Microbial metabolic engineering to produce alcohols from cellulosic hydrolysates

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Project Goals:

Alcohols are much less toxic than other advanced biofuels and yeast can produce and tolerate them up to 150 g/L. We have engineered yeast strains capable of producing high titers (100-150 g/L) of ethanol (mono-alcohol) and 2,3-butanediol (di-alcohol) not only from glucose but also from prevalent sugars (cellobiose, xylose, and galactose) in the hydrolysates of terrestrial and marine biomass. While alcohols can be used as a biofuel directly, they can be also catalytically upgraded into various chemicals. Ethanol and related alcohols, such as n-butanol can be dehydrated into corresponding olefins with high selectivity and conversion yield. 2,3-Butanediol can be also dehydrated into methyl ethyl ketone (MEK), a potential platform chemical towards synthesis of jet and diesel fuels and 1,3-butadiene, a monomer of synthetic rubber361. Given the feasibility of high titer production and catalytic upgrading, we will engineer east strains to produce various alcohols from inexpensive sugar sources with a high yield and titer. We will develop and use a versatile and fully automated biofoundry, the Illinois Biological Foundry for Advanced Biomanufacturing (iBioFAB) for strain improvement.

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