Rational Engineering of Xylose Co-utilization in Yeast for Advanced Biofuels Production

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Project Goals:
Yeast Engineering for glucose/Xylose co-utilization and advanced biofuels production.

We previously engineered yeast (*S. cerevisiae*) to produce bisabolene, which after hydrogenation, is a good diesel replacement fuel. Economic feasibility of biofuel production from lignocellulosic feedstock will require efficient utilization of all the sugars available in plant hydrolysates. Despite its history of industrial use, yeast cannot naturally utilize pentoses efficiently, including Xylose, a major constituent of hydrolyzed lignocellulosic biomass. Several groups have tried to engineer xylose utilization in yeast for bioethanol production for the last 30 years with very limited success (e.g. slow xylose utilization following depletion of glucose). These attempts usually involved a combination of rational engineering and directed evolution to achieve improved phenotypes. However, the genetic bases of these selected phenotypic improvements have never been characterized. We sought to elucidate the genetic basis of strain phenotypic improvement after evolution on xylose in order to rationally transplant these traits into strains previously engineered for advanced biofuels production. The resulting strains should be capable of using biomass hydrolysates efficiently (i.e. consume glucose and xylose simultaneously in the proportions present) to produce a biofuel.

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