EARNEST C. WATSON LECTURE SERIES

CALIFORNIA INSTITUTE OF TECHNOLOGY
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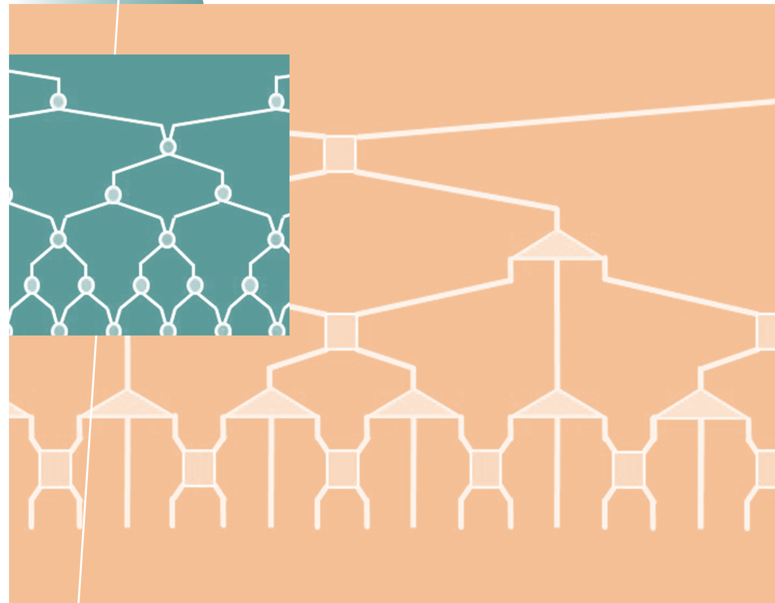
APRIL 3, 2013

Quantum Entanglement and Quantum Computing

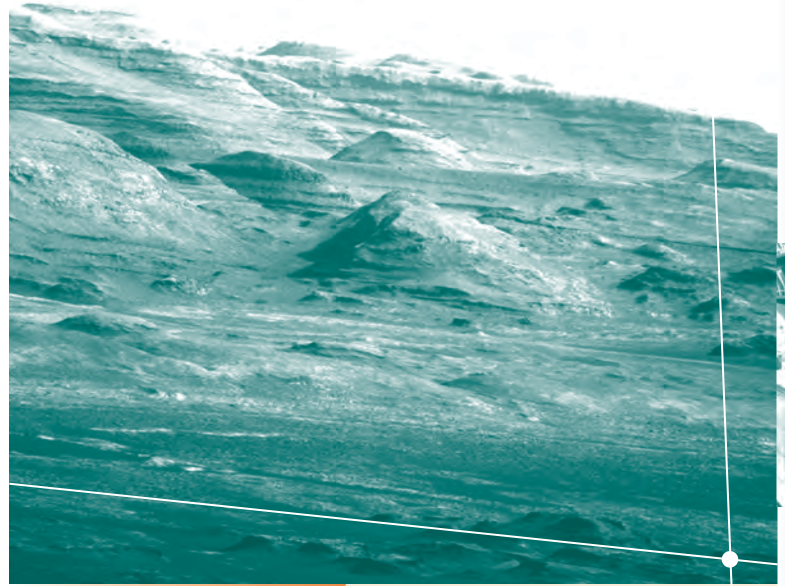
John Preskill

Richard P. Feynman Professor of Theoretical Physics

The quantum laws governing atoms and other tiny objects seem to defy common sense, and information encoded in quantum systems has weird properties that baffle our feeble human minds. Preskill will explain why he loves quantum entanglement, the elusive feature making quantum information fundamentally different from information in the macroscopic world. By exploiting quantum entanglement, quantum computers should be able to solve otherwise intractable problems, with far-reaching applications to cryptology, materials science and medicine. Preskill is less weird than a quantum computer, and easier to understand.



APRIL 24, 2013



Mars Science Laboratory: The Search for Habitable Environments

John P. Grotzinger

Fletcher Jones Professor of Geology

The Mars Science Laboratory Mission was designed to explore the habitability of Mars. This includes both modern environments, as well as ancient environments represented by the Gale Crater landing site. The geological context of the region in which Gale Crater is found, along with strong evidence that its stratigraphic record includes a progression through a number of potentially habitable environments, means it has likely preserved a rich record of the environmental history of early Mars. The *Curiosity* rover—with a designed lifetime of approximately two Earth years and a drive capability of a minimum of 20 kilometers—will explore that environment. This talk will discuss its initial results.

