

Session 2

## Biological Research

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Biotechnology is not a new phenomenon; its techniques have been used throughout history. Microorganisms have been used since early times to make bread and beer. These processes were the beginnings of the microbial fermentation technologies that continue to be practiced today. It was not until the 1970s, however, that scientists learned to reach into living organisms and precisely alter their genetic structures, leading to the development of metabolic engineering, which takes advantage of advances in DNA cloning and sequencing technologies, synthesis and amplification techniques, arming scientists with the ability to target and purposefully alter metabolic pathways within organisms. This will result in a better understanding and utilization of the cellular pathways for chemical transformation, energy transduction, and supermolecular assembly.

Bioprocessing is the ability to use living organisms or their components to produce marketable materials. Chemicals and fuels can be produced through bioprocesses, eliminating the need for energy-intensive chemical processes and reducing our national dependence on petroleum. In the case of fuel production, ethanol produced from lignocellulosic biomass, which includes agricultural wastes, such as rice straw and corn fiber, represents an opportunity to clean up waste products that have polluted our environment and turn them into a valuable commodity.

The work presented in this session is representative research in chemical and fuels production using biological organisms in place of chemical methods. These biological systems, whether they are *E. coli* engineered with the capability to grow on limonene, or yeasts that can ferment five and six carbon sugars, will be valuable to the future of the chemical and fuels industry. As scientists learn more about our environment and the need to reduce petroleum-based chemistry, more and more opportunities arise for novel bioprocesses, and with the development of each process, there is an overwhelming need to learn more about the systems under development.