetic cell on the planet evolved a collective gene pool of at least 80,000 genes (compared to the human gene pool of about 20,000)—effectively an app store full of tools for keeping the genus going. Just as each mobile electronic device runs a selected set of apps, each individual cell has about 2,000 genes, and the core operating system might be about 1,200. Penny Chisholm, a discoverer of *Prochlorococcus* almost three decades ago, has discovered much about the Earth and natural selection by studying this single, abundant phytoplankton genus. Most recently, her lab has found that seawater is filled with vesicles—“snack packets” of RNA, DNA, lipids, and proteins—that may be a form of DNA exchange for dilute phytoplankton like *Prochlorococcus*. They may also serve as chaff or decoys, part of bacterial defenses against viral infection.

@Prochlorococcus

### Sallie W. “Penny” Chisholm

*Institute Professor of environmental studies and professor of biology, MIT*

10:30 – 11 a.m.

Kresge Lobby

### Break

11 a.m. – noon

Kresge Auditorium

### Concurrent Sessions

#### The genome’s mysterious UCE surveillance system

Genomes are dynamic, rearranging themselves as they function and evolve. Ting Wu’s lab studies the parts of the animal genome that resist change. Called ultraconserved elements, or UCEs, these chunks of DNA have been maintained essentially unchanged for 300 million to 500 million years—appearing today exactly as they were when birds, reptiles, and mammals diverged from each other. Since UCEs were discovered in 2004, many ideas about their function and significance have been proposed, and yet they remain a mystery. Wu’s group has proposed that the maternal and paternal copies of UCEs undergo a process of side-by-side comparison; when the copies don’t match up, the individual’s fitness decreases, and the lineage eventually dies out. Thus UCEs may provide stability in the midst of genome change, helping sort good mutations from bad ones. Cancer

#WhatsaUCE

and other disease cells may grow unchecked in part because they have lost this surveillance function. Someday, Wu imagines, there might be therapies that prevent cancer, and even radiation damage for space travelers, by supporting the work of UCEs in blocking the proliferation of damaged cells.

### Ting Wu

*professor of genetics, Harvard Medical School  
director, Personal Genetics Education Project*

La Sala de Puerto Rico

### Next in space: Spray-on microthrusters for miniature satellites

One of the hottest items in space these days is the cubesat, a miniature satellite that you can build with off-the-shelf parts practically at home. Outfitted with miniature computers, cameras and equipment for communications, a fleet of cubesats can be lofted on a single rocket into space to do many of the things traditional satellites do, but much more affordably. Unfortunately, the ion engines that provide propulsion for satellites don't miniaturize, so cubesats can't move about once in space, and they may contribute to the space debris problem since they cannot push themselves out of orbit. Now Paulo Lozano has figured out how to miniaturize high-performance propulsion as well. Lozano's thrusters use thousands of microtips as emitters and liquid salt as a propellant, producing plenty of thrust in an ion propulsion system weighing just 100 grams. He envisions cubesats that would provide high-bandwidth communication to underserved regions of Earth or make cheap testing of space interferometers for science possible. Lozano will report on results from the first tests of the microspray propulsion engines.

@PauloLozanoMIT  
#TinyThrusters

### Paulo Lozano

*associate professor and chair of the graduate program, Department of Aeronautics and Astronautics, MIT*

noon – 2 p.m.

Student Center  
and other locations

### Lunch With a Luminary I

Organized by Knight Science Journalism  
*Pick up box lunch in Kresge Lobby*

### MIT Plasma Science and Fusion Center tour

*Pick up box lunch in Kresge Lobby for walk to Building NW17*

2 – 3 p.m.

Kresge Auditorium

### Patrusky Lecture

#### The Earth's microbiomes: Opportunities for research and policy

Thanks to an explosion of knowledge about microbiomes—the communities of microorganisms specific to varied habitats—scientists now realize that microorganisms control the health of virtually every ecosystem on Earth. The effects of microbiomes are far-reaching. The human microbiome is associated with chronic diseases such as obesity, diabetes, depression, and asthma, conditions long blamed on other causes. Microbiomes influence crop productivity, climate change, and ocean health. There is tremendous potential for managing microbiomes to achieve

@Jo\_OSTP

beneficial outcomes for human health, agricultural productivity, clean energy supply, environmental health, and the economy, but a new approach to microbiome research is needed.

### Jo Handelsman

*associate director for science, U.S. Office of Science and Technology Policy; Howard Hughes Medical Institute Professor and Frederick Phineas Rose Professor of Molecular, Cellular and Developmental Biology (on leave), Yale University*

3 – 3:30 a.m.

Kresge Lobby

### Break

3:30 – 4:30 p.m.

Kresge Auditorium

### Concurrent Sessions

#### Lessons from the lives of older homeless adults

An improving economy and local services may be making a dent in homelessness nationwide, but Margot Kushel is finding troubling developments on the streets. As a physician and researcher who has treated homeless patients in the San Francisco Bay area since the 1990s, she works with a population that is rapidly aging and carrying a heavy burden of chronic illness. Kushel and her research group are studying the lives of homeless older adults and their families, focusing on the growing numbers of 50-and-older adults who lost their homes as affordable housing disappeared in many cities. In a three-year study of 350 older homeless adults in Oakland, Calif., Kushel and her collaborators are encountering life stories that challenge many of the assumptions that currently drive policies and medical care for the homeless. They are asking why grandpa so often ends up on the streets—confused, unsafe and chronically ill—and whether public policy is contributing to the problem. Trying to treat the elderly as they struggle to survive on the streets, she says, is a matter of “doing the best we can do in an absurd situation.”

