

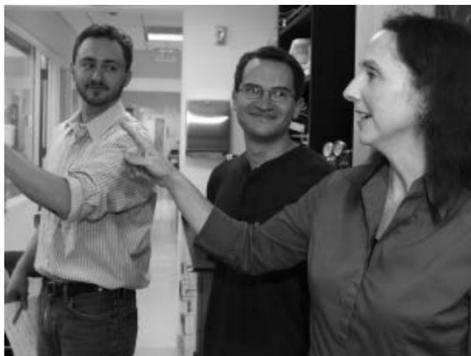


APRIL 1, 2015

### A MOLECULAR ARMS RACE: THE IMMUNE SYSTEM VERSUS HIV

Pamela J. Bjorkman, *Max Delbrück Professor of Biology and Investigator, Howard Hughes Medical Institute*

More than 30 years after the emergence of HIV, there is no effective vaccine, and AIDS remains a threat to global public health. Following HIV infection, the human immune response is unable to clear the virus, partly because the virus rapidly mutates to evade antibodies, one of our antipathogen weapons. In the absence of treatment with antiretroviral drugs, which are unfortunately not readily available in the developing world, an HIV-infected person's immune system gradually collapses, and he or she cannot fight off normally innocuous pathogens in the environment. Bjorkman's presentation will focus on her lab's efforts to modify natural antibodies using molecular engineering so that HIV is powerless to mutate against them. The goal is to create potent antibody reagents that can be delivered to prevent or treat HIV/AIDS.



MAY 6, 2015

### SEARCHING FOR VIBRATIONS FROM THE BIG BANG

James J. Bock, *Professor of Physics and Jet Propulsion Laboratory Senior Research Scientist*

Moments after the Big Bang, our observable universe underwent a violent growth spurt that flung space apart faster than the speed of light. This "inflationary" expansion explains the basic properties of the universe we see today and laid the gravitational seeds that later grew into clusters of galaxies. In this talk, Bock will report on the precise measurements he has been making of the cosmic microwave background to learn about the exotic physics that drove inflation. A quest to measure a faint polarization pattern produced by gravitational vibrations from inflation has led him to develop specialized experiments for observing from the South Pole and outer space.



FEBRUARY 4, 2015

### HOW THE BRAIN LEARNS FROM THE PAST AND MAKES GOOD DECISIONS FOR THE FUTURE: A TOUR OF NEURAL REINFORCEMENT LEARNING

John P. O'Doherty, *Professor of Psychology and Director, Caltech Brain Imaging Center*

In order to make sound decisions, we need to learn from our past actions. This capacity depends on the function of a network of brain areas. O'Doherty's lecture will summarize our current understanding of how these brain regions work and describe how this knowledge might not only help us better understand human behavior in general, but also provide new insights into psychiatric disorders in which the capacity to make sound decisions is sometimes compromised.

MAY 20, 2015

### WATCHING PAINT DRY AND COLORS FADE: THE INTERSECTION OF ART AND SCIENCE

Katherine T. Faber, *Simon Ramo Professor of Materials Science*

Mysteries regarding museum objects have captured the imaginations of engineers and scientists alike. Chemists have brought new analytical tools to discern especially hard-to-identify pigments, which has helped explain why a dramatic sky disappeared from Winslow Homer's *For to Be a Farmer's Boy*. Materials scientists have unearthed the sources of color in ancient Chinese jades. Environmental engineers have uncovered the reasons behind the faded brilliance of Georges-Pierre Seurat's *A Sunday on La Grande Jatte*. Faber will examine the science behind these and other object-based studies and discuss the links between science, engineering, and art, which build bridges between universities and museums.



### THE EARNEST C. WATSON LECTURE SERIES

is named for its founder, the late Earnest C. Watson, who was a professor of physics at Caltech from 1919 until his retirement in 1959. Spotlighting a small selection of the pioneering research our faculty is currently conducting, the Watson Lectures are geared toward a general audience, part of the Institute's ongoing commitment to benefiting the local community through education and outreach. Through a gift from the estate of Richard C. Biedebach, the Watson Lecture Series has expanded to nine lectures annually.

**TIME & LOCATION** All lectures are held on Wednesdays at 8 p.m. in Beckman Auditorium, which is located near Michigan Avenue, south of Del Mar Boulevard.

**ADMISSION & SEATING** A minimum of 700 seats are available on a free, no-ticket-required, first-come, first-served basis, beginning at 7:30 p.m. each lecture evening.

**PARKING** There are lots south of Del Mar Boulevard between Wilson and Chester Avenues, as well as parking structures at 341 and 405 South Wilson Ave., and 370 South Holliston Ave. Parking is free, with no permit required, after 5 p.m. on weekdays and all day on weekends.

