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Session 2

Applied Biological Research

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This session focuses on advances in biocatalyst development, with emphasis on the use of genetic engineering, applied microbiology, and biochemistry as they relate to new and improved microorganisms and enzymes. Metabolic engineering and enzyme engineering continue to provide powerful tools for altering microbial and enzymatic traits. Biocatalysts improved by these methods are increasingly being integrated into commercial processes.

This session and the associated posters represent current efforts in biocatalysis development. In the area of microbial biocatalyst development, progress has been made in developing industrial bacteria and yeast with the ability to use both six-carbon sugars and five-carbon sugars such as D-xylose and/or L-arabinose (the most abundant pentoses in hemicellulose of lignocellulosic feedstocks). Much work has also been done to develop organisms with new or improved ability to produce ethanol and other chemicals, including succinic acid, hydroaromatics, aromatics, 1,2-propanediol (propylene glycol), xylitol, and hydrogen.

In the area of developing enzymatic biocatalysts, much work has focused on cellulases and other enzymes involved in biomass degradation. The techniques used range from rational design using site-directed mutagenesis to new evolutionary approaches. One particularly exciting approach is DNA shuffling, which can yield improvements in enzyme activities 1000-fold or more above those obtained with traditional methods. Successful DNA shuffling typically depends on the ability to select or screen for a desired improvement. We expect that as such selections and screens are developed, gene shuffling will become a powerful tool in the development of improved biocatalysts for biomass utilization.

Applied biology is advancing rapidly. Based on the work presented in this session, we are enthusiastic that the future is bright for the commercial production of fuels and chemicals from renewable resources.