@mkushel

#OldandHomeless

### Margot Kushel

*professor of medicine, University of California San Francisco*

La Sala de Puerto Rico

#### Can computer science help physicists resolve the firewall paradox?

A bit like a black hole itself, a lively debate about something called the firewall paradox is inexorably sucking in theoretical physicists who venture near it. And now it's tugging at computer scientists, who may have novel approaches to help physicists unscramble the problem. The firewall paradox is a challenge to quantum mechanics uncovered in 2012 by a group of physicists who showed that black holes may generate unresolvable contradictions between fundamental laws of physics. One creative proposed solutions involves quantum computing, which connects the laws of quantum mechanics to information theory and ideas about computational complexity. Scott Aaronson, a computer scientist, is now collaborating with physicist Leonard Susskind on a thought experiment that extends this work, exploring the complexity dimensions of decoding the radiation coming

#BlackHoleFail

from a black hole. To Aaronson, a black hole is not only an extreme test of all the laws of physics but the most compact hard disk imaginable—one from which it's extremely hard to retrieve information.

**Scott Aaronson**

*associate professor of electrical engineering and computer science, MIT*

**4:30 – 5:30 p.m.**

Kresge Auditorium

*Science + Science  
Writing panel  
moderated by Tara  
Haele*

**Concurrent Sessions**

**Vaccines and vaccine hesitancy: Lessons for science writers**

Increasing measles and pertussis outbreaks, as well as state vaccine-related legislation, have put the spotlight on vaccines, vaccination rates, anti-vaccination sentiment and vaccine refusal, yet the quality and accuracy of coverage has been spotty at best, sometimes irresponsible and reckless. This panel will elucidate some poorly understood facts about vaccines, disease resurgence, and vaccine hesitancy. Participants will critique reporting on real and perceived risks of vaccines and vaccine injury claims and assess what lessons science writers can draw from the controversy. The panel will also discuss challenges in framing coverage about vaccines and persistent pitfalls in that coverage.

**Ari Brown**

*pediatrician*

*founder and chief executive officer, 411 Pediatrics, Austin, Texas*

**Seth Mnookin**

*co-director, MIT Graduate Program in Science Writing*

*author, The Panic Virus: The True Story Behind the Vaccine-Autism Controversy*

**Daniel Salmon**

*associate professor and deputy director, Institute for Vaccine Health, Bloomberg School of Public Health, Johns Hopkins University*

@baby411  
@tarahaele  
@sethmnookin  
#VaccineNuance

La Sala de Puerto Rico

**Controversy in the “Goldilocks zone” as the search for habitable exoplanets intensifies**

The explosion of known exoplanets has energized the quest to discover a habitable or “Earth-like” planet in a distant solar system. Exoplanet pioneer Sara Seager is one of many scientists building space- and Earth-based instruments to search for signs of life on planets far, far away. She expects that the next few years will bring a number of possible discoveries of the “first Earth-like planet” to rival the discovery of Earth “cousin” Kepler 452b in July. To prepare science writers for this phase of discoveries, she will share a developing predictive framework for assessing whether a planet might support life. And she will describe how scientists’ understanding of what a “habitable planet” might look like is evolving and expanding amid heated debate.

**Sara Seager**

*Class of 1941 professor of planetary science and physics, MIT*

@ProfSaraSeager  
#ExoplanetScience

**7 – 10 p.m.**

**ScienceWriters party**

The Boston Globe

*First buses depart from Hyatt 6:40 pm*



# MONDAY

OCTOBER 12

7:15 – 8:30 a.m.

Kresge Lobby

## Continental breakfast

8:30 – 9:30 a.m.

Kresge Auditorium

## Concurrent Sessions

*Science + Science  
Writing panel  
moderated by Ron  
Winslow*

### Money and medicine: Challenges and opportunities for science writers

Science writers are comfortable covering the most complex and arcane topics, but when it comes to corporate science they often don't engage. Yet amid a flurry of advances in biology, a major story today is how discovery is translated into new medicines—the province of entrepreneurs, venture capitalists and pharmaceutical companies. This panel draws on the resources of the Boston and Cambridge academic/biotech industry complex to provide a glimpse of the kind of translational science being done outside academia and a forum to discuss the challenges and opportunities of reporting at the intersection of innovation and commerce.

@ksbosley  
@schenkein  
@megtirrell  
@ronwinslow  
#BiotechStories

#### Katrine Bosley

*chief executive officer, Editas Medicine*

#### William N. Hait

*global head, research and development*

*Janssen Research & Development, Johnson & Johnson*

#### David Schenkein

*chief executive officer, Agios Pharmaceuticals*

#### Meg Tirrell

*reporter, CNBC*

La Sala de Puerto Rico

### Applying science to poverty

In the fight against poverty, what actually works? An MIT-based network of academics is applying science to answer that question. The Abdul Latif Jameel Poverty Action Lab uses randomized controlled trials to advise policymakers and non-governmental organizations on every kind of intervention that might be deployed to reduce poverty. Recently they conducted six experiments on microfinance in different countries, asking whether microloans were effective in boosting people out of poverty by enabling them to start businesses. The results suggested that these programs' vaunted repayment programs suppressed entrepreneurship; cash gifts and products that enabled people to save were far more effective in helping people lift themselves out of poverty.

