

Ted Brown 90th Birthday and Research Symposium on
**CONFRONTING THE CHALLENGES
OF CLIMATE CHANGE**

Monday, October 15 – Tuesday, October 16, 2018

CONFRONTING THE CHALLENGES OF CLIMATE CHANGE

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3 pm: Beckman Institute Auditorium

Dire Predictions: Understanding Global Warming Beckman-Brown Lecture on Interdisciplinary Science

Michael Mann, *Distinguished Professor of Atmospheric Sciences and Director of the Earth System Science Center, Pennsylvania State University*

Mann is an award-winning climate scientist and author of *Dire Predictions: Understanding Global Warming* and, more recently, a book describing his experiences at the center of the debate over climate change, *The Hockey Stick and the Climate Wars*.

Followed by book signing and birthday cake in the Beckman Atrium

Tuesday, October 16, 2018

Beckman Auditorium and Atrium

7:45 am: Breakfast

8:15 am: Climate Predictions and Projections in the Coming Decades: Uncertainty due to Natural Variability

James Hurrell, *Scott Presidential Chair of Environmental Science and Engineering, Colorado State University*

Abstract:

Future climate change at local and regional scales will result from a combination of human and natural factors. In this talk, I show that unpredictable, internally generated climate fluctuations make a substantial contribution to climate trends projected for the next 50 years over North America and Europe. Results are based on large ensembles of climate change integrations with the Community Earth System Model (CESM). I also will show that the large-scale atmospheric circulation is responsible for much of the diversity in climate change projections across the individual ensemble members. I will conclude by discussing some implications of the results for model validation, intermodel comparisons, and interpretation of observed climate trends.

9:15 am: A Role for Organometallic Chemistry in Sustainable Energy Accessibility: Synthetic Analogues of Hydrogenases

Marcetta York Darensbourg, *Distinguished Professor of Chemistry, Texas A&M University*

Abstract:

From lessons learned in Ted Brown's lab of the most fundamental chemistry of metal-carbon bonds in organolithium compounds, to the synthetic development of biomimetics containing carbon monoxide as ligands to iron in biology, the last half-century has provided this organometallic chemist with the background to contribute to the understanding of hydrogenases (H₂ases). As nature's masterpiece enzymes for hydrogen production and its use as an energy vector in hundreds of microorganisms, an array of enzymatic and spectroscopic probes, crowned by modern protein x-ray diffraction technology, provide opportunities for structure-function analysis of the intricate H₂ase active-site molecular machinery, perhaps more explicitly than in any other known catalyst. This lecture will focus on key questions in a structure-function analysis of bioinspired electrocatalysts for the Hydrogen Evolution Reaction.

10:15 am: Break

10:30 am: Harnessing Plants to Fight Climate Change

Joanne Chory, *Investigator, Howard Hughes Medical Institute; Professor and Director, Plant Biology Laboratory at The Salk Institute for Biological Studies*

Abstract:

Steadily rising atmospheric carbon levels pose a significant challenge due to their effects on climate. To counteract this CO₂ accumulation, technologies are needed that draw down CO₂ and store it stably for centuries. Plants are a natural solution to this challenge, as their main activity is fixing CO₂ and converting it into biomass. However, most of the biomaterials synthesized by plants are degraded annually, releasing the fixed carbon back into the atmosphere and limiting plants' ability to reduce atmospheric CO₂ levels. We propose to develop plant varieties that can stably sequester significant amounts of carbon in the soils of marginal lands through the production of suberin, a highly stable biopolymer.



11:30 am: Lunch

1:00 pm: Managing World Soils for Confronting the Challenges of Climate Change

Rattan Lal, *Distinguished University Professor of Soil Science and Director of the Carbon Management and Sequestration Center, the Ohio State University, and Adjunct Professor of the University of Iceland*

Abstract:

World soils can be a source or sink of atmospheric carbon (C) depending on land use and management. The magnitude of the depletion of soil organic C (SOC) depends on climate, soil profile characteristics, landscape position, soil moisture and temperature regimes, soil texture, clay mineralogy and internal drainage. In general, the extent and severity of soil degradation (i.e., decline in soil aggregation and aggregate stability; accelerated erosion by water and wind; salinization, nutrient depletion, elemental imbalance) exacerbate the magnitude of SOC depletion. Therefore, conversion of degraded soils to a restorative land use and adoption of conservation-effective practices can create a positive soil/ecosystem C budget and make soil a sink of atmospheric CO₂.

2:00 pm: Carbon Capture and Utilization (CCU): Polycarbonates Produced from Carbon Dioxide

Donald J. Darensbourg, *Distinguished Professor of Chemistry, Texas A&M University*

Abstract:

Carbon capture and utilization (CCU) processes represent effective options for reducing CO₂ emission. In this context, several processes exist that use sizeable quantities of carbon dioxide, e.g., the production of urea, methanol, cyclic carbonate, and polymers. CCU's contribution to reducing the greenhouse effect would be greatly enhanced if the technology was available for efficiently converting CO₂ into energy-rich products or fuels. The copolymerization of CO₂ and epoxides to synthesize degradable aliphatic polycarbonates is a promising approach. For example, aliphatic polycarbonates have been proposed as alternatives to petro-based chemicals in automotive, medical, and electronic applications. This presentation will focus on the development of efficient procedures for the preparation of CO₂-based polymeric materials for wide-scale industrial use, as well as designer polymers for potential applications in the biomedical fields.

3:00 pm: Break

3:15 pm: Can Nanotechnology Save the World?

Catherine J. Murphy, *Larry R. Faulkner Endowed Chair in Chemistry, University of Illinois at Urbana-Champaign*

Abstract:

Nanotechnology is the applied study of objects in the 1-100 nm regime, especially if the objects have size-dependent behavior in that regime. In this talk, I will outline the fundamental science behind nanotechnology and describe how many scientists and engineers are using nano-enabled technologies for cleaner water, cleaner air, cleaner energy, and improved agricultural practices. But in addition to the promises of nanotechnology, there is peril in their potential environmental impacts. I will also describe work from the Center for Sustainable Nanotechnology, a consortium of universities across the country, that address the latter challenge.

4:15 pm: TerraPower and Nuclear Energy Innovation


John Gilleland, *Chief Technical Officer, TerraPower*

Abstract:

In 2006, Bill Gates and colleagues gathered to discuss how to provide energy to the world's population in an environmentally acceptable manner. At that time 2 billion people had little of the energy needed to support acceptable levels of wellness. Nuclear energy was identified as one of the essential elements of any low carbon global energy infrastructure. This talk will present how innovation has led to a new type of nuclear reactor operating within a greatly simplified nuclear infrastructure. This traveling wave reactor (TWR) system offers new inherent safety features, reduced waste, more efficient use of uranium resources, enhanced weapons resistance, and new carbon-free industrial applications.

5:15 pm: Closing remarks

5:30 pm: Closing reception with audience open mic



Organizing Committee: Jeff Moore, *Director, Beckman Institute*; Jonathan Sweedler, *Director, School of Chemical Sciences*; Martin Gruebele, *Head, Department of Chemistry*; Evan DeLucia, *Director, Institute for Sustainability, Energy, and Environment*; Gene Robinson, *Director, Carl R. Woese Institute for Genomic Biology*.

Organizing Committee Point of Contact: Patty Jones, *Associate Director for Research, Beckman Institute*

For more information on the event and biosketches of the speakers, please visit: bit.ly/climatechallengesprog

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