

Department of

Chemical and Environmental Engineering

2015—2016 Seminar Series

Friday, November 20, 2015

9:30-10:30 am

WCH 205/206



Yi-Heng Percival Zhang

Professor

Biological Systems Engineering

Virginia Tech

Carbohydrate would be new oil via a new biomanufacturing platform

The sustainability revolution is occurring in the 21st century when we start utilizing more and more renewable resources instead of depleting fossil fuels. Oil is the primary energy source, but it will be replaced with some cheap and renewable energy sources eventually. The largest production challenge of biocommodities (e.g., biofuels, renewable chemicals, and even food) is the economically viable production with satisfying three manufacturing criteria: high product yield, fast productivity and easy product separation. In vitro synthetic biosystem (IVSB) implements complicated biological reaction via the in vitro assembly of numerous standardized and exchangeable enzymes or their complexes and/or (biomimetic) cofactors. Compared to microbial fermentation, IVSB features numerous manufacturing advantages, such as high product yield, fast reaction rate, easy product separation, easy access and control for open systems, tolerance of toxic compounds and broad reaction conditions, and so on.

In this talk, I will introduce the concept of this new technology platform; present its three large applications: (i) sweet hydrogen produced from sugars; (ii) synthetic starch made from nonfood biomass, and (iii) high-energy density sugar biobattery; as well as advances of developing building blocks of IVSB. In a word, IVSB would lead to a biomanufacturing paradigm shift and the electricity-hydrogen-carbohydrate cycle would bridge primary energies and secondary energies, meeting different energy needs.

BioSketch: Dr. Yi-Heng Percival Zhang is a tenured full professor in the department of Biological Systems Engineering of Virginia Tech (USA) and an affiliated researcher of Chinese Academy of Sciences – Tianjin Institute of Industrial Biotechnology (China). He received his degrees of bachelor and master from East China University of Science and Technology (Shanghai, China) in 1993 and 1996, respectively. He received his Ph.D. of Chemical Engineering from Dartmouth College in 2002. He joined Virginia Tech in 2005 as a tenure tracked assistant professor and was promoted to associate professor (2010) and full professor (2014).

His research interests include renewable energy systems, biomanufacturing 4.0, synthetic biology (in vitro and in vivo), biocatalysis, biorefining, sustainable agriculture, and so on. He is a pioneer of in vitro synthetic biosystems for biomanufacturing 4.0. Via this technology platform, his mission is (i) to replace crude oil with sweet hydrogen (i.e., 1 kg of carbohydrate equals 1.2 kg of gasoline for driving), (ii) to feed the world through out-of-the-box solutions, and (iii) to power electronics by using sugar-powered metal-free biobatteries, 10-time of those of lithium ion batteries.

He has published more than 100 peer-reviewed SCI journal papers and more than 20 invited book chapters, and received more than 20 issued patents. He has the SCI citations of 5,000+ and an H-index of 37. He founded two USA startup companies – Gate Fuels and Cell-free Bioinnovations and three Chinese start-up companies.

He received numerous distinctions, such as Virginia Tech College of Agriculture and Life Sciences Excellence in Applied Research Award (2015), Virginia Tech College of Engineering Faculty Fellow Award (Virginia Tech, 2011), Biotechnology and Bioengineering Daniel IC Wang Award (ACS BIOT, 2010), Sunkist Young Designer Award (2009), College of Engineering Outstanding New Faculty Award (Virginia Tech, 2008), BP young scientist Award (2008), DuPont Young Faculty Award (2008), Air Force Young Investigator Award (2008), ACS PRF New Faculty Award (2007), Best and Bright People of Year 2006 by Esquire, Ralph E. Powe Junior Faculty Enhancement Award (2006), to name a few.

He serves as deputy editor-in-chief of a Wiley Journal -- Energy Science and Engineering, academic editor of PLoS One, and editorial board members for a few journals: Biotechnology for Biofuels (BMC), Process Biochemistry (Elsevier), Bioprocess and Biosystems Engineering (Springer), Bioresources and Bioprocessing (Springer), International Journal of Agricultural and Biological Engineering, Frontiers in Bioengineering and Biotechnology, Frontiers in Energy Research, etc.