#PovertyScience

#### Abhijit Banerjee

*Ford Foundation international professor of economics, MIT*

9:30 a.m. – noon

### Harvard John A. Paulson School of Engineering and Applied Sciences tour

*Bus departs from Kresge Lobby*

**9:30 – 10:30 a.m. Concurrent Sessions**

Kresge Auditorium

**Gathering big data on tiny devices: A path to better medical diagnosis?**

@MichaelJCima  
#TinyNMR

With today's sequencing techniques, every individual's genotype can be precisely described. But genetic information is useful to medicine only when it can be related to the same individual's actual condition, or phenotype. Michael Cima is one of a growing number of engineers looking for better ways to gather phenotypic data to enable comparisons of genetic patterns with patterns of disease and dysfunction, in many cases using wearable electronics. Among the devices he is developing is a miniaturized NMR-based sensor to determine an individual's hydration state—something not possible with current measurement tools. The project, driven by the military's need to address dehydration in the field, could improve kidney dialysis and reduce hospitalization of heart-failure patients. Cima is participating in a large-scale project that will use novel technologies to monitor and analyze the genotypes, phenotypes, and clinical outcomes of 10,000 super-volunteers to improve diagnosis and treatment.

**Michael J. Cima**

*David H. Koch professor of engineering and professor of materials science and engineering, MIT*

La Sala de Puerto Rico

**Mercury, fisheries and human health: Local threats and global challenges**

#OceanMercury

Although scientists know much about mercury poisoning in fish and those who eat them, there's still plenty of mystery about the processes that capture mercury from industrial pollution of air and rivers, as well as natural sources, and convert it in the sea to toxic, bioavailable methylmercury. Elsie Sunderland is among the scientists putting together the pieces of this puzzle even as it is changing. The Pacific tuna in U.S. stores and restaurants are just part of the story. Mercury associated with rapid industrial development in Asia is threatening fisheries that provide a livelihood for many in Southeast Asia and becoming buried in nearshore sediments. Meanwhile regulators and health advocates are challenged by open science questions, problems assessing risks and benefits, and consumer behavior. Sunderland will share current research and perspectives from her experience helping develop U.S. policy.

**Elsie Sunderland**

*associate professor of environmental science and engineering  
John A. Paulson School of Engineering and Applied Sciences and T. H. Chan School of Public Health, Harvard University*

**10:30 – 11 a.m.**

Kresge Lobby

**Break****10:30 a.m. – 2 p.m. Boston University Photonics Center tour**

*Bus departs from Kresge Lobby*

11 a.m. – noon

**Concurrent Sessions**

Kresge Auditorium

**How technology designers will dictate our civic future**

Technology designers are the new policymakers. No one elected them, and most people do not know their names, but the decisions they make when producing our gadgets and online innovations dictate the code by which we conduct our daily lives and govern our country. Challenges to the privacy and security of personal data are part of the first wave of this change; as technology progresses, says Latanya Sweeney, every demographic value and every law will likely be redefined by what technology does or does not enable. No one is thinking about how it all fits together or falls apart. Sweeney, who recently served as chief technology officer at the Federal Trade Commission and is writing a book on the topic, will discuss how to engineer the way forward.

@LatanyaSweeney  
#AppsRule

**Latanya Sweeney**

*professor of government and technology in residence, Harvard University*

La Sala de Puerto Rico

**Air pollution and hurricanes: A connection?**

Armed with supercomputers and vast and varied troves of data, meteorologists and climate scientists can now continually ask new questions about how human activity affects earth systems. Kerry Emanuel has been studying the forces behind cyclonic storms on Earth and other planets for decades. While many scientists focus on the radiative forcing that results from increasing carbon dioxide in the Earth atmosphere, Emanuel has recently looked more closely at aerosols in industrial emissions, such as sulfates, which are short-lived in the atmosphere but may have powerful effects on storm formation. He will report on current work to tease out the natural and anthropogenic factors that may be driving the frequency, intensity and other characteristics of North Atlantic hurricanes.

#WhyHurricanes

**Kerry Emanuel**

*Cecil and Ida Green professor of atmospheric science, MIT*

noon – 2 p.m.

Student Center  
and other locations**Lunch With a Luminary II and Ingredients for Innovation panel**

Organized by Knight Science Journalism  
*Pick up box lunch in Kresge Lobby*

2 – 4:30 p.m.

**Boston University National Emerging Infectious Diseases Laboratories tour**

*Bus departs from Kresge Lobby*

2 – 3 p.m.

Kresge Auditorium

**New observations and new ideas about cosmic inflation**

Proposed 35 years ago, the inflationary hypothesis is one of cosmology's sturdiest ideas and a continuing source of speculation and testing. Inflation inserts into the earliest instant of the big bang a period when space itself expanded exponentially, explaining why different regions of space have temperatures and curvatures that are nearly equal. In recent years there have been attempts to confirm inflation and look for evidence supporting different versions of the theory. Detailed observations of the cosmic microwave background

#CosmicInflation

have supported inflation, and several groups of astronomers are taking measurements that could shed additional light. Alan Guth, author of the hypothesis, will reflect on what was learned in last year's excitement over the BICEP2 team's measurement, what might come from current observations, and how inflation theory is being refined through interaction with "multiverse" theorists proposing that our universe is just one among others.