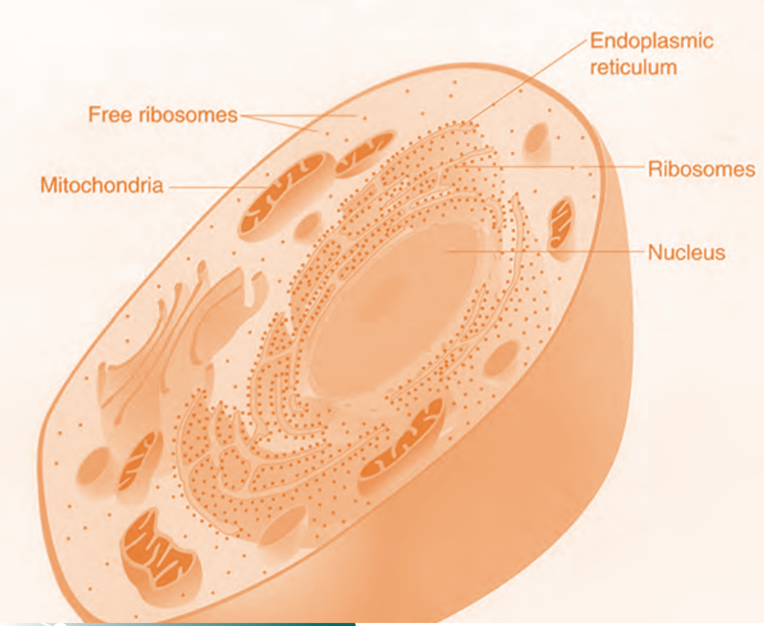
MAY 22, 2013

Decision Making and Quality Control in Early Moments of a Protein's Life

Shu-ou Shan

Professor of Chemistry

Proteins are the workhorses that carry out the vast majority of our cellular functions; they are essential for the survival of all cells. The first few moments of a protein emerges from the ribosome, the protein-synthesis machinery of the cell, has a profound impact on that protein's future. During those initial seconds to minutes, the newly synthesized protein must be precisely identified, engaged with the proper cellular machinery and committed to the correct biological pathways. This talk will look at examples of research done at Caltech and elsewhere that illustrate how cells are able to make these decisions and assert quality control so early in a protein's life.



THE WATSON LECTURE SERIES, featuring prominent Caltech researchers, is named for the late EARNEST C. WATSON, who founded the series in 1922. He presented one of his most popular lectures, "Liquid Air," as one of the first programs at the new Beckman Auditorium, a gift of Arnold O. and Mabel Beckman, in October 1964.

All lectures are held on Wednesdays at 8:00 p.m. in Beckman Auditorium, which is located near Michigan Ave., south of Del Mar Blvd.

Through a gift from the estate of Richard C. Biedebach, the Watson Lecture Series has expanded to nine lectures annually.

ADMISSION IS FREE.

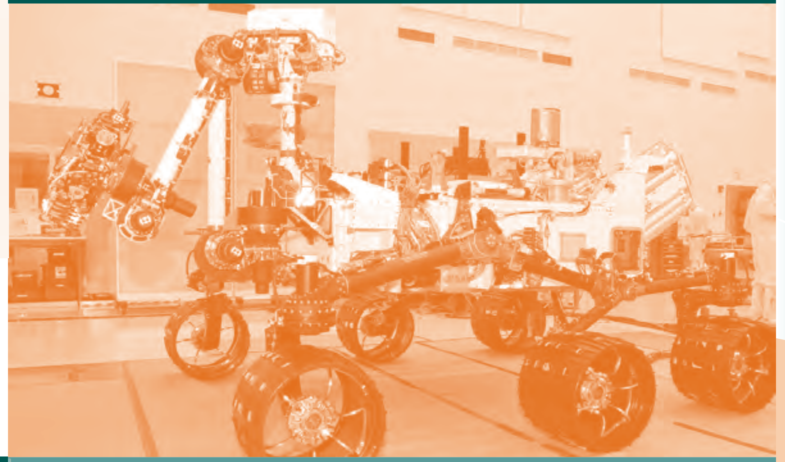
SEATING INFORMATION: A minimum of 700 seats is available on a free, no-ticket-required, first-come, first-served basis, beginning at 7:30 p.m. each lecture evening.

