Conversion of Sugar Mixtures into Products using Substrate Selective Uptake

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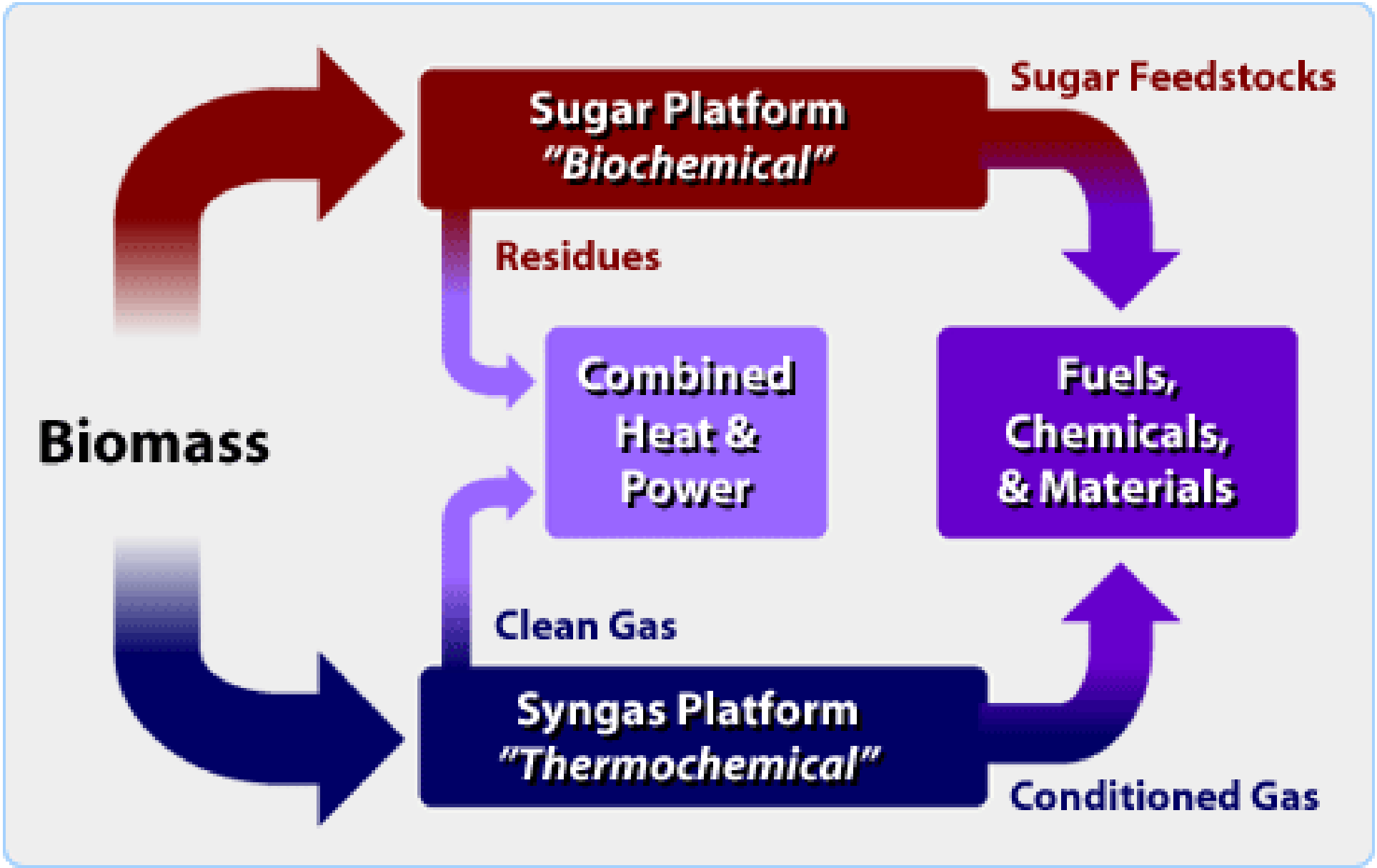
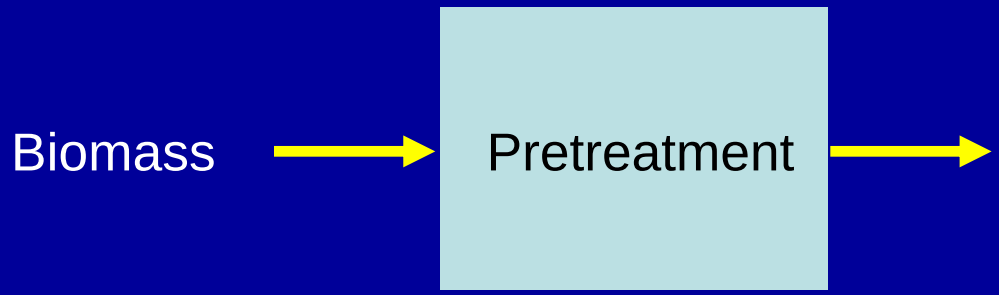
Biorefinery Concept