**Alan Guth**

*Victor F. Weisskopf professor of physics, MIT*

**3 – 3:30 p.m.**  
Kresge Lobby

**Break**

**3 – 5 p.m.**

**LabCentral tour**

*Departs from Kresge Lobby*

**3:30 – 5:30 p.m.**  
Kresge Auditorium

**Post-screening  
discussion  
moderated by  
Cristine Russell**

**Merchants of Doubt film screening and discussion**

The formal program for New Horizons in Science and ScienceWriters2015 wraps with a screening of a documentary that asks whether the U.S. public, journalists and policymakers have been taken in by a corporate spin machine bent on shaping the debate over climate change. Naomi Oreskes, co-author of the book on which the film is based, will join us for a short follow-up discussion.

@NaomiOreskes  
@MerchantsOfDoubt

**Naomi Oreskes**

*professor of the history of science and affiliated professor of earth and planetary sciences, Harvard University*

**5:30 – 7:30 p.m.**

**Broad Institute of Harvard and MIT tour**

*Bus departs from Kresge Lobby*

**8 – 10 p.m.**

**Story Collider**

*Oberon Theater, 2 Arrow Street in Harvard Square (travel on your own; prior registration required)*

## TUESDAY

**OCTOBER 13**

*All tours depart from the Hyatt Regency Cambridge*

**7:15 a.m. – 5 p.m.**

**Marine Biological Laboratory/Woods Hole Oceanographic Institution tour**

**9 – 11:30 a.m.**

**Biogen tour  
Dana-Farber Cancer Institute tour  
Harvard Museums of Science & Culture tour  
Johnson & Johnson Innovation tour  
Novartis Institutes for BioMedical Research tour**

**9:30 a.m.–12:30 p.m. Draper Laboratory tour**

# New Horizons in Science

## 2015 SPEAKERS



### **Scott Aaronson**

*associate professor of electrical engineering and computer science  
Massachusetts Institute of Technology*

Scott Aaronson's research focuses on the capabilities and limits of quantum computers, and more generally on computational complexity and its relationship to physics. Aaronson studied at Cornell and UC Berkeley and did postdoctoral research at the Institute for Advanced Study as well as the University of Waterloo.

His first book, *Quantum Computing Since Democritus*, was published in 2013 by Cambridge University Press. The son of a science writer, Aaronson has written about quantum computing for *Scientific American* and *The New York Times*, and writes the popular blog Shtetl-Optimized. He has received the National Science Foundation's Alan T. Waterman Award, the United States PECASE Award, and MIT's Junior Bose Award for Excellence in Teaching.

[www.scottaaronson.com](http://www.scottaaronson.com) • [aaronson@csail.mit.edu](mailto:aaronson@csail.mit.edu)



### **Abhijit Banerjee**

*Ford Foundation international professor of economics  
Massachusetts Institute of Technology*

Abhijit Banerjee applies science to combating poverty. He and Esther Duflo are directors of the MIT-based Abdul Latif Jameel Poverty Action Lab (J-PAL), a global network of researchers driven by a belief in the power of scientific evidence to understand what really helps the poor, and what does not. Banerjee, Duflo and their colleagues conduct randomized evaluations to test and improve the effectiveness of policies and programs and disseminate their results to policymakers, nonprofit organizations and foundations. The lab and its directors were recently awarded the 2014/15 Albert O. Hirschman Prize by the Social Science Research Council. In addition to his research publications, Banerjee's books include, with Duflo, *Poor Economics*, chosen as Goldman Sachs Business Book of the Year for 2011. Past president of the Bureau for Research in the Economic Analysis of Development, a research associate of the National Bureau of Economic Research and a fellow of the Econometric Society, he has also been a Guggenheim Fellow and an Alfred P. Sloan Fellow and was appointed in 2012 to the U.N. Secretary-General's High-level Panel of Eminent Persons on the Post-2015 Development Agenda. In 2014 Banerjee was honored with the Bernard Harms Prize, awarded every two years by the Kiel Institute for the World Economy.

[economics.mit.edu/faculty/banerjee](http://economics.mit.edu/faculty/banerjee) • [banerjee@mit.edu](mailto:banerjee@mit.edu)



**Katrine Bosley**  
*chief executive officer*  
*Editas Medicine*

Katrine Bosley is an experienced biotech entrepreneur. Before joining Editas, a Cambridge startup aiming to translate genome-editing technology into human therapeutics, she was the Entrepreneur-in-Residence at the Broad Institute, a biomedical and genomic research center founded by MIT and Harvard. Prior to that, she was CEO of Avila Therapeutics) and vice president for business development and then for strategic operations at Adnexus Therapeutics. Earlier, Bosley held several positions at Biogen in business development, commercial operations, and portfolio strategy and was part of the healthcare team at the venture firm Highland Capital Partners. She is a graduate of Cornell University. In addition to her role at Editas, Bosley currently serves as chairman of the board of Genocea Biosciences and is a board member of Galapagos NV and Scholar Rock, LLC. She is also a review committee member for the Translation Fund of the Wellcome Trust.

editasmedicine.com • ksb@editasmed.com



**Edward Boyden**  
*associate professor of biological engineering and brain and cognitive sciences, Media Lab and McGovern Institute*  
*Massachusetts Institute of Technology*