PARKING IS FREE: Parking is available in the lots south of Del Mar Boulevard between Wilson and Chester Avenues, as well as in the parking structures at 341 and 405 South Wilson Avenue, and 370 South Holliston Avenue. Parking is free, with no permit required, after 5:00 p.m. on weekdays and all day on weekends.

FOR INFORMATION: Phone: (626) 395-4652 • Web: www.events.caltech.edu • E-mail: events@caltech.edu

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 send an e-mail to events@caltech.edu for information and assistance.

MAILING ADDRESS: Ticket Office, Caltech (332-92), 332 S. Michigan Ave., Pasadena, CA 91125-9200



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EARNEST C. WATSON LECTURE SERIES
2012 | 2013

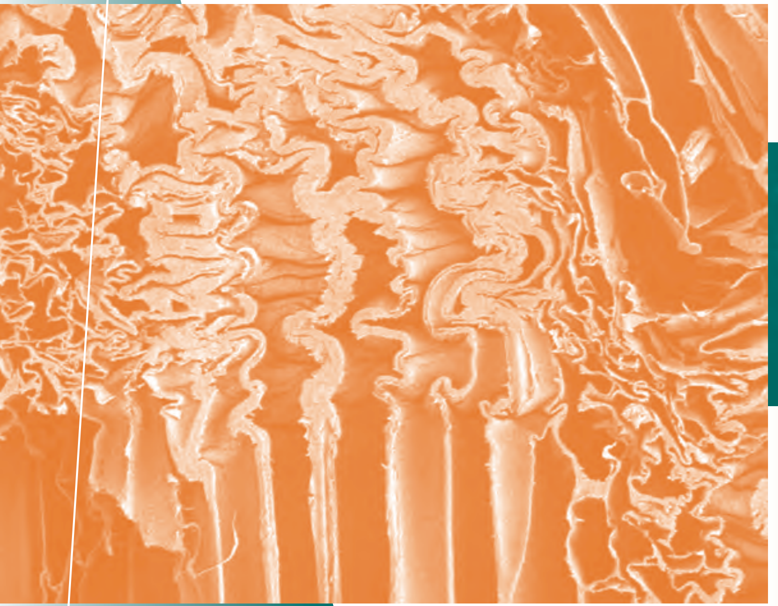
OCTOBER 24, 2012

Engineering with Impact

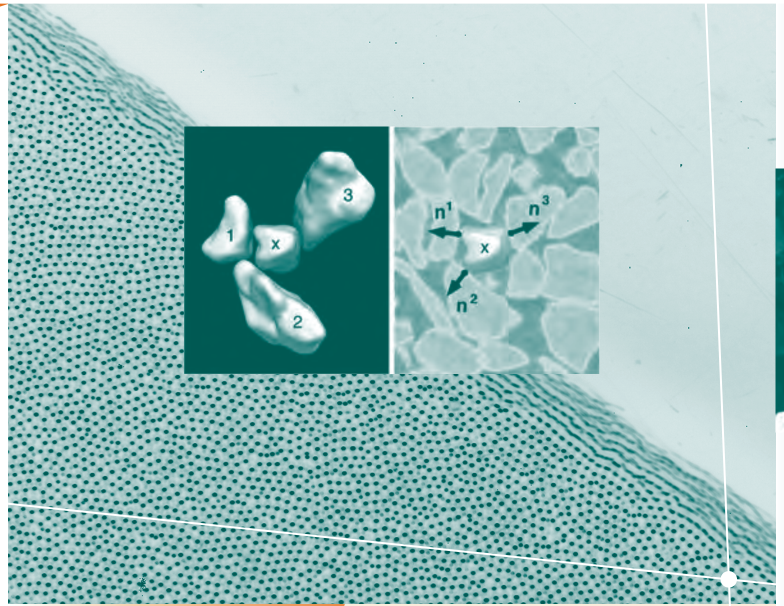
Guruswami (Ravi) Ravichandran

John E. Goode, Jr., Professor of Aerospace and Professor of Mechanical Engineering; Director, Graduate Aerospace Laboratories

Impact events have awesome power—they have shaped planets and wiped out dinosaurs. This talk will examine how we can use this power for engineering, and how we can engineer structures to mitigate the impact. At the heart of impact events is the propagation of stress/shock waves. Experimental techniques to study dynamic events resulting in high pressures (millions of atmospheres) and lasting millionths of a second will be discussed, along with our efforts to understand material properties under such extreme conditions and their utility in synthesizing unique new materials and designing protective structures.