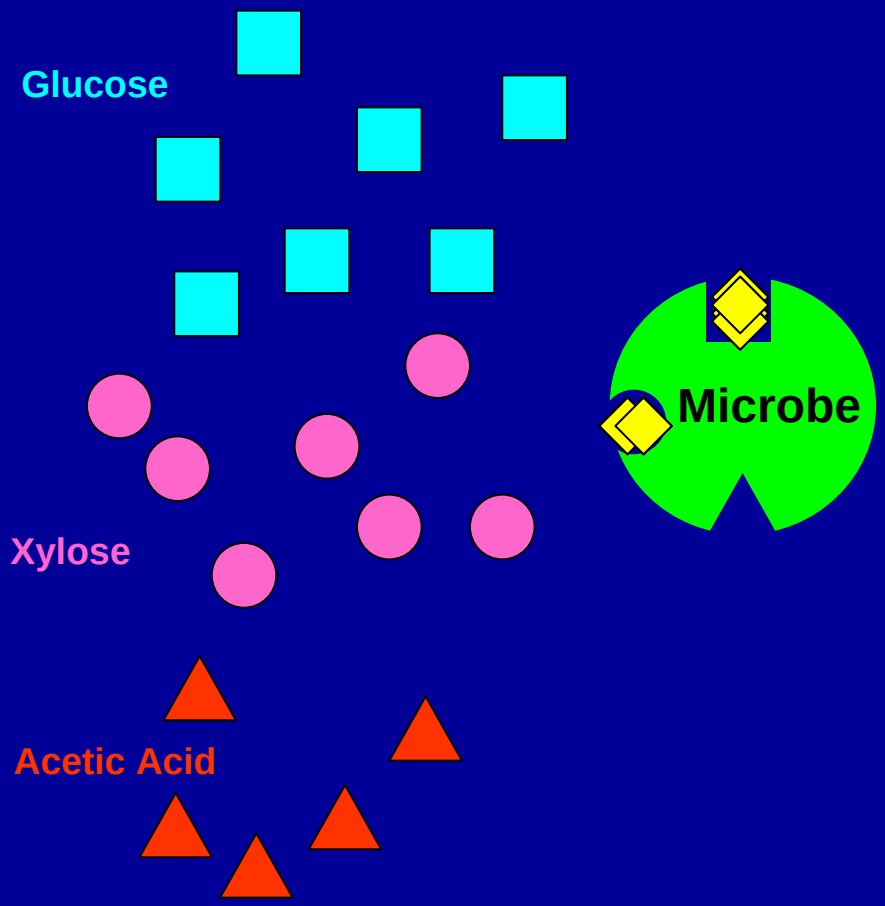
Source: www.eere.energy.gov/biomass

Sugar Platform



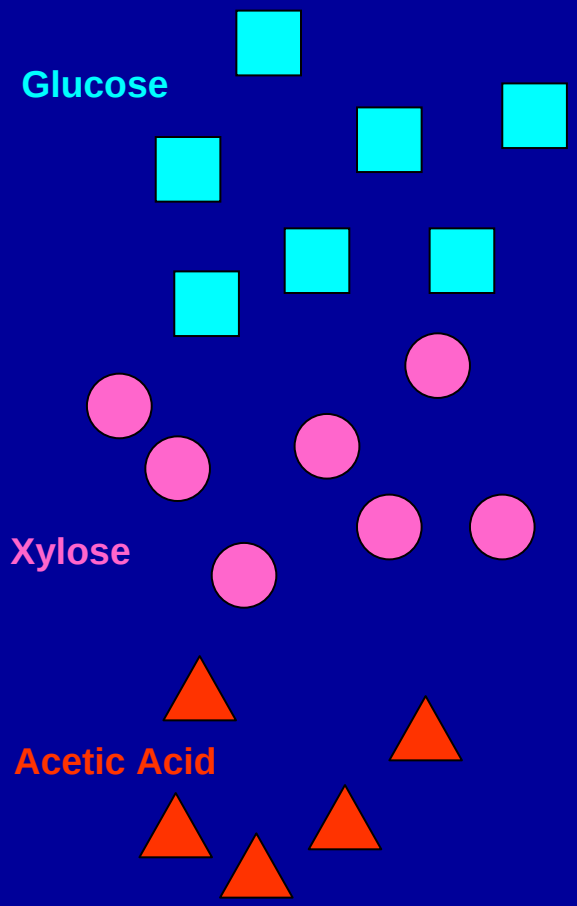
Glucose
Xylose
Arabinose
Mannose
Galactose
Galacturonic Acid
Acetic Acid
Furfural
Hydroxymethylfurfural
Sinapyl Alcohol
Coniferyl Alcohol
p-Coumaryl Alcohol

