



CaltechAssociates

discovering
tomorrow
today



winter|spring

2024

CALTECH ASSOCIATES STAFF

Catherine E. Reeves
Executive Director

Ruth Calichman
Director, Development & Outreach

Jennifer Alcántara
Associate Director, Engagement & Programming

Wes Pitts
Assistant Director, Marketing & Communications

Lelia Marshall
*Membership & Member Services Coordinator;
Administrative Manager*

Isabella Faith
Events & Production Coordinator

Production of this calendar has been funded, in part, by the Caltech Employees Federal Credit Union.



www.cefcu.org



Dear Associates Members and Friends,

I'm pleased to share our winter/spring 2024 calendar with you.

We begin the year with a series of programs that showcase research with the potential to bring major advances in medical care. **Richard Andersen's** team is developing brain-machine interfaces that enable people to overcome physical paralysis by controlling software and robotics with their thoughts. **Dianne Newman** is studying an antibiotic-resistant bacterium that is a common cause of wound infections and is making significant progress toward new ways to combat this pathogen by disrupting its metabolism. **André Hoelz's** lab is investigating the nuclear pore complex—a component of every cell that acts as a “gatekeeper” to protect its genetic information—to explore how a better understanding of its function might lead to new disease therapies. **Sarkis Mazmanian** will discuss his team's discovery of a connection between the gut microbiome and autism and tell us about a pilot study based on this work that shows promise in alleviating anxiety and irritability in test subjects.

On the cover. From April 5 to April 9, 2024, the Caltech Associates will travel to Texas Hill Country to witness a rare total solar eclipse.

This sold-out trip will be led by Michael E. “Mike” Brown, the Richard and Barbara Rosenberg Professor of Planetary Astronomy, holder of the Terence D. Barr Leadership Chair, and director of the Caltech Center for Comparative Planetary Evolution.

Some narratives about our programs may be provided by the **Caltech Science Exchange**.

The discoveries being made by these professors and their research teams are not only scientifically significant, but also a cause for hope in improving medicine and human health.

In addition to these programs, we'll hear from faculty looking outward to space. **Katherine Bouman's** research group made headlines when they produced the first image of Sagittarius A*, a black hole at the center of our Milky Way galaxy. She will describe the techniques the team used to create this image using the Event Horizon Telescope, which is a network of telescopes worldwide. **Lisa Rand Ruth** will discuss the history of space junk and the implications of a growing mass of space industry byproducts circling our planet.

We'll also enjoy our annual dinner with Provost **David A. Tirrell** at The Athenaeum and, for President's Circle members, our President's Circle Garden Party.

Your generous support of the Institute through your membership in the Caltech Associates enables this research. I encourage you to make the most of your membership by taking advantage of these opportunities to hear directly from faculty who are expanding the boundaries of human knowledge.

Warmest regards,

A handwritten signature in cursive script that reads 'Catherine'.

Catherine E. Reeves
Executive Director

NORTHERN CALIFORNIA

President's Circle Dinner

Saturday, January 6, 2024, 6:00 pm
San Jose Museum of Art

We warmly invite President's Circle members to an intimate dinner and private guided tours of the San Jose Museum of Art.

Caltech president **Thomas F. Rosenbaum**, holder of the Sonja and William Davidow Presidential Chair and professor of physics, and **Katherine T. Faber**, the Simon Ramo Professor of Materials Science, will join us to celebrate you and your generosity to Caltech. President Rosenbaum will also share the latest Institute news.



