

2014 ALKIVIADES PAYATAKES LECTURE

***Developing the bioprocesses of a sustainable bioeconomy via
Biotechnology and Metabolic Engineering***

**Institute of Chemical Engineering Sciences
Foundation for Research and Technology-Hellas (FORTH/ICE-HT), Patras, Greece**

Gregory Stephanopoulos

**Department of Chemical Engineering, MIT
Cambridge, MA 02139**

Abstract

Biotechnology is rapidly coming of age as enabling technology for the production of biobased chemicals and biofuels. In this task, it is aided by critical advancements in Metabolic Engineering that facilitate the construction of cells as chemical factories converting renewable feedstocks to a variety of products. While this application was limited to specialized chemicals and pharmaceutical products in earlier years, recent advances in metabolic engineering have expanded the portfolio of biotechnological applications beyond the space of specialty products and into the domain of commodity chemicals that have been traditionally the realm of chemical process industry using fossil fuels as feedstocks. As such, we are witnessing a process of creative destruction whereby one manufacturing technology based on chemistry is gradually being replaced by another based on biology. To be sure, chemical technologies have some definite advantages such as very high space times due to high temperatures of operation. These benefits can be counterbalanced by the superb specificity of biotechnological processes and their unique ability to convert with high efficiency renewable feed stocks.

In this talk, I will present the origin and basic technologies of metabolic engineering and illustrate its applications with examples from the engineering of microbes for lipid synthesis for biodiesel production, as well as synthesis of mono ethylene glycol and fermentation of gases for biofuel production. I will expand on the parameters that will define the winners and losers of the antagonism between chemistry and biotechnology whose ultimate result will be efficient processes for the *sustainable* manufacturing of the products needed by current society.