Department of Chemical and Environmental Engineering

2014—2015 Seminar Series

Friday, January 16, 2015

9:10—10:00 AM

WCH 205/206

Jim Flatt

President of Genovia Bio

Synthetic Genomics, Inc.

Recent Advances in Cell Engineering for Production of Food, Medicines, Chemicals and Biofuels

Biobased manufacturing processes will become increasingly important in the future to meet the needs for large-scale production of food, medicines, chemicals and fuels in a world constrained by limits on availability of arable land and water, and carbon emissions. The biocatalyst represents the heart of these biobased processes, with overall process economics primarily determined by the product yield, titer and productivity performance of the biocatalyst. Recent significant advances in synthetic biology have increased the complexity of cell metabolic engineering challenges which may be undertaken, improved biocatalyst performance outcomes and shortened biocatalyst development time and cost. Products derived from synthetic biology are expected to generate nearly $10 billion dollars in revenue by 2016, and grow rapidly thereafter.

Cell engineering is increasingly becoming a DNA software development exercise. The ability to rapidly and accurately assemble increasingly complex DNA structures is critical to the development of improved biocatalysts. Researchers at the J. Craig Venter Institute announced the creation of the first chemically synthesized microbial cell in 2010. Building upon this technology, Synthetic Genomics, in collaboration with Novartis Vaccines and Diagnostics, developed a revolutionary new method to produce influence vaccine seeds from wholly synthetic viruses. This method shortens the time required to develop a new influenza vaccine seed from roughly eight weeks to less than one week.

The promise of sustainable production of biofuels from either non-food organic substrates or light and carbon dioxide has generated significant research activity in both academic and industry sectors. The challenges of developing economical, second generation processes are significant; commercialization of these new processes will take decades before they contribute a meaningful percentage of the global fuel supply. Algal biofuels are attractive due to the ability to produce an infrastructure-compatible biocrude oil on marginal land with high areal productivity. Algal biofuels are currently uneconomical due to high unit capital and operating costs associated with production and recovery of product from a dilute aqueous culture. Recent discoveries by Synthetic Genomics of genetic elements responsible for regulation of light adaptation provide the foundation for increasing photosynthetic efficiency, biomass productivity and standing cell titer.

Biosketch: Dr. James (Jim) Flatt joined Synthetic Genomics Inc. (SGI) in 2010 as the Chief Technology Officer. SGI is a leader in the development and application of synthetic biology technology for sustainable production of fuels and chemicals and application in agriculture. Since 2013, Jim has served as President of Genovia Bio, which is responsible for the development of algal-based solutions for food fuels and chemicals markets. Jim has been involved in the industrial biotechnology field for over 20 years. Just prior to SGI, Jim was the Executive Vice President of Research & Development and Operations at Mascoma Corporation, a leader in the development of cellulosic biofuels. Prior to Mascoma. Jim served as Sr. Vice President of Research for Martek Biosciences Corporation (Columbia, MD), leading the development of nutritional fatty acids from microalgae which are now included in many infant formula and food products. Prior to Martek, Jim was involved in microbial biotechnology research at Merck and Monsanto. Jim received his undergraduate degree in Chemical Engineering from Massachusetts Institute of Technology and graduate degrees in Chemical Engineering from the University of California-Berkeley and University of Wisconsin-Madison. Jim served as the Chairman of the Industrial Advisory Board for the National Science Foundation Engineering Research Center for Marine Biotechnology (MarBEC) at the Universities of Hawaii and California-Berkeley.