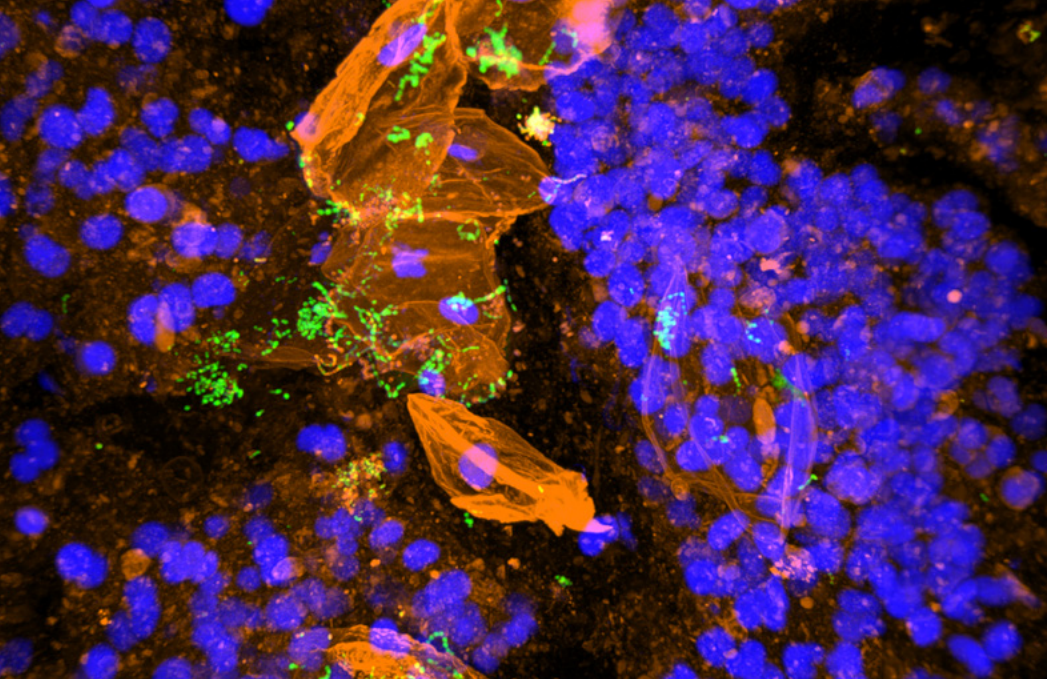
PASADENA

Restoring Ability Using BMIs

Tuesday, January 16, 2024, 6:00 pm • Chen Institute for Neuroscience

Spinal cord injuries at the level of the neck can lead to tetraplegia, the loss of movement and feeling in all four limbs. Brain-machine interfaces (BMIs) can help people with tetraplegia by allowing them to control assistive devices with their thoughts. A BMI consists of tiny electrodes that can record the activities of large numbers of cortical neurons, together with machine learning algorithms that can interpret the person's intent based on neural activity. Electrical stimulation through electrodes implanted in the sensory cortex can also restore the sense of touch.

Richard Andersen, Caltech's James G. Boswell Professor of Neuroscience and director of the T&C Chen Brain-Machine Interface Center, will describe the novel approach to BMIs his research team and collaborating colleagues have used: implanting electrodes in a variety of specialized cortical areas rather than just the motor cortex. Using this approach, study participants can control robotics and computers that have enabled them to drink a beverage, play a computer piano, use software, drive an automobile, feel touch using previously insensate hands and arms, and even decode speech (including silent internal speech) and the actions of others they observe.



MiPACT-HCR, a technique designed for bacterial identification, was applied to a sputum sample from a cystic fibrosis patient. *Streptococcus* (green) aggregated around host cells stained with WGA lectin (orange). DAPI staining (blue) shows host cell nuclei.

ORANGE COUNTY / SAN DIEGO

Controlling Chronic Infections

Thursday, January 25, 2024, 6:00 pm • Home of Bruce & Beverly Nickerson

Unlike animals and plants, bacteria can eat and respire an extraordinary range of nutrients. Understanding this defining feature of bacterial biology is both intellectually fascinating and practically important, as insights into the metabolism of bacteria can be leveraged to control their growth.

Dianne Newman, the Gordon M. Binder/Amgen Professor of Biology and Geobiology, will tell us how her team built upon knowledge of bacterial anaerobic respiration to develop a new strategy to treat chronic infections of the opportunistic pathogen *Pseudomonas aeruginosa*. Among the most virulent and antibiotic-resistant pathogens, this bacterium is commonly found in wound infections, including those associated with implanted medical devices such as catheters and ventilators. Professor Newman will describe a journey that began in the lab with a “crazy hypothesis” that has now reached a stage where it has the potential for exciting real-world applications.