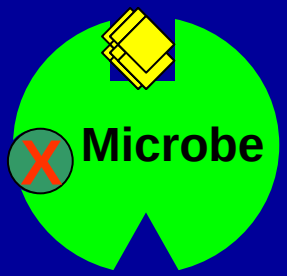
Approach #1



Ethanol

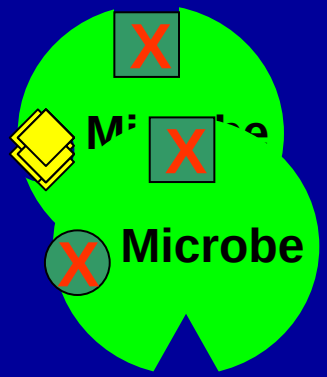
Approach #2





Glucose-Selective Strain

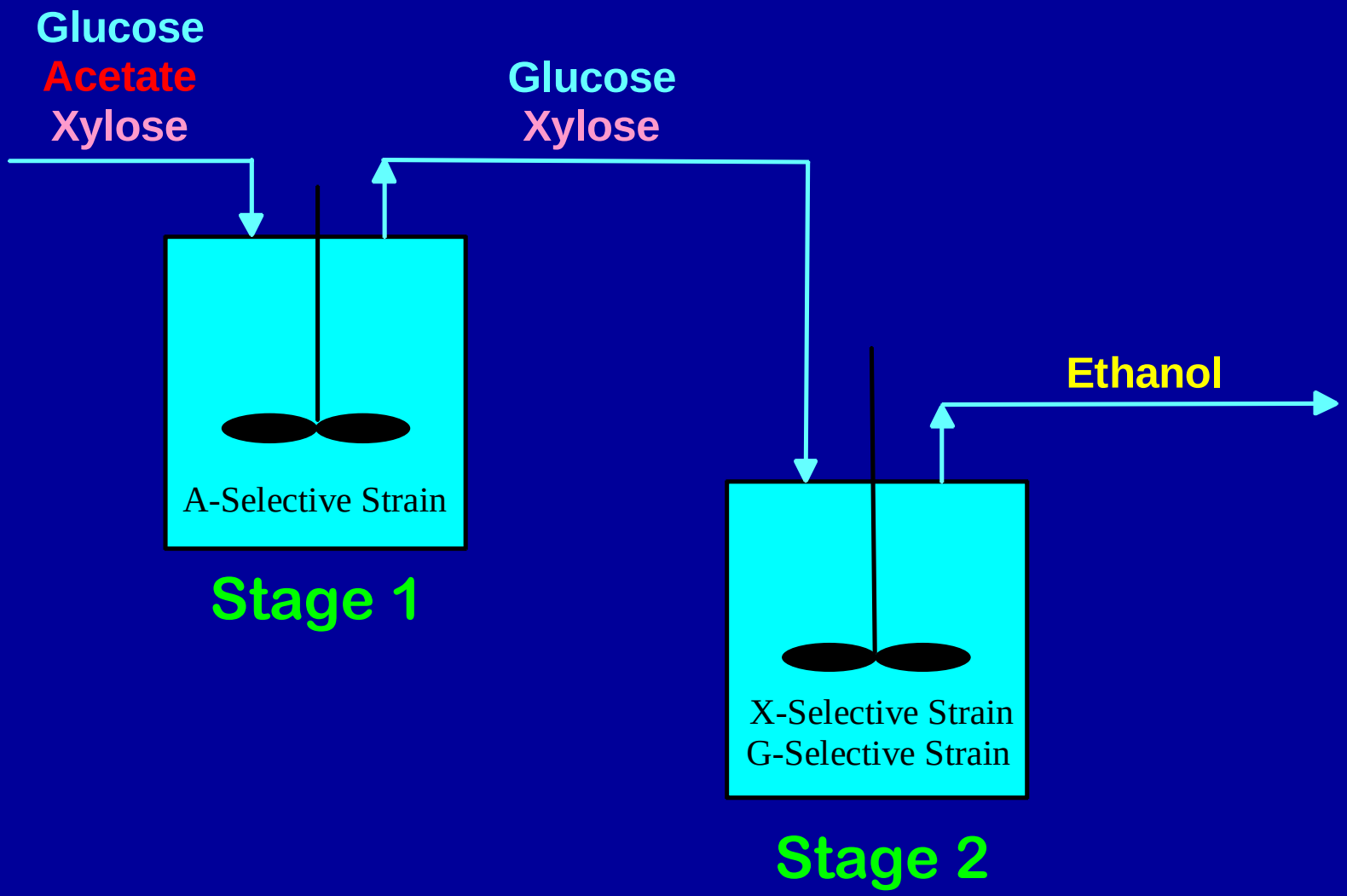
Ethanol



Xylose-Selective Strain

Acetate-Selective Strain

Process Concept



Materials and Methods

Strains (*E. coli*)

ZSC113 (*ptsG manZ glk*)
ALS1008 (*xylA*)
ALS1060 (*ptsG manZ glk xylA*)