NOVEMBER 28, 2012



Seeing the World in a Grain of Sand

José E. Andrade

Associate Professor of Civil and Mechanical Engineering

Granular materials are ubiquitous in nature and, after water, are the second most manipulated materials on earth. Deceivingly simple at the grain scale, these materials are composed of individual particles that collectively display complex behavior controlling the onset of macroscopic phenomena such as earthquakes, landslides and planetary morphology. This lecture will present new methods to characterize and model granular materials for terrestrial and extraterrestrial applications. With advanced X-ray tomography, we can obtain measurements at the grain scale that then can be used to construct predictive computational models for the study of earthquake-induced liquefaction and landslides, and of samples returned from solar system bodies.

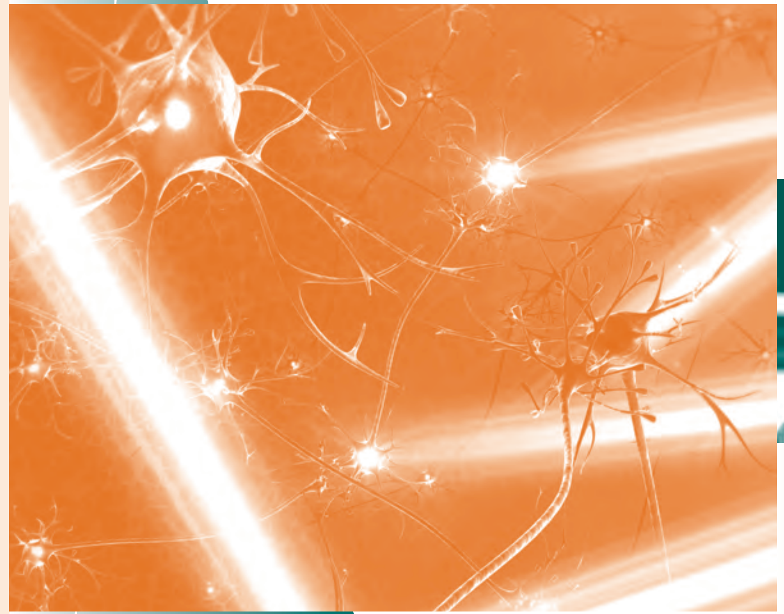
DECEMBER 5, 2012

Brain Control with Light

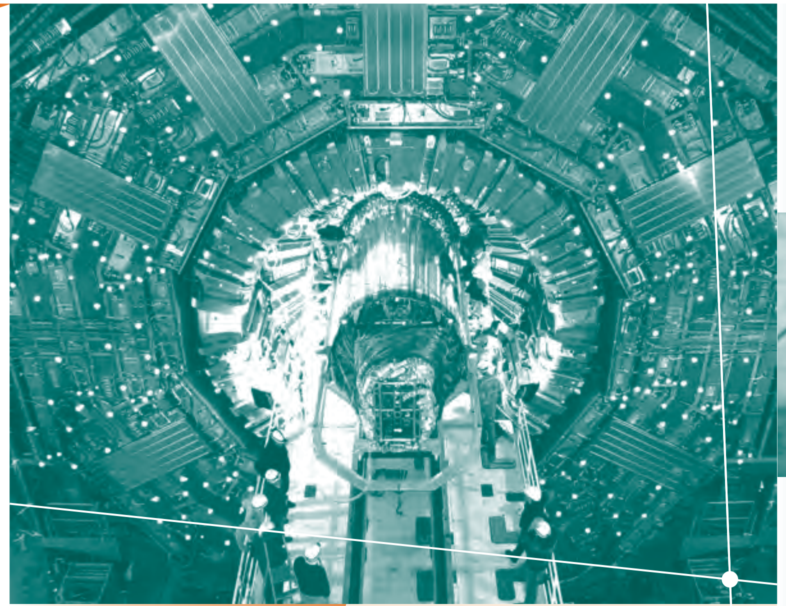
Viviana Gradinaru

Assistant Professor of Biology
This lecture is the Richard C. Biedebach Memorial Lecture.

