190. Direct Conversion of Plant Biomass to Ethanol by Engineered *Caldicellulosiruptor bescii*

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Project Goals: The BioEnergy Science Center (BESC) is focused on the fundamental understanding and elimination of biomass recalcitrance. BESC's approach to improve accessibility to the sugars within biomass involves 1) designing plant cell walls for rapid deconstruction and 2) developing multi-talented microbes or converting plant biomass into biofuels in a single step (consolidated bioprocessing). BESC research in biomass deconstruction and conversion targets CBP by studying model organisms and thermophilic anaerobes to understand novel strategies and enzyme complexes for biomass deconstruction.

Ethanol is the most widely used renewable transportation biofuel in the US - 13.3 billion gallons in 2012. In spite of considerable effort to produce fuels from lignocellulosic biomass, chemical pretreatment and the addition of saccharolytic enzymes prior to microbial bioconversion remain economic barriers to industrial deployment[2]. We began with a bacterium that efficiently uses unpretreated biomass and engineered it to produce ethanol. Here we report the direct conversion of switchgrass, a non-food, renewable feedstock, to ethanol by an engineered thermophilic, anaerobic, bacterium, and *Caldicellulosiruptor bescii*. This was accomplished by heterologous expression of a *Clostridium thermocellum* bifunctional acetaldehyde/alcohol dehydrogenase.

While wild-type *C. bescii* lacks the ability to make ethanol, 70% of the fermentation products in the engineered strain was ethanol from switchgrass without pretreatment. Direct conversion of biomass to ethanol represents a new paradigm for consolidated bioprocessing (CBP) offering the potential for carbon neutral, cost effective, sustainable fuel production.

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