**OUR COMMITMENT TO PATRONS WITH DISABILITIES** For information about our services, which include wheelchair seating and large-print programs, please call us at 626-395-4652 or e-mail [events@caltech.edu](mailto:events@caltech.edu).

**FRIENDS OF BECKMAN AUDITORIUM** We invite you to join the Friends of Beckman Auditorium, a group that helps support Caltech Presents' educational outreach programs. One of the benefits of membership is priority seating for the Watson Lecture Series. For information, call the Friends Service Desk at 626-395-6400 or visit [events.caltech.edu](http://events.caltech.edu) and click on Support Us.

CALTECH TICKET OFFICE (101-51)  
101 Winnett Center, Pasadena, CA 91125-9200  
626-395-4652 [events@caltech.edu](mailto:events@caltech.edu) [events.caltech.edu](http://events.caltech.edu)

Non-Profit Org.  
U.S. Postage PAID  
Permit #583  
Pasadena, CA

Electronic Service Requested

CALTECH *presents*

### THE EARNEST C. WATSON LECTURE SERIES

2014-2015

Caltech

Caltech Presents (101-51)  
Pasadena, CA 91125-9200

Caltech

CALTECH *presents*

**SINCE 1922, THE EARNEST C. WATSON LECTURE SERIES HAS BROUGHT CALTECH'S MOST INNOVATIVE SCIENTIFIC RESEARCH TO THE PUBLIC.**

OCTOBER 15, 2014

### QUANTUM STATES OF MATTER IN CRYSTALS

David Hsieh, *Assistant Professor of Physics*

We have all encountered the three classical states of matter: solid, liquid, and gas. But what is a quantum state of matter, where do we find it, and what is it good for? In this talk, Hsieh will explore the behavior of electrons in crystals with an eye toward how the interactions between those electrons and their crystalline host can generate a large variety of unusual states of matter that exhibit macroscopic quantum properties. Exactly which crystals to search, their potential technological applications, and practical feasibility will all be addressed.



NOVEMBER 19, 2014

### PHOTOSYNTHESIS: A PLANETARY REVOLUTION

Woodward Fischer, *Professor of Geobiology*

Photosynthesis is the most important bioenergetic innovation in Earth's history. It dramatically increased global primary production and transformed Earth's cycles. At the same time, this new source of oxygen brought about tremendous biological change, facilitating evolution of the richness we associate with modern biology. In this lecture, Fischer will present diverse observations from genomes to the ancient rock record to demonstrate how this process emerged billions of years ago and transformed the planet. He will also discuss how knowledge of photosynthesis shapes our search for life outside our solar system and pushes chemical creativity in the development of solar fuels to help meet society's energy needs.



DECEMBER 17, 2014

### CONTROLLING LIGHT ON A CHIP AT THE SINGLE-PHOTON LEVEL

Andrei Faraon, *Assistant Professor of Applied Physics and Materials Science*

Integrated electronic and optical circuits have revolutionized the way we process and transmit information, with profound economic and social impact. These technologies have progressed to such an extent that researchers currently develop integrated chips in which light is guided via optical wires, and individual atoms can control the flow of light at the quantum level. Besides increasing the performance of current optical communication technologies, these chips have the potential to be used in advanced devices, such as ones that would generate cryptographic keys for secure Internet connections, or quantum computers that can speed up exceedingly complex computational problems, such as those used in discovering new drugs. Faraon's presentation will give an overview of how this unprecedented control of photons is achieved and cover future challenges and applications.



JANUARY 7, 2015

### HOW DO YOU MAKE A GREASY PROTEIN?

William M. Clemons Jr., *Professor of Biochemistry*

An impermeable greasy membrane called a bilipid layer—acting a bit like a water balloon—encapsulates all cells of organisms, including those of humans. Information and nutrients cross this barrier via an important class of greasy molecules called membrane proteins. Because of their central role in cellular communication, these proteins are hugely important in medicine, as they account for the majority of drug targets. In this talk, Clemons will discuss the difficulties associated with making membrane proteins and highlight our current understanding of how the cell overcomes those difficulties.



JANUARY 21, 2015

### SIZE MATTERS: THE IMPORTANCE OF BUILDING SMALL THINGS

Julia R. Greer, *Professor of Materials Science and Mechanics*

Structural materials are usually either strong and heavy or weak and lightweight. For centuries, societies have had to rely on this historical coupling of strength and density, and use large amounts of heavy materials to make bridges, buildings, and vehicles. In this lecture, Greer will describe how a biology-inspired approach to engineering has helped create lightweight yet extremely strong and damage-tolerant materials. She will outline how her group has been creating materials that contain more than 98 percent air, yet possess strengths similar to those of metals. In the process, Greer will explain how she uses nanometer-sized materials with specific atomic arrangements to set us free from the strength-density coupling.

