Fungal Biotechnology: How can we improve enzyme production?

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Project Goals: Development of recombinant protein production platforms in fungi for the production of ionic liquid-tolerant lignocellulolytic enzymes at high titers.

Efficient and economical deconstruction of biomass is critical for the success of lignocellulosic biorefineries. Biomass pretreatment with ionic liquids (ILs) tackles this issue as it increases biomass saccharification efficiency at lower cellulase loadings. However, some ILs inhibit the activity of commercial cellulases and must first be removed from the biomass, a costly mitigation.

To overcome this issue, the Microbial Communities and Enzyme Optimization teams at JBEI have identified cellulases that can function in the presence of ILs. These enzymes were expressed in *Escherichia coli*, which is a suitable host for lab-scale enzyme characterization but not for industrial-scale production of enzymes.

Filamentous fungi have been widely utilized for enzyme production in industry and therefore the Fungal Biotechnology team has focused on developing *Aspergillus niger* as a heterologous enzyme production host. Several approaches have been utilized to increase enzyme production in the fungus: 1) reverse genetics, 2) forward genetics and mutagenesis, 3) genetics parts development, and 4) characterization of a wide variety of heterologously expressed enzymes. We are also expanding our efforts to include fungal lignin deconstruction and conversion into advanced bioproducts.

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