Michael M. Abbott (1938-2006)

Michael Abbott received his B.S. in Chemical Engineering in 1961, and his Ph.D. in Chemical Engineering in 1965, both from Rensselaer Polytechnic Institute. He worked for four years at Exxon Research and Engineering. He joined Rensselaer as a postdoctoral fellow in 1969, and joined the Chemical Engineering Department as a Professor in 1974, where he worked till 2006.

Prof. Abbott was an internationally recognized expert in chemical thermodynamics. He co-authored four textbooks, including the best-selling chemical engineering text of all time, *Introduction to Chemical Engineering Thermodynamics*, currently in its seventh edition. Abbott had a passion for teaching, and received many awards in recognition of his work as a teacher and mentor, including the Tau Beta Pi Outstanding Engineering Instructor Award (1976), the Trustees' Outstanding Teacher Award, the Western Electric Fund Award from ASEE (1979), the Rensselaer Distinguished Teaching Fellowship (1986-88), and the first Rensselaer Alumni Association Teaching Award in 1994. Beyond academics, Abbott had wide ranging interests including literature, poetry, and music. The Michael M. Abbott Lecture Series hosted each spring in the Chemical Engineering Department honors Abbott's legacy and celebrates his achievements.

Previous Abbott Lecture Awardees

2006 Jefferson W. Tester, Massachusetts Institute of Technology
2007 Pablo Debenedetti, Princeton University
2008 Michael F. Doherty, University of California-Santa Barbara
2009 Zhen-Gang Wang, California Institute of Technology
2010 George "Bud" Homsy, University of British Columbia
2011 Frank S. Bates, University of Minnesota
2012 K. Dane Wittrup, Massachusetts Institute of Technology
2013 Curtis W. Frank, Stanford University
2014 John F. Brady, California Institute of Technology
2015 Jay Keasling, University of California, Berkeley

The Isermann Department of Chemical & Biological Engineering

presents

Professor Gregory Stephanopoulos

Willard Henry Dow Professor in Chemical Engineering

Department of Chemical Engineering
Massachusetts Institute of Technology

Michael M. Abbott Lecture Series

Wednesday, April 20, 2016
Thursday, April 21, 2016

Gregory Stephanopoulos

Professor Stephanopoulos' current research focuses on *metabolic engineering* and its applications to the production of fuels, biochemicals and specialty chemicals, as well as mammalian cell physiology as it pertains to diabetes and metabolism. He co-authored the first textbook on Metabolic Engineering. He has co-authored or –edited 5 books and ~300 papers and 25 patents. He has supervised 50 graduate and 40 post-doctoral students and is presently the editor-in-chief of the journal *Metabolic Engineering*; he also serves on the Editorial Boards of 7 scientific journals.

He received his B.S. from the National Technical University of Athens, M.S. from the University of Florida and his Ph.D. from the University of Minnesota, all in Chemical Engineering. He joined, upon finishing his doctorate in 1978, the Chemical Engineering Faculty of Caltech and in 1985 he was appointed Professor of Chemical Engineering at MIT where he has been ever since. He served as Associate Director of the Biotechnology Process Engineering Center (1990-97) and member of the International Faculty of the Technical University of Denmark (2001-). He is also the Taplin Professor of HST (2001-), Instructor of Bioengineering at HMS (1997-), and the W. and H. Dow Professor of Chemical Engineering and Biotechnology.

He has been recognized with the Dreyfus Foundation Teacher Scholar Award (1982), Excellence in Teaching Award (1984), Technical Achievement Award of the AIChE (1984), PYI Award (1984), AIChE-FPBE Division Award (1997), M.J. Johnson Award of ACS (2001), and the R.H. Wilhelm Award in Chemical Reaction Engineering of the AIChE (2001). In 1992 he chaired the FPBE Division of AIChE and was elected a Founding Fellow of the American Institute for Medical and Biological Engineering. In 2002 he received the Merck Award in Metabolic Engineering and was elected to the Board of Directors of AIChE. In 2003, he was elected to the National Academy of Engineering (NAE) and in 2005 was awarded an honorary doctorate degree (*doctor technices honoris causa)*by the Technical University of Denmark. In 2007 he won the C. Thom Award from SIM and the Founders Award from AIChE. He is currently President of AIChE.

April 20, 2016 – Ricketts 211 @ 9:30 AM
Coffee & pastries – 9 AM – Coonley Lounge

"Linking Cancer and Metabolism via Isotope Labeling and Network Analysis"

ABSTRACT: The metabolic engineer's toolbox, comprising, among others, stable isotope tracers, pathway flux estimation and analysis, pathway identification, and pathway kinetics and regulation, has long been used to elucidate and quantify pathways primarily in the context of engineering microbes for product overproduction. These tools are also well-suited for analyzing the physiology of tumor cells as they commonly undergo metabolic rewiring during oncogenesis to meet the biosynthetic needs required for aggressive growth. Metabolism is now emerging as a new space of potential therapeutic interest in cancer, so it is important to identify effective targets through fundamental understanding of the metabolic pathways preferentially used by tumor cells. To this end, these tools are increasingly finding use in cancer biology due to their unparalleled ability to quantify intracellular metabolism of mammalian cells and in particular the role of glucose and glutamine that must be efficiently directed to contribute carbon and nitrogen for biomass and cofactor production. An overview of this approach, highlighting a systems-theoretic analysis of pathways and bioreaction networks will be presented. In particular, we will focus on implications of the Warburg effect, the role of reductive carboxylation and IDH activity and the interplay between glucose and glutamine uptake as sources of carbon skeletons, energy and reducing equivalents required for tumor cell growth. These results suggest new targets for cancer therapy some of which will be addressed in the presentation.

April 21, 2016 – BioTech Auditorium @ 9:15 AM
Coffee & pastries – 8:45 AM

"Metabolic Engineering: Synthetic Chemistry of the 21st Century"

ABSTRACT: Metabolic engineering is a maturing field, just about 20 years old. During this period, it has developed new concepts, a well-defined methodology and a focused research portfolio of rich intellectual content and particular relevance to biotechnology and biological engineering. Its goal is to harness the immense potential of microorganisms for the production of useful products, in particular from renewable resources. This it does by engineering the cellular metabolism such as to favor product-forming pathways while maintaining normal cellular functions. Having been founded on modern genetic methods and concepts of chemical reaction engineering, Metabolic Engineering is now adapting itself to rapid changes to take advantage of genome sequencing and avalanches of cell- and genome-wide-data.

In this talk I will review the foundations of metabolic engineering, its key technologies and how it has evolved since its genesis. Particular emphasis will be placed on the new and diverse types of chemistry that can be carried out with the use of microbial catalysts that are extremely challenging for synthetic chemistry. As such, metabolic engineering emerges as the enabling science for the production of chemical and pharmaceutical products in the 21st century. Examples from the production of biofuels, pharmaceuticals and materials from renewable resources will be used to illustrate the above points.