This is an exciting time for engineering neuronal circuits to reverse pathological behaviors like depression, addiction and Parkinson's disease, and enhance mental performance. With the convergence of accumulating knowledge about brain circuits and technological advances in imaging and electrophysiology instrumentation, previously unimagined experiments are possible. Until recently, no available technology could cope with the tremendous variety of cell types in brain tissue. Now, optogenetics—a technology based on light-responsive proteins—can be used to probe brain circuitry, offering insight into both healthy and diseased brains. This lecture will describe the development of optogenetics and its applications and challenges.



JANUARY 9, 2013



Physics at the Large Hadron Collider: A New Window on Matter, Spacetime, and the Universe

Harvey B. Newman

Professor of Physics

We have embarked on a journey at the frontier of high energies with the Large Hadron Collider (LHC) at CERN in Geneva, Switzerland. Using the Compact Muon Solenoid (CMS) and the LHC, two of the most complex instruments ever devised, and new methods developed at Caltech, we are homing in on the nature of the Higgs particles thought to be responsible for mass in the universe; searching for supersymmetry, which brings together particle physics and spacetime; and searching for evidence of extra dimensions of space and other exotic new particles. This lecture presents the latest results from the high-energy frontier of particle physics and offers a perspective on the discoveries that lie ahead.

JANUARY 30, 2013

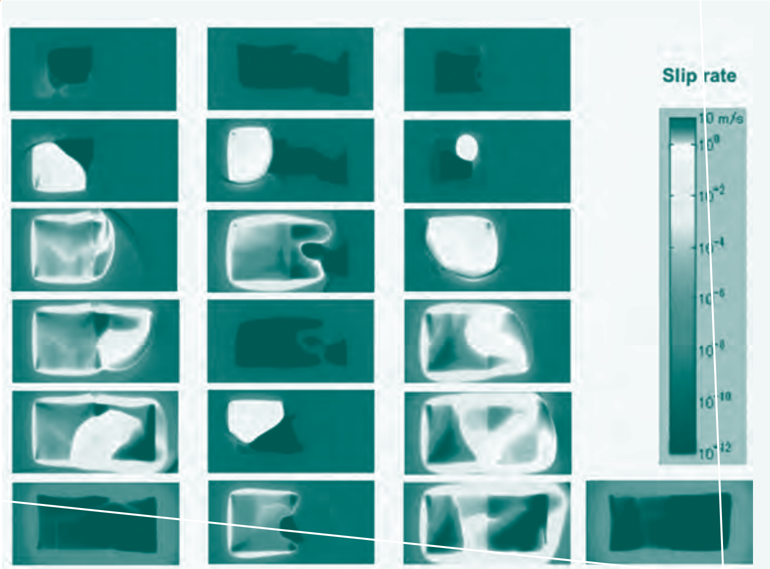
For Love or Money: Marriage and Economic Development in the Past

Tracy K. Dennison

Professor of Social Science History

Before industrialization, people married young and lived in extended families with several generations under the same roof—or so the story goes. In parts of Europe, however, our "modern" pattern—late age at first marriage combined with nuclear family households—goes back many centuries, leading some researchers to wonder if this very pattern actually brought about the Industrial Revolution and early economic growth in the west. This talk will address questions about the relationship between family patterns and economic development, drawing on evidence for a number of societies in pre-industrial Europe.

FEBRUARY 13, 2013



Under the Hood of the Earthquake Machine

Nadia Lapusta

Professor of Mechanical Engineering and Geophysics

The San Andreas and similar faults separate two tectonic plates slowly moving in opposite directions. The faults can remain locked for many years, then catch up in sudden dramatic rupture events perceived as earthquakes. These occasional fast motions co-exist with much slower fault slips. This talk will describe how laboratory-derived friction laws and sophisticated numerical models can reproduce, in remarkable detail, all stages of past fault behavior—locked, slowly moving and earthquake-producing—bringing us closer to understanding earthquake physics. Such calibrated physical models will provide new ways to assess seismic hazards and forecast the seismic response to both natural and man-made perturbations.

WATSON LECTURE SERIES