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For almost 30 years, Science and its Breakthrough of the Year issues have been observing and commemorating the essence of humanity: our innate hunger to understand and document the world around us. These issues serve us in two ways: They celebrate moments of success in science and engineering, and act as a prompt, encouraging us to ask even more questions.

To encourage adolescents to inquire more about science, the Tencent Youth Science Festival—a forum targeting the youth in China and cosponsored by Science/AAAS and Tencent, a China-based tech giant and artificial intelligence (AI) leader—will be launched in January 2019. A shortlist of breakthrough topics was collated by the News team at Science and provided to Tencent, which leveraged its social, data, and analysis services to gauge the interests of more than 100,000 young users, providing the final 10 breakthrough topics that will be discussed at the forum and also published online on the Science website on January 20.

Although the breakthroughs reported are diverse, spanning all fields of science, technology, engineering, and math (STEM), they can all be defined according to their scale. For example, some of these achievements deal with the macroworlds of our solar system and our planet, such as the discovery of liquid water on Mars, and an examination of samples from the Earth’s oldest ice cores, which has given us a clearer picture of Earth’s atmosphere 2.7 million years ago. Some breakthroughs have expanded the scale of human history, such as a skull found in a Moroccan cave that astonishingly turned back the clock for the emergence of the first Homo sapiens to 300,000 years ago—100,000 years earlier than previously thought!

Other breakthroughs demonstrate the ability to examine our universe on a smaller scale. For instance, we are now uncovering increasingly detailed information about our cells and our enigmatic brains. And recently, scientists have started to better understand and even tinker with memory’s physical framework, discovering ways to manipulate specific memories in mice using optogenetics, a powerful technique that harnesses laser light to trigger nerve cells in animals’ brains. In addition, we have begun to unravel the mystery of sleep and the fact that it serves not just as a way to rest, but as a mechanism to flush out debris from our cells that could cause plaques associated with Alzheimer’s disease.

Groundbreaking techniques such as CRISPR, which can be used to edit genes, and new interdisciplinary fields like synthetic biology, which integrates innovations in engineering and the life sciences, are helping us comprehend our lives at even smaller scales. For example, new knowledge concerning the human microbiome, and the body’s role as a vast “apartment complex” that serves as home to trillions of microbes, will help us appreciate how these tiny “tenants” impact human health.

The more we understand about ourselves at the cellular level and below, the more we can influence systems on much larger scales. Our knowledge of how neurons work has led to the first large-scale neuromorphic chips, designed to process information in ways similar to human brains. And our increasing comprehension of human cognition has enabled scientists to show that autonomous robot-robot communication is possible, and will allow these devices to “think” and act together, improving their efficiency and capacity to “learn.” Advances in artificial intelligence have also made it possible for the newest robots to navigate unmapped environments.

A lot of uncharted territory remains in science. But make no mistake: Each new discovery, while seemingly small, is a thread woven together with all our previous knowledge into an extremely strong cord. And it is this cord that unites us, inspires us, guides us, and defines us as human beings in our quest for greater understanding.

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CDR-H3 residue utilization in antibodies derived from human samples and the Trianni transgenic Ig Mouse. In the naive Trianni Mouse, heavy chain CDR3 (CDR-H3) aa utilization frequency is effectively the same in humans and in The Trianni Mouse.

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CARBON CYCLE PROCESSES, POLICIES, AND UNCERTAINTIES: NEW PERSPECTIVES
Organized by Maureen McCarthy, University of Nevada, Reno, NV; Gyami Shrestha, U.S. Global Change Research Program, Washington, DC

CLUTCHING AT STRAWS: SCIENCE ADVICE, UNCERTAINTY, AND GLOBAL MICROPLASTIC POLLUTION
Organized by Jeremy Bray, European Commission, Brussels, Belgium

EXTREME EVENT ATTRIBUTION IN THE CONTEXT OF CLIMATE CHANGE
Organized by Francis Zwiers, University of Victoria, Canada; Debbie J. Dupuis, HEC Montreal, Canada
CLIMATE CHANGE: UNDERSTANDING FEEDBACK FROM NATURE, CULTURE, AND SOCIETY
Organized by Marianne Lucien, ETH Zürich, Switzerland

COMMUNITY RESPONSES TO CLIMATE CHANGE
Organized by Emily Therese Cloyd and Elana Kimbrell, AAAS, Washington, DC

ECOLOGIES OF INNOVATION: THE POTENTIAL FOR BIOTECHNOLOGY TO ADDRESS FOREST HEALTH
Organized by Kara Laney, National Academies of Sciences, Engineering, and Medicine, Washington, DC

ENVIRONMENTAL AND TEXTILE SCIENTISTS COMBATING MICROPLASTIC POLLUTION
Organized by Margaret Murphy, Washington, DC; Judith Weis, Rutgers University, Newark, NJ

ENVIRONMENTAL HEALTH DATA INTEGRATION: MEASUREMENT AND IMPACT
Organized by Andrea Hodgson and Ben Wender, The National Academies of Sciences, Engineering, and Medicine, Washington, DC