Batch

16 g/L glucose, 8 g/L xylose, 10 g/L acetate

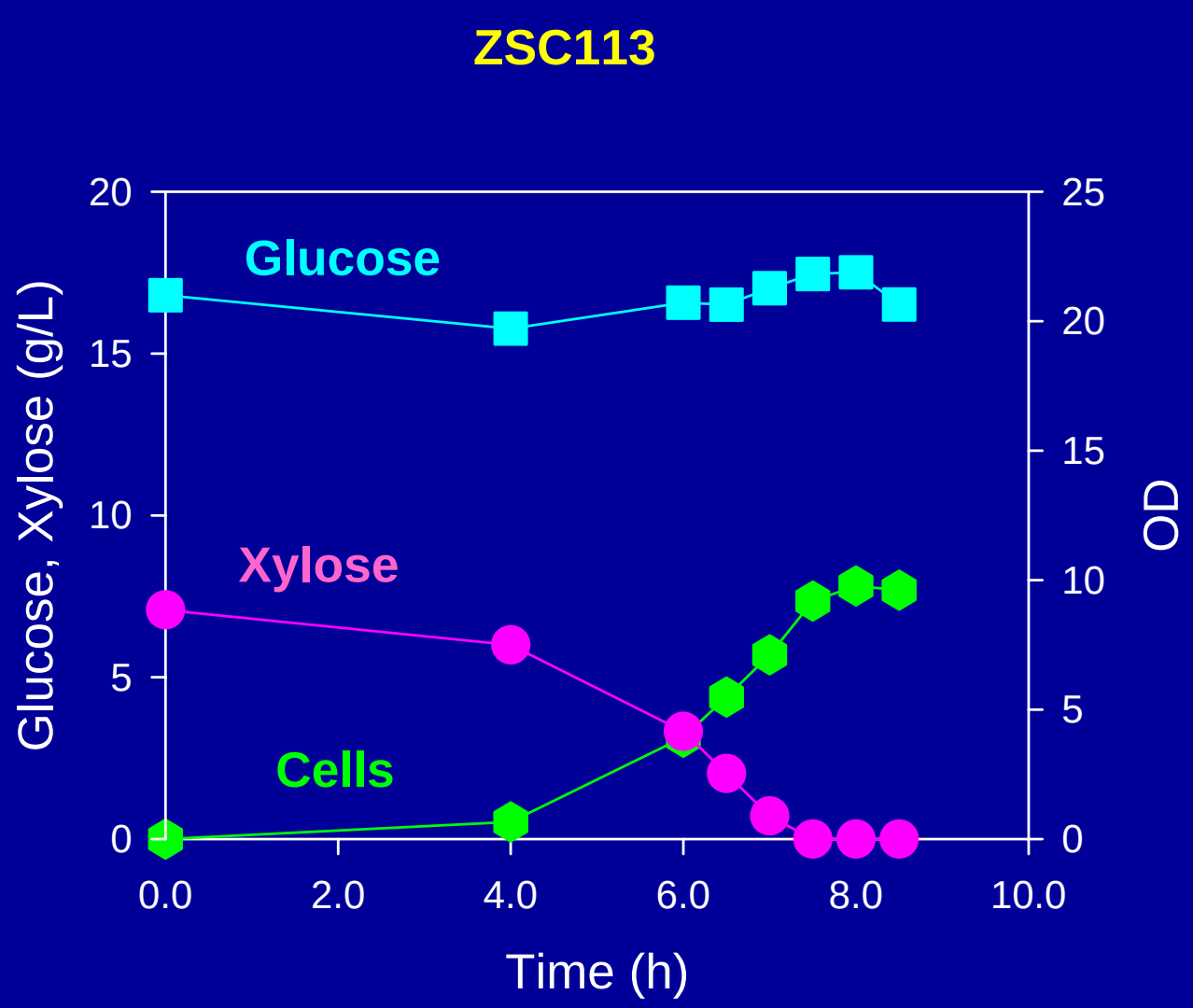
Fed-Batch

