



UNIVERSITY OF MINNESOTA
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Department of Chemistry Kolthoff Lectureship in Chemistry

April 13-15, 2015
Professor James Mayer
Department of Chemistry at Yale University

Website: <http://www.chem.yale.edu/faculty/mayer.html>
Faculty Host: William Tolman



Professor James "Jim" Mayer was born and raised in Manhattan, New York. He attended the United Nations International School, which fostered his passion for science. He started doing research in inorganic chemistry just after high school at Hunter College, with Professor Edwin H. Abbott. He was an undergraduate at Harvard University from 1975-78. He received his doctorate in 1982 from the California Institute of Technology, working with Professor John E. Bercaw on organometallic chemistry of tantalum hydride complexes. He then spent two years as a visiting scientist in the Central Research Department of the DuPont Company. In 1984, he was appointed to the faculty at the University of Washington, where he rose through the academic ranks. He became a professor of chemistry at Yale University in 2014. He has served as chair of the American Chemical Society Division of Inorganic Chemistry and currently serves as an associate editor of the journal *Inorganic Chemistry*.

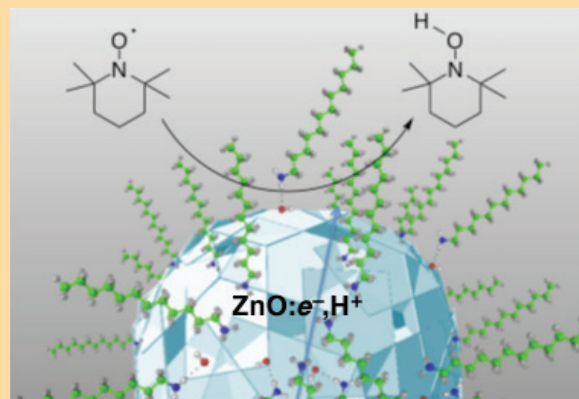
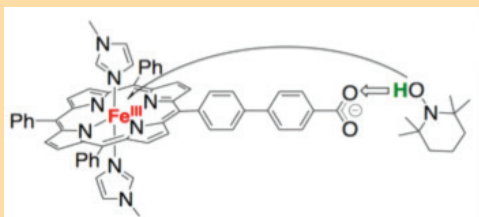
Professor Mayer's research interests span coordination chemistry, catalysis and electrocatalysis, bioinorganic chemistry, organometallic chemistry, physical organic chemistry, electron transfer, and reactions of nanoscale materials. His focus is on discovering and understanding new reaction chemistry, particularly the involvement of protons in all sorts of redox reactions that make or break chemical bonds. Chemical reactions of this type are involved in many biological, industrial, energy, and environmental processes.

Lecture 1: Proton-Coupled Electron Transfer: from Hydrogen Atom Transfer and Marcus Theory to Electrocatalysis to Nanoparticles **3:45 p.m. Monday, April 13, 331 Smith Hall**

A reception for Professor Mayer will be conducted in Kate & Michael Barany Conference Room (117/119 Smith Hall) immediately following this lecture. All are welcome to attend.

A wide range of chemical processes proceed by proton-coupled electron transfer (PCET), from combustion to fuel cells to redox processes of minerals. This presentation will begin with fundamental studies of single reaction steps that involve transfer of one proton and one electron. Some of these reactions "look like" hydrogen atom transfers, while in other reactions the electron and proton are quite separated in the reactants or products (*drawing below left*). The rate constants for many of these reactions can be understood using a version of Marcus Theory, which shows the commonality of organic and transition metal H-atom transfer reactions. PCET concepts are also being used in the development of new oxygen-reduction electrocatalysts, and to develop the redox reactivity of oxide nanoparticles.

For instance, reduced and protonated ZnO and TiO₂ nanoparticles will transfer e⁻ and H⁺ (H•) to nitroxyl and phenoxyl radicals (*drawing on right*).



Izaak Maurits Kolthoff was born on February 11, 1894, in Almelo, Holland. He died on March 4, 1993, in St. Paul, Minnesota. In 1911, he entered the University of Utrecht, Holland. He published his first paper on acid titrations in 1915. On the basis of his world-renowned reputation, he was invited to join the faculty of the University of Minnesota's Department of Chemistry in 1927. By the time of his retirement from the University in 1962, he had published approximately 800 papers. He continued to publish approximately 150 more papers until his health failed. His research, covering approximately a dozen areas of chemistry, was recognized by many medals and memberships in learned societies throughout the world, including the National Academy of Sciences and the Nichols Medal of the American Chemical Society. Best known to the general public is his work on synthetic rubber. During World War II, the government established a comprehensive research program at major industrial companies and several universities, including Minnesota. Kolthoff quickly assembled a large research group and made major contributions to the program. Many of Kolthoff's graduate students went on to successful careers in industry and academic life and, in turn, trained many more. In 1982, it was estimated that approximately 1,100 Ph.D. holders could trace their scientific roots to Kolthoff. When the American Chemical Society inaugurated an award for excellence in 1983, he was the first recipient.