ENVIRONMENTAL MICROBIOMES: BACTERIAL AND FUNGAL COMMUNITIES IN EXTREME ECOSYSTEMS
Organized by Barbara Illman, U.S. Forest Service, Madison, WI

HOMES AT THE CENTER OF CHEMICAL EXPOSURE: UNITING CHEMISTS, ENGINEERS AND HEALTH SCIENTISTS
Organized by Glenn Morrison, University of North Carolina at Chapel Hill, NC; Jon Abbatt, University of Toronto, Canada

PLASTICS IN THE OCEANS: SOURCES, SINKS, AND SOLUTIONS
Organized by Linsey Haram and Christina Simkanin, Smithsonian Environmental Research Center, Edgewater, MD

SUSTAINABILITY SCIENCE AND PUBLIC ENGAGEMENT: INVOLVING LAND OWNERS IN RESEARCH
Organized by Kimberly La Pierre, Smithsonian Environmental Research Center, Edgewater, MD; Sally Koerner, University of North Carolina, Greensboro, NC

THE FOURTH NATIONAL CLIMATE ASSESSMENT: ADVANCING SCIENCE, INFORMING DECISIONS
Organized by Katie Reeves, U.S. Global Change Research Program, Washington, DC; Donald J. Wuebbles, University of Illinois at Urbana-Champaign, IL

TRANSBOUNDARY AIR POLLUTION: THE IMPACT OF SCIENCE ON POLICY
Organized by Terry Keaning, U.S. Environmental Protection Agency, Washington, DC; Barry Lefer, NASA, Washington, DC

Sharing Science

A FEWIST AGENDA FOR SCIENCE COMMUNICATION: NECESSARY AND TIMELY
Organized by Megan Halpern, Michigan State University, East Lansing, MI

AGRICULTURAL INNOVATION AND UPTAKE: USING A MULTI-Actor APPROACH
Organized by Jean-Marc Gautier, Institut de l’Elevage, Castanet-Tolosan Cedex, France; Cathy Dwyer, Scotland’s Rural College, Midlothian, United Kingdom

FIGHTING FAKE NEWS: VIEWS FROM SOCIAL AND COMPUTATIONAL SCIENCE
Organized by Stephan Lewandowsky, University of Bristol, United Kingdom; Edward W. Maibach, George Mason University, Fairfax, VA

GLOBALIZATION OF THE STEM WORKFORCE: IMPLICATIONS FOR CAREERS AND INSTITUTIONS
Organized by Julia E. Melkers, Georgia Institute of Technology, Atlanta, GA; Eric Welch, Arizona State University, Phoenix, AZ

HUMAN GENETIC VARIATION AND EDUCATION: NOT A SOCIALLY NEUTRAL ENDEAVOR
Organized by Jonathan Beckwith, Harvard Medical School, Boston, MA; Kostia Bergman, Northeastern University, Boston, MA

HUMAN RESOURCE DEVELOPMENT AND DIVERSITY: INSIGHTS FROM PUBLIC AND PRIVATE SECTORS
Organized by Takashi Inutsuka, Ministry of Education, Culture, Sports, Science and Technology, Tokyo, Japan

IMPROVING ATTITUDES TOWARDS CHEMISTRY THROUGH INFORMAL SCIENCE COMMUNICATION
Organized by Larry Bell and David Sittenfeld, Museum of Science, Boston, MA

SCIENCE ENGAGEMENT WITH FAITH COMMUNITIES
Organized by Robert O’Malley, AAAS, Washington, DC

SCIENTIFIC INTEGRITY: PRINCIPLES AND BEST PRACTICES
Organized by Alison Kretser, International Life Sciences Institute North America, Washington, DC

TALKING WITHOUT SPEAKING: OVERCOMING COMMUNICATION CHALLENGES WITH TECHNOLOGY
Organized by Nan Ratner, University of Maryland, College Park, MD

TECHNOLOGY TRANSFER AND INNOVATION: RESHAPING LABORATORY-MARKET RELATIONSHIPS
Organized by Heather Evans, National Institute of Standards and Technology, Gaithersburg, MD; Anice Anderson, Private Engineering Consulting, Carmel, IN

TECHNOLOGY TRANSFER FROM BLUE SKY SCIENCE: AVOIDING PITFALLS, MAXIMIZING RETURNS
Organized by Terry O’Connor, UK Research and Innovation, Swindon, United Kingdom; Ana Godinho, CERN, Geneva, Switzerland

THE BIOLOGY OF RESILIENCE: HOW SCIENCE AND FAITH COMMUNITIES CAN WORK TOGETHER
Organized by Se Y. Kim and Curtis Baxter, AAAS, Washington, DC

YOUTUBE: FRIEND OR FOE IN COMMUNICATING ABOUT SCIENCE AND HEALTH
Organized by Erik Bucy and Ashley Landrum, Texas Tech University, Lubbock, TX
Flash Talks