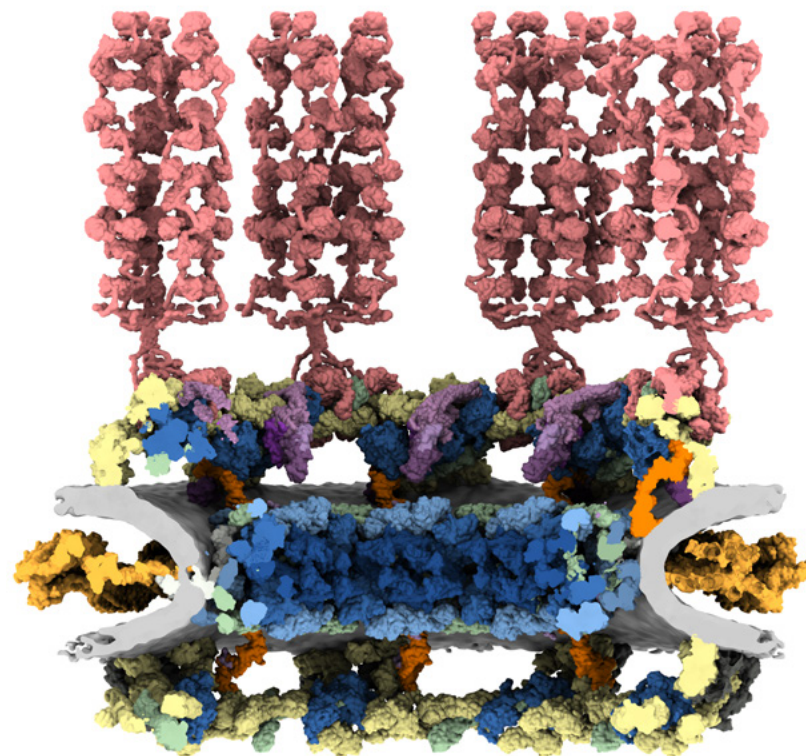
VIRTUAL

The Cell's Gatekeeper

Monday, February 26, 2024, 11:30 am • Via Zoom

A better understanding of the inner workings of human cells could significantly advance medical technology and our methods for treating disease. Every cell in the human body contains a nucleus—a “vault” that holds the cell's genetic information. The nucleus is protected by a double membrane that shields it from chemical reactions in other parts of the cell.

The nuclear pore complex (NPC) functions as a “gatekeeper” to the nucleus, precisely controlling the exchange of macromolecules between the nucleus and the rest of the cell. Dysfunction of the NPC or its components contributes significantly to human illness. **André Hoelz**, the Mary and Charles Ferkel Professor of Chemistry and Biochemistry, and his research team have been working to improve our knowledge of the NPC's architecture and its function, which could lead to revolutionary new disease therapies.



Dinner with the Provost

Thursday, March 14, 2024, 6:00 pm • The Athenaeum

As provost, **David A. Tirrell** helps to secure Caltech's future as a source of discovery and innovation. Over dinner at The Athenaeum, hear from Provost Tirrell, the Ross McCollum-William H. Corcoran Professor of Chemistry and Chemical Engineering, about the latest Institute developments.



Imaging a Black Hole

Tuesday, April 2, 2024, 6:00 pm • Location to Be Determined

At the heart of our Milky Way galaxy lies a supermassive black hole called Sagittarius A* that is evolving on a timescale of mere minutes. It has been theorized for decades that a black hole will leave a “shadow” on a background of hot gas. However, creating a photograph of this using traditional imaging approaches would require an Earth-sized radio telescope.

Katherine Bouman, assistant professor of computing and mathematical sciences, electrical engineering, and astronomy, will describe the techniques her team developed to produce the first image of Sagittarius A* using the Event Horizon Telescope—a network of telescopes around the globe—and the challenges of accounting for time-variability using this method. She also will talk about the still-unanswered scientific questions that motivate her team to improve this computational telescope to see black hole phenomena that remain invisible to us and the techniques the researchers are developing to extract the evolving structure of Sagittarius A*, including plans to observe its changing environment in 3D. In particular, she will discuss Orbital Black Hole Tomography, which integrates known physics with a neural representation to map evolving flaring emissions around the black hole.



PASADENA

President's Circle Garden Party

Saturday, May 4, 2024 • President's Circle Members Only

Caltech president **Thomas F. Rosenbaum**, holder of the Sonja and William Davidow Presidential Chair and professor of physics, and **Katherine T. Faber**, the Simon Ramo Professor of Materials Science, invite President's Circle members to their home for an elegant evening to celebrate members' generosity to Caltech. Enjoy food, drink, and good company at this annual event.



NEW YORK CITY

The Gut-Brain Axis & Autism

Tuesday, April 23, 2024, 6:00 pm • The Lotos Club

The gut microbiome has been associated with autism spectrum disorder (ASD), which is defined by delayed or reduced social communication and repetition of familiar traits. **Sarkis Mazmanian**, the Luis B. and Nelly Soux Professor of Microbiology, and his research team discovered that specific molecules produced by the microbiome differ between people with an autism diagnosis and control individuals, with outcomes also reproduced in mouse models.