Ed Boyden leads MIT's Synthetic Neurobiology Group, which develops tools for analyzing and repairing complex biological systems such as the brain and applies them systematically to reveal ground-truth principles of biological function as well as to repair these systems. He also co-directs the MIT Center for Neurobiological Engineering. Among other recognitions, he has received the Carnegie Prize in Mind and Brain Sciences (2015), the Schuetze Prize (2014), the Jacob Heskell Gabbay Award (2013), the Lundbeck "Brain" Prize (2013), and the NIH Director's Pioneer Award (2013). In 2012, he was named to *Wired's* Smart List "50 People Who Will Change the World." He has launched an award-winning series of classes at MIT that teach principles of neuroengineering, starting with basic principles of how to control and observe neural functions, and culminating with strategies for launching companies in the nascent neurotechnology space. His group has hosted hundreds of visitors to learn how to use neurotechnologies. Boyden earned his Ph.D. in neurosciences as a Hertz Fellow at Stanford University after earning degrees in electrical engineering, computer science, and physics from MIT. He has contributed to more than 300 peer-reviewed papers, current or pending patents, and articles.

syntheticneurobiology.org • esb@media.mit.edu



**Ari Brown**  
*pediatrician; founder and chief executive officer*  
*411 Pediatrics, Austin, Texas*

In private practice for 20 years, Ari Brown is an author, child health advocate, and a mom. She received her B.S. in child development and family relationships from the University of Texas at Austin and her medical degree from Baylor College of Medicine, and completed her pediatric residency and fellowship training in developmental and behavioral pediatrics at Harvard Medical School and Boston

Children's Hospital. Passionate about educating families about children's health, she is the author of the bestselling "411" parenting book series, including *Baby 411: Clear Answers and Smart Advice for your Baby's First Year* (7th Edition 2015), *Expecting 411*, and *Toddler 411*. She serves as a medical adviser for *Parents* magazine and a spokeswoman for the American Academy of Pediatrics and speaks to healthcare professionals and parenting groups across the country regarding accurate and compassionate health communications with families. Brown currently chairs the AAP Children, Adolescents, and Media Leadership Working Group, charged with addressing the evolving role technology plays in the lives of children, and was honored with the AAP Advocacy Award in 2012.

DrAriBrown.com • baby411doc@gmail.com



**Sallie W. "Penny" Chisholm**

*Institute Professor of environmental studies and professor of biology  
Massachusetts Institute of Technology*

Penny Chisholm is a biological oceanographer who holds a joint appointment between MIT's departments of Civil and Environmental Engineering and Biology. Her research focuses on understanding of the role of microorganisms in shaping marine ecosystems. It is centered on understanding the biology and ecology of *Prochlorococcus*, the smallest and most abundant photosynthetic microorganism on Earth. Discovered only 30 years ago, it numerically dominates large regions of the world's oceans and is responsible for a sizable fraction of ocean photosynthesis. In addition to her scientific publications, Chisholm has published (with Molly Bang) three award-winning children's picture books—*Living Sunlight*, *Ocean Sunlight*, and *Buried Sunlight*—which describe the central role of photosynthesis in shaping life on Earth. Chisholm has been a member of the MIT Faculty since 1976. She is a member of the National Academy of Sciences and the American Academy of Arts and Sciences, has been a Guggenheim Fellow, and has received the Alexander Agassiz Medal, the Margalef Prize in Ecology, and the National Medal of Science.

chisholmlab.mit.edu • thesunlightseries.com • chisholm@mit.edu



**Michael J. Cima**

*David H. Koch professor of engineering, Koch Institute for Integrative Cancer Research, and professor of materials science and engineering  
Massachusetts Institute of Technology*

Michael Cima is author or co-author of more than 250 scientific publications and 58 U.S. patents and is a recognized expert in the field of materials processing. Cima is actively involved in materials and engineered systems for improvement in human health such as treatments for cancer, metabolic diseases, trauma, and urological disorders. His research concerns advanced forming technology such as for complex macro- and microdevices, colloid science, microelectromechanical systems and other microcomponents for medical devices used for drug delivery and diagnostics. In the early 1990s, Cima co-invented one of the first practical 3D printers. He is also the top faculty member at the Lemelson-MIT Program, which makes awards to recognize promising collegiate and mid-career inventors and funds STEM education initiatives at the high school level. His honors include election to the National Academy of Engineering in 2011.

ki.mit.edu/people/faculty/cima • mjcima@mit.edu

**Kerry Emanuel**

*Cecil and Ida Green professor of atmospheric science  
Massachusetts Institute of Technology*

Kerry Emanuel joined the faculty of MIT, his alma mater, in 1981 after three years on the UCLA faculty. His research focuses on tropical meteorology and climate, with a specialty in hurricane physics. His interests also include cumulus convection, and advanced methods of sampling the atmosphere in aid of numerical weather prediction.

He is the author or co-author of more than 200 peer-reviewed papers. His books include *Divine Wind: The History and Science of Hurricanes* (Oxford University Press, 2005), and *What We Know about Climate Change* (MIT Press, 2007). Elected to the National Academy of Sciences in 2007, he is a co-director of MIT's Lorenz Center, a climate think tank devoted to basic, curiosity-driven climate research.

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**Alan Guth**

*Victor F. Weisskopf professor of physics  
Massachusetts Institute of Technology*

As a postdoctoral researcher after completing his Ph.D. in physics at MIT in 1971, Alan Guth worked mostly on abstract mathematical problems in the theory of elementary particles. While at Cornell, he was persuaded by fellow postdoc Henry Tye to collaborate on work that would change the direction of Guth's career. The two found that standard assumptions in particle physics and cosmology

would lead to a fantastic overproduction of magnetic monopoles. From the search for alternatives came Guth's modification of the big bang theory, the inflationary universe. Since returning to MIT as an associate professor in 1980, Guth has refined the inflationary model through interactions with theorists in particle physics, string theory, relativity and quantum mechanics as well as evidence from astronomy and cosmology. He has been elected to the National Academy of Sciences and the American Academy of Arts and Sciences, and has been awarded the MIT School of Science Prize for Undergraduate Teaching, the Franklin Medal for Physics of the Franklin Institute, and the Dirac Prize of the Abdus Salam International Center for Theoretical Physics. In addition to holding a named professorship, he is a Margaret MacVicar Faculty Fellow at MIT.

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**William N. Hait**

*global head, research and development  
Janssen, pharmaceutical companies of Johnson & Johnson*

Bill Hait is an oncologist who heads Janssen Research & Development, the global pharmaceutical research and development group of Johnson & Johnson. He holds an M.D. and a Ph.D. in pharmacology from the Medical College of Pennsylvania. He joined the Yale University School of Medicine faculty in 1984 and rose to chief of the Division of Medical Oncology, taking

leadership roles in the breast cancer and lung cancer programs of the Yale University Comprehensive Cancer Center. A former president of the American Association for Cancer Research and a Fellow of the AACR Academy, he has served as editor-in-chief of *Clinical*



*Cancer Research* and associate editor of *Cancer Research*. Before joining Janssen, he was founding director of The (Rutgers) Cancer Institute of New Jersey.

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**Jo Handelsman**  
**2015 PATRUSKY LECTURER**

*associate director for science, U.S. Office of Science and Technology Policy*

*Howard Hughes Medical Institute Professor and Frederick Phineas Rose Professor of Molecular, Cellular and Developmental Biology (on leave) Yale University*

Appointed by President Obama and confirmed by the Senate in June 2014, biologist Jo Handelsman has taken a public service leave from Yale University to focus on advancing basic research and developing targeted areas in biological research, STEM education, and diversity in science. During her White House service, Handelsman's Yale laboratory is continuing studies to understand diversity in microbial communities and the role of these communities in infectious disease. Current research uses the fruit fly gut as a model for the microbiology of the human gut and employs functional metagenomics to probe microbial communities' genetic and biochemical diversity. Handelsman, who is making her third appearance at New Horizons in Science, earned her Ph.D. in molecular biology at the University of Wisconsin-Madison and joined UW's plant pathology faculty in 1985. After serving in a number of roles, including chair of the Department of Bacteriology, she moved to Yale in 2010. Her teaching, mentorship and research and her promotion of opportunities for women and minorities in science have been recognized with a number of awards. She received the Presidential Award for Excellence in Science, Mathematics and Engineering Mentoring in 2011 and also co-chaired the PCAST working group that developed *Engage to Excel*, a 2012 report making recommendations for strengthening STEM education to meet workforce needs. She has also served the scientific community as a panel member, peer reviewer and journal editor and as president of the American Society for Microbiology.

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**Margot Kushel**  
*professor of medicine*  
*University of California San Francisco*  
*internist, San Francisco General Hospital*

Margot Kushel's research is informed by her 20 years of experience as a practicing internist at San Francisco General. She studies the health and health care utilization patterns of homeless adults and other vulnerable populations, with a focus on improving outcomes among older homeless adults. Her other interests include the use and misuse of prescription opioid analgesics and improving access and quality of care in safety-net settings. In this work, she uses descriptive epidemiology and develops, implements and evaluates novel interventions designed to improve outcomes. Kushel is the principal investigator for two studies on older homeless adults funded by the National Institute on Aging. One focuses on the causes and consequences of geriatric conditions, the other on family-assisted housing as an intervention. Kushel has also obtained support

for her work as a mentor for junior investigators interested in improving health outcomes among older vulnerable populations. She is co-director of the UCSF Primary Care Research Fellowship, which trains primary care physicians and recent Ph.D.'s in research of relevance to primary care. Kushel obtained her M.D. from Yale and completed a residency, chief residency and fellowship in internal medicine at UCSF.

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**Paulo Lozano**

*associate professor and chair of the graduate program, Department of Aeronautics and Astronautics  
Massachusetts Institute of Technology*

Paulo Lozano heads MIT's Space Propulsion Laboratory, where his group develops highly efficient, compact ion thrusters for small spacecraft. His main interests are in plasma physics, space propulsion, ion beam physics, small satellites and nanotechnology. His work on micro-propulsion, which is sponsored by NASA,

defense research agencies, the National Science Foundation and other public and private sources, earned a Young Investigator Program Award from the U.S. Air Force and the "Future Mind" award from *Quo Science* magazine and the Discovery Channel. A recipient of MIT's Outstanding Faculty Mentor Award for his contributions to the research experience of undergraduate students, Lozano teaches space and rocket propulsion, fluid mechanics and plasma physics and was recently named faculty director of MIT Mexico. An associate fellow of the American Institute of Aeronautics and Astronautics, he served on the Asteroid Mitigation and NASA Technology Roadmaps panels of the National Research Council. Lozano earned his master's and doctoral degrees in space propulsion at MIT.

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**Seth Mnookin**

*co-director, Graduate Program in Science Writing  
Massachusetts Institute of Technology*

Seth Mnookin's most recent book, *The Panic Virus: The True Story Behind the Vaccine-Autism Controversy*, won NASW's 2012 Science in Society Award. He is also the author of the 2006 *New York Times* bestseller *Feeding the Monster: How Money, Smarts, and Nerve Took a Team to the Top*, which chronicles the challenges and triumphs of the John Henry–Tom Werner ownership group of the

Boston Red Sox. His first book, 2004's *Hard News: The Scandals at The New York Times and Their Meaning for American Media*, was a *Washington Post* Best Book of the Year. Mnookin is currently a member of the FDA's Expert Working Group on Medical Countermeasure Emergency Communication Strategies. Since 2005, he's been a contributing editor at *Vanity Fair*. His essays and reporting have been featured in the annual *Best American Science and Nature Writing* anthologies, and his journalism has appeared in numerous publications, including the *New Yorker*, *New York*, *Wired*, the *New York Times*, the *Washington Post*, the *Boston Globe*, *Spin*, *Slate*, and *Salon.com*. A former music columnist for the *New York Observer*, he began his journalism career as a rock critic and has also worked as a crime reporter, city hall reporter, a presidential campaign reporter, and a jack-of-all-trades. A history and science graduate of Harvard College, he was a 2004 Joan Shorenstein Fellow at Harvard's Kennedy School of Government.

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**Naomi Oreskes**

*professor of the history of science and affiliated professor of earth and planetary sciences  
Harvard University*

Naomi Oreskes is a historian of science with a particular interest in understanding scientific consensus and dissent. She joined the Harvard faculty in 2013 after 15 years on the faculty of the University of California, San Diego, and the Scripps Institution of Oceanography. Oreskes's research focuses on the earth and environmental sciences, which were the focus of her scientific training and early research. In a 2004 essay "The Scientific Consensus on Climate Change," Oreskes made waves with an analysis of the scientific literature concluding that 75 percent of published abstracts on climate change supported the consensus on anthropogenic climate change. Her 2010 book *Merchants of Doubt: How a Handful of Scientists Obscured the Truth on Issues from Tobacco to Global Warming*, co-authored with Caltech historian Erik M. Conway, is the basis of the documentary "Merchants of Doubt" and was awarded the 2011 Watson-Davis Prize by the History of Science Society. Oreskes received her Ph.D. from Stanford's graduate special program in geological research and history of science. Her most recent book, also with Erik Conway, is science-based fiction. *The Collapse of Western Civilization: A View from the Future* imagines a world devastated by climate change.

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**Daniel Salmon**

*associate professor and deputy director, Institute for Vaccine Health,  
Bloomberg School of Public Health  
The Johns Hopkins University*

Dan Salmon's primary research and practice interest is in optimizing the prevention of childhood infectious diseases through the use of vaccines. He has focused on post-licensure vaccine safety and the factors associated with parental decisions to vaccinate, or not vaccinate, their children. He has conducted studies examining the rates of vaccine refusal, the reasons why parents refuse vaccines, the impact of health care providers and local and state policies on vaccine refusal and the individual and community risks of unvaccinated children. He joined the faculty of the Johns Hopkins Bloomberg School of Public Health after serving as the director of vaccine safety at the National Vaccine Program Office, where he was responsible for coordinating federal vaccine safety activities. He holds master's and doctoral degrees in public health from Emory and Johns Hopkins universities, respectively.

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**David Schenkein**

*chief executive officer, Agios Pharmaceuticals*

David Schenkein has been a hematologist and medical oncologist for more than 20 years. He currently serves as an adjunct attending physician in hematology at Tufts Medical Center and is a member of the board of directors for the Biotechnology Industry Organization, the world's largest biotechnology trade association. Prior to joining Agios as CEO in 2009, he was the senior vice president, clinical hematology/oncology, at Genentech, Inc., where he was responsible

for numerous successful oncology drug approvals and leading the medical and scientific strategies for their BioOncology portfolio. While at Genentech, he served as an adjunct clinical professor of medical oncology at Stanford University School of Medicine. Earlier he served as senior vice president of clinical research at Millennium Pharmaceuticals, overseeing the clinical development and worldwide approval of the cancer therapy Velcade. Schenkein holds an M.D. from the State University of New York Upstate Medical School.

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**Sara Seager**

*Class of 1941 professor of planetary science and physics  
Massachusetts Institute of Technology*

Sara Seager is an astrophysicist and planetary scientist whose research focuses on theory, computation, and data analysis of exoplanets. Her work led to the first detection of an exoplanet atmosphere and has introduced many new ideas to the field of exoplanet characterization. Her space instrumentation group is focusing on “ExoplanetSat,” a nanosatellite capable of high-precision pointing for discovering transiting exoplanets. She is a co-investigator on TESS, a NASA Explorer Mission to be launched in 2017, and chairs the NASA Science and Technology Definition Team for a “Probe-class” starshade and telescope system for direct imaging discovery and characterization of Earth analogs. After earning her Ph.D. at Harvard in 1999 and before joining MIT in 2007, Seager spent four years on the senior research staff at the Carnegie Institution of Washington, preceded by three years at the Institute for Advanced Study. She is a 2013 MacArthur Fellow, the 2012 recipient of the Raymond and Beverly Sackler Prize in the Physical Sciences, and the 2007 recipient of the American Astronomical Society’s Helen B. Warner Prize. Sometimes called an “astronomical Indiana Jones,” she was included in *Time* magazine’s 25 Most Influential in Space in 2012.

