

Jim Mayer was born and raised in Manhattan, in New York City. He attended the United Nations International School (UNIS), which fostered his passion for science. He started doing research in inorganic chemistry just after high school, at Hunter College, City University of New York, with Prof. Edwin H. Abbott. Dr. Mayer was an undergraduate at Harvard University from 1975-78, where he worked on modelling interstellar chemistry with Prof. William Klemperer. He received his PhD in 1982 from the California Institute of Technology for work 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, Dr. Mayer was appointed to the faculty at the University of Washington, where he rose through the academic ranks. He moved to become Professor of Chemistry at Yale University in 2014, and was named Charlotte Fitch Roberts Professor in 2016.

Prof. 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 central to many future energy conversion strategies, and are involved in many biochemical, industrial, and environmental processes.

Professor Mayer has been named as Fellows of the Alfred P. Sloan Foundation, the American Association for the Advancement of Science, and the American Chemical Society. He has served as chair of the American Chemical Society Division of Inorganic Chemistry and has served as an associate editor of the journal *Inorganic Chemistry* for more than a dozen years.

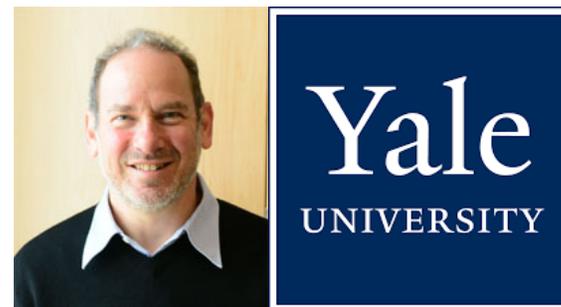
3M Lecturers

1962	Sir Derek H. R. Barton, Imperial College
1963	Sir Ronald Nyholm, University College
1964	F. C. Tompkins, Imperial College
1965	S. Winstein, U.C.L.A.
1966	F. A. Cotton, M.I.T.
1967	J. O. Hirschfelder, Wisconsin
1968	A. Eschenmoser, E.T.H., Switzerland
1969	H. Taube, Stanford
1970	S. A. Rice, Chicago
1971	F. H. Westheimer, Harvard
1972	R. G. Pearson, Northwestern
1973	W. A. Klemperer, Harvard
1974	G. Stork, Columbia
1975	R. J. P. Williams, Oxford
1976	J. A. Morrison, McMaster
1977	D. Arigoni, E.T.H., Switzerland
1978	J. Chatt, Sussex
1979	J. A. Pople, Carnegie-Mellon
1980	W. P. Jencks, Brandeis
1981	J. Halpern, Chicago
1982	Sir John Meurig Thomas, Cambridge
1983	R. Breslow, Columbia
1984	M. L. H. Green, Oxford
1985	D. R. Hershbach, Harvard
1986	J. M. Lehn, Strasbourg
1987	M. H. Chisholm, Indiana
1988	R. A. Marcus, Cal. Tech.
1989	D. J. Cram, U.C.L.A.
1990	D. Seyferth, M.I.T.
1991	D. A. Shirley, Berkeley
1992	K. U. Ingold, NRC, Ottawa
1993	H. Schmidbauer, Munich
1994	A. J. Bard, U. Texas, Austin
1996	R. Huisgen, Munich
1998	J. M. J. Fréchet, Berkely
1999	R. W. Field, M.I.T.
2000	I. Dance, New South Wales
2001	K. C. Nicolaou, San Diego
2002	R. R. Birge, Connecticut/Syracuse
2003	D. Fenske, Karlsruhe
2004	A. Padwa, Emory
2005	N. Dovichi, Washington State
2006	K. N. Raymond, Berkeley
2007	K. Tamao, RIKEN and Kyoto University
2008	P. Corkum, NRC, Ottawa
2009	D. Astruc, Univ. Bordeaux
2010	Harry B. Gray, Cal. Tech.
2013	Ian Manners, Bristol, UK
2015	Angela Belcher, M.I.T.
2017	Jim Mayer, Yale



The 3M University Lecturer in Chemistry 2017

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Chemistry Website: <http://www.uwo.ca/chem/>

Monday, May 15, 2017
3:30 p.m.
Western University
3M Centre, Room 3250

REFRESHMENTS WILL BE SERVED PRIOR TO THE LECTURE

Lecture 1 Proton-Coupled Electron Transfer Reactions: from hydrogen atom transfer to separated e^- and H^+

A wide range of chemical processes proceed by proton-coupled electron transfer (PCET), including combustion, fuel cells, the action of antioxidants, and catalysis by many metalloenzymes. Understanding these processes is being developed through fundamental studies of single reaction steps that involve transfer of one proton and one electron. Some of these reactions 'look like' hydrogen atom transfers $X-H + Y \rightarrow X + H-Y$, while in other reactions the electron and proton are quite separated in the reactants or products. In the example depicted (Lecture 1 Figure, top), the hydroxylamine transfers a proton to a carboxylate concerted with transfer of an electron to an iron center 14 Å away. The example depicted (Lecture 1 Figure, bottom) shows a reaction that cleaves a C-H bond by a PCET process, with the electron going to an external oxidant and the proton to a nearby carboxylate base. The rate constants for many of these reactions can be understood using models based on Marcus Theory. These studies indicate the factors that influence the facility of concerted proton/electron transfers, and show the commonality of organic and transition metal PCET reactions. These PCET concepts provide the basis for the development of new electrocatalysts for the reduction of oxygen.



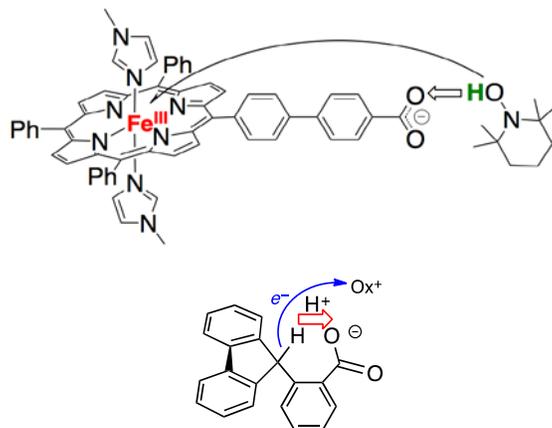
Tuesday, May 16, 2017
1:30 p.m.
Western University
3M Centre, Room 3250

REFRESHMENTS WILL BE SERVED PRIOR TO THE LECTURE

Lecture 2 Proton-Coupled Electron Transfer Reactions of Colloidal Metal Oxide Nanocrystals: a different look at interfacial redox chemistry

Interfacial charge transfer reactions are key to the behaviour of many devices and technologies and are prevalent in the environment. They are often described as pure electron (or hole) transfer processes. However, many of the important processes, from energy production and storage to corrosion, are proton-coupled electron transfer (PCET) processes. Similarly, batteries inherently involve cation-coupled electron transfer. These processes are not easily described with the electronic energy level model, starting from band theory, that dominates the thinking in this area. This talk will explore how protons and other ions affect the thermodynamics and kinetics of interfacial redox reactions, and how an alternative model could be developed. Colloidal ZnO and TiO₂ nanocrystals are interesting PCET reagents, with their reduced forms readily transferring e^- and H^+ (equivalent to a hydrogen atom, H^\bullet) to organic reagents (see Lecture 2 Figure). Redox reactivity of ceria nanocrystals, metal-organic frameworks (MOFs) and high surface area molybdenum nitride (Mo₂N) may also be discussed. It is suggested that chemical change of the reacting materials is a key feature of solid-solution interfaces at the nanoscale.

Lecture 1



Lecture 2