A pilot human study using an oral gut-restricted sequestrant drug showed a reduction of specific microbial metabolites in blood after eight weeks of treatment. Significantly, drug therapy targeting the microbiome was associated with improvements in anxiety and irritability. These findings suggest that changes in the microbiome regulate behaviors associated with ASD and that targeting gut-derived metabolites represents a new approach to treating autism.



VIRTUAL

The History of Space Junk

Tuesday, June 25, 2024, 11:30 am • Via Zoom

The things humans send into outer space have a way of not staying put. Whether they languish in orbit, crash into each other, or fall back to Earth, the unwanted byproducts of the space industry can pose significant risks—not just to the lives of astronauts, but also to the integrity of the satellite information infrastructure and the safety of individuals and environments on the planet below.

Although the quantity of artificial material in orbit has risen exponentially in the past five years, communities worldwide have viewed outer space as a place that could be polluted since the beginning of the Space Age.

Assistant professor of history and William H. Hurt Scholar **Lisa Ruth Rand** will explore how space junk became an environmental problem, who has raised the alarm along the way, and why you should care. A historian of science, technology, and the environment, she is in the process of writing a book, currently titled *Space Junk: An Environmental History of Waste in Orbit* (under contract with Harvard University Press), that focuses on waste practices to trace changing ideas about outer space as a natural resource.

Watson Lectures

Caltech Associates members receive complimentary preferred seating for the Earnest C. Watson Lecture Series in the Beckman Auditorium. To reserve tickets, call (626) 395-4652.

Wednesday, January 31, 2024, 7:00 pm

Bethany Ehlmann

Professor of Planetary Science

The Lunar Trailblazer mission to investigate water on the moon.

Wednesday, February 7, 2024, 7:00 pm

Shrinivas (Shri) Kulkarni

George Ellery Hale Professor of Astronomy and Planetary Science

The latest discoveries from the Zwicky Transient Facility.

Wednesday, March 13, 2024, 7:00 pm

Diana Kormos-Buchwald

Robert M. Abbey Professor of History; Director and General Editor, The Einstein Papers Project

Albert Einstein's time in Pasadena as reflected in the Einstein Papers.

Wednesday, April 24, 2024, 7:00 pm

Zhongwen Zhan

Professor of Geophysics

Using fiber optic cables to better detect earthquakes.

Wednesday, May 22, 2024, 7:00 pm

Carver Mead

Gordon and Betty Moore Professor of Engineering and Applied Science, Emeritus

The history of science.

Bon voyage!

These **sold-out** trips are departing in 2024.

April 2024 **Eclipse**



August 2024 **Galápagos**



winter/Spring 2024

Travel Preview

Here is a look at destinations we are considering for Associates excursions in late 2024 and beyond.

Fall 2024 **Napa**



Spring 2025 **Vietnam**



Fall 2025 **Kenya**



Queue & Questions

If you'd like to be among the first to register for these trips, or if you have questions or suggestions, please send us an email: caltechassociates@caltech.edu.



CaltechAssociates

ASSOCIATES BOARD 2023–2024

Tracy Fu (BS '92)
President

Betty Huang
Immediate Past President

Ellen Brown

Michael Cann

Mary Ann Cloyd

Susan Condrey

Jeff Deeter

Eric Fung (BS '90)

Ruby Grewal

Erich Kreidler

Paul Lee (BS '67, PhD '72)

Ruth Lipper

Rhonda MacDonald (BS '74)

Gloria Mullendore

Ellen Neches

Tim Neufeld

Bruce Nickerson

Janice Ohta

Zach Rivkin (BS '14)

Karen Rossum

Evangelos Simoudis (BS '83)

Atul Suklikar (BS '91)

Steve Yamshon



California Institute of Technology
1200 E. California Blvd.
MC 5-32
Pasadena, CA 91125
associates.caltech.edu

EMERITI PRESIDENTS

Fred Blum (PhD '68)

Jane Factor

Chip Fairchild

Lynda Boone Fetter

John H. Glanville

Cathleen A. Godzik

Betty Huang

Robert T. Jenkins (BS '65)

Ilene O. Marshall

Priscilla McClure

Ananth Natarajan

Elizabeth Loucks Samson

Tom Tisch (BS '61)

Elizabeth Tito

Thomas J. Tyson (BS '54, PhD '67)