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**Alan Stern**

*associate vice president for research and development  
Space Science and Engineering Division, Southwest Research Institute*

Alan Stern has been principal investigator of NASA’s New Horizons Mission since before it was authorized by NASA in 2001. He has been involved in 24 space missions and served as principal investigator for eight of them. In addition to his work as a planetary scientist and developer of scientific instruments for planetary and near-space research, he has been a NASA administrator, aerospace consultant, and author. Stern first joined the Southwest Research Institute as a scientist in 1991 after working as an engineer and researcher at Martin Marietta Aerospace and the University of Colorado (Boulder), where he earned his Ph.D. in astrophysics and planetary science. He served as associate administrator of NASA’s Science Mission Directorate in 2007 and returned to SwRI in 2008. Co-author with Jacqueline Milton of *Pluto and Charon: Ice Worlds on the Ragged Edge of the Solar System* (2nd edition 2005), he has been involved with private space ventures including the Moon Express team pursuing the Google Lunar X-Prize and his own space-products company, Uwingu. He also serves on the board of the Challenger Center for Space Science Education. Earlier in 2015 he was named an Honorary Fellow of the Royal Astronomical Society and chosen by *Smithsonian* magazine to receive an American Ingenuity Award.

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**Elsie Sunderland**

*associate professor of environmental science and engineering, John A. Paulson School of Engineering and Applied Sciences and T.H. Chan School of Public Health  
Harvard University*

Elsie Sunderland studies how biogeochemical processes affect the fate, transport and food-web bioaccumulation of trace metals and organic chemicals in aquatic ecosystems. She began work tracing mercury in the marine food web in the late 1990s as a Ph.D. student in environmental toxicology at Simon Fraser University. After completing her degree, she held several positions at the U.S. Environmental Protection Agency, working on air pollution policy and regulation and the use of models at EPA. She came to Harvard as a research associate and joined the faculty of the Chan School as an assistant professor of aquatic science in 2010. She joined the engineering faculty in 2014. She is associated with both the Harvard University Center for the Environment and the Harvard Center for Risk Analysis. Her group develops and applies models at a variety of scales ranging from ecosystems and ocean basins to global applications to characterize how changes in climate and emissions affect human and ecological health and assess the potential impacts of regulatory activities.

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**Latanya Sweeney**

*professor of government and technology in residence  
director, Data Privacy Lab, Institute for Quantitative Social Science  
Harvard University*

Latanya Sweeney is a computer scientist who creates and uses technology to assess and solve societal, political and governance problems, and teaches others how to do the same. She founded the Data Privacy Lab at Carnegie Mellon University before joining the Harvard faculty. She was formerly the Chief Technology Officer (also called the Chief Technologist) at the U.S. Federal Trade Commission. Her work on data privacy technology was recognized by the Patient Privacy Rights Foundation with the 2014 Louis D. Brandeis Privacy Award and has also won awards from the American Psychiatric Association, American Medical Informatics Association and the Blue Cross Blue Shield Association. Sweeney is an elected fellow of the American College of Medical Informatics and author of more than 100 academic publications and patents. She holds a Ph.D. in computer science from MIT.

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**Meg Tirrell**

*reporter  
CNBC*

Meg Tirrell joined CNBC in April 2014 as a general assignment reporter focusing on biotechnology and pharmaceuticals. She appears on CNBC's Business Day programming, contributes to CNBC.com and is based at the network's global headquarters in Englewood Cliffs, N.J. Prior to joining CNBC, she led coverage of the biotechnology industry for Bloomberg News. She broke news on proxy fights, mergers and acquisitions, and drug development, and wrote features that illuminate how science and business meet. She also contributed to Bloomberg Television

and *Bloomberg Businessweek*. She holds a master's degree in journalism from Northwestern University and a bachelor's degree in English and music from Wellesley College.

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**Ting Wu**

*professor of genetics, Harvard Medical School  
director, Personal Genetics Education Project  
Harvard University*

Ting (C.-ting) Wu's laboratory investigates how the organization of chromosomes within the nucleus can influence gene expression in various organisms. Her particular focus in this area is the behavior of homologous chromosomes—how they sense each other, find each other, and then, in certain circumstances, physically pair, influencing gene activity and possibly even genome evolution. Her laboratory also develops new technologies, ranging from protocols for engineering genomes to strategies for visualizing chromosomes with nucleic acid probes. Wu also works to increase public awareness of the benefits and ethical implications of learning the details of one's genome. She founded the Personal Genome Education Project, which is dedicated to making that awareness equally accessible regardless of socioeconomic, cultural, ethnic, and religious influences. Wu completed her genetics Ph.D. at Harvard, did research at Stanford and Yale, and returned to Boston as a fellow at Massachusetts General Hospital before joining the Harvard faculty. She was honored in 2012 with the NIH Director's Pioneer Award for her work on chromosome organization and inheritance.

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**Tara Haelle**

*freelance science journalist*

Tara Haelle specializes in writing about vaccines, infectious disease, pediatrics, prenatal health and other areas of medicine as well as marine biology and environmental science. She is a *Forbes* contributor whose work also appears in NPR, *Scientific American*, *Slate*, *Politico*, *HealthDay*, *Everyday Health*, *Medscape*, *Muse*, *Science News for Students*, the *Washington Post*, *Wired* and elsewhere. She coauthored *The Informed*

*Parent: A Science-Based Guide to the First Four Years*, due in April 2016, with Emily Willingham, and she blogs about evidence-based parenting at Red Wine & Applesauce.



**Ron Winslow**

*deputy editor, health and science, and senior medical and health care writer, Wall Street Journal*

Ron Winslow has written some 1,500 articles describing new medical and health care research and chronicling the economic forces transforming the nation's health care system. He is a recipient of the CASW Victor Cohn Prize for Excellence in Medical Science Reporting. His work has also won awards from the New York Press Club, the

Association of Health Care Journalists, the American Heart Association and other groups. A founding board member of the Association of Health Care Journalists, he is immediate past president of NASW.

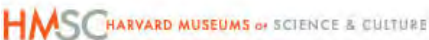
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