Exponential, Varied Concentrations

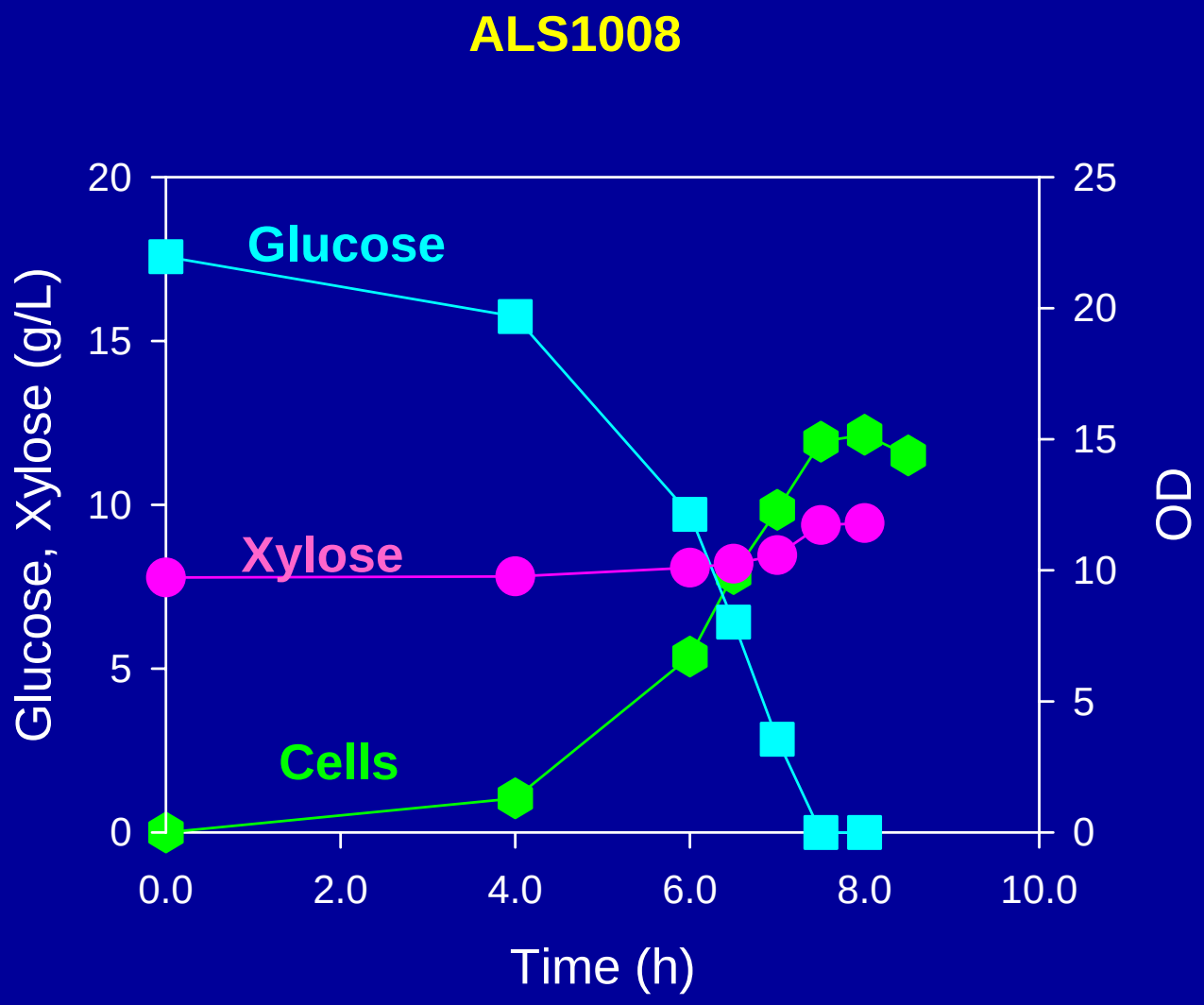
Conditions

1.0L, 37°C, pH = 7.0

Xylose Consumption