Brief presentations highlighting scientific findings and programs

A Balancing Act: Navigating Jargon Use When Communicating with Citizen Scientists
The Biology of Fatherhood: Adaptive Origins, Day-to-Day Functions, and Men’s Health
Building a Seismic Network in Africa
Developing Engagement Through Early Career Science Policy Groups
Development of a Transdisciplinary Scale to Measure Household Water Insecurity
Drivers of Data Ecologies in Genomics and the Infrastructure Sciences
Engagement and the All of Us Research Program: Meeting People Where They Are
Environmental Perceptions and Migration Decisions Within the United States Gulf Coast
Football, Disabilities, and Engineering: Customer Centered Innovation
From Pipette to Pen: A Scientist’s Summer in the Newsroom
Gut Microbiome of Bees and Wasps
Hard Lessons from the Soft Sciences on Gender in Engineering and Technology
International Partnerships and the Open Knowledge Africa Platform
Making Hands-on Biology Experiences Accessible for Everyone
March Mammal Madness: The Power of Science as Narrative
The Next NASA Golden Record Anchored in Science, Information, and Digital Literacies
Nonlinear Optical Study of Two-Dimensional Materials
Optical Markers and Biomarkers for the Risk Assessment of Oral Premalignant Lesions
Promising Genetic Research for Prognosis and Treatment of Many Cancers
Public Engagement Leadership: A Journey From Practitioner to Change Agent
Regenerative Medicine and Tissue Engineering: Transforming 21st Century Medicine
#ScientistsWhoSelfie: Instagramming the Way to Public Trust
The Second Quantum Revolution
The Shape of Human Evolution
Using Policy Analysis to Engage Policymakers and the Public with Research Results
Using Science to Engage Business
Virtual Scientific Communities: Choose Development! Takes Broadening Participation to the Next Level
Zika Virus Mediated Immunopathology: Defining Disease Damage to Infectious Agents

Career Workshops

Opportunities to gain advice and strategies from experienced STEM professionals

A Shared Vision: Overcoming the Barriers for Scientists to Communicate and Engage
Accessibility and Inclusion in STEM Education
Applying Negotiation Tools to Improve Communication and Address Conflict
Attract Recruiters and Jump-start Networking With an All Star LinkedIn Profile
Authorship Decisions: Advocating for Representation
Conducting Science Outreach Online: Social and Multimedia
Diversity + STEM = X: Solving the Equation for Higher Education and the Workforce
Exceptional Presentations in Spite of PowerPoint: How to Communicate Science in the Digital Age
Finding Your Voice: Storytelling Lessons for Scientists
Formulate to Communicate: Heroes, Improv, and Science Storytelling
From a Moment to a Movement: Building Infrastructure to Sustain Scientist Advocacy
Influencing Policy: Opportunities for Scientists and Engineers
LGBTQ+ in Academia and the Workplace: Rights and the Law
Making the Most of the First Two Years On the Tenure Track
Overcoming the STEM-Policy Divide with Fellowships in State Governments
Polish Pitches—For Scientists, Researchers, and Science Journalists
Research Funding: Exploring Programs in the European Union
Scholarly Publishing: Avoiding Pitfalls and Showing Impact
Scientists Engaged in Human Rights: Professional Societies Offer Opportunities
Scientists Who Draw Comics: The Double Life of Visual Science Communicators
YouTube as Outreach: How to Document Research Using Social Media and Video
The Gender Dimension of Science Advice
The Global Entrepreneur: How to Harness International Innovation
Celebrating Scientific Milestones
with the following special sessions and other exciting activities:

NEARLY DOUBLE PLATINUM:
150 YEARS OF THE PERIODIC TABLE

THE LEGACY OF THE APOLLO
PROGRAM: 1969 TO 2069

ARPANET: CELEBRATING 50 YEARS
SINCE “LO”

AAAS Film Showcase
presented in partnership with

AlphaGo
Attenborough’s Ant Mountain
The Kingdom—How Fungi Made Our World

Let There Be Light
Mosquito
Space’s Deepest Secrets: Cassini’s Grand Finale

Advance registration rates are available now through January 22, 2019.

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<tr>
<th>General Attendee</th>
<th>Advance Rates for AAAS Member for members in good standing</th>
<th>Advance Rates for Non-Member for all other attendees</th>
<th>On-site Rates after 1/22/2019 AAAS Member/Non-Member</th>
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According to the 2017 Member Survey, you joined AAAS ...

- to subscribe to Science magazine: 3.63
- to support formal advocacy for STEM: 4.16
- to be part of a larger community that supports STEM: 3.98
- to show public support for STEM in our society: 4.04
- to support STEM learning in our schools: 4.01

OUT OF FIVE

TELL US WHAT’S IMPORTANT TO YOU!

The 2018 Member Survey is launching in September. Look in your inbox for a link.

Your responses help us to better serve science, scientists, and the global community. Don’t miss your chance to tell us what’s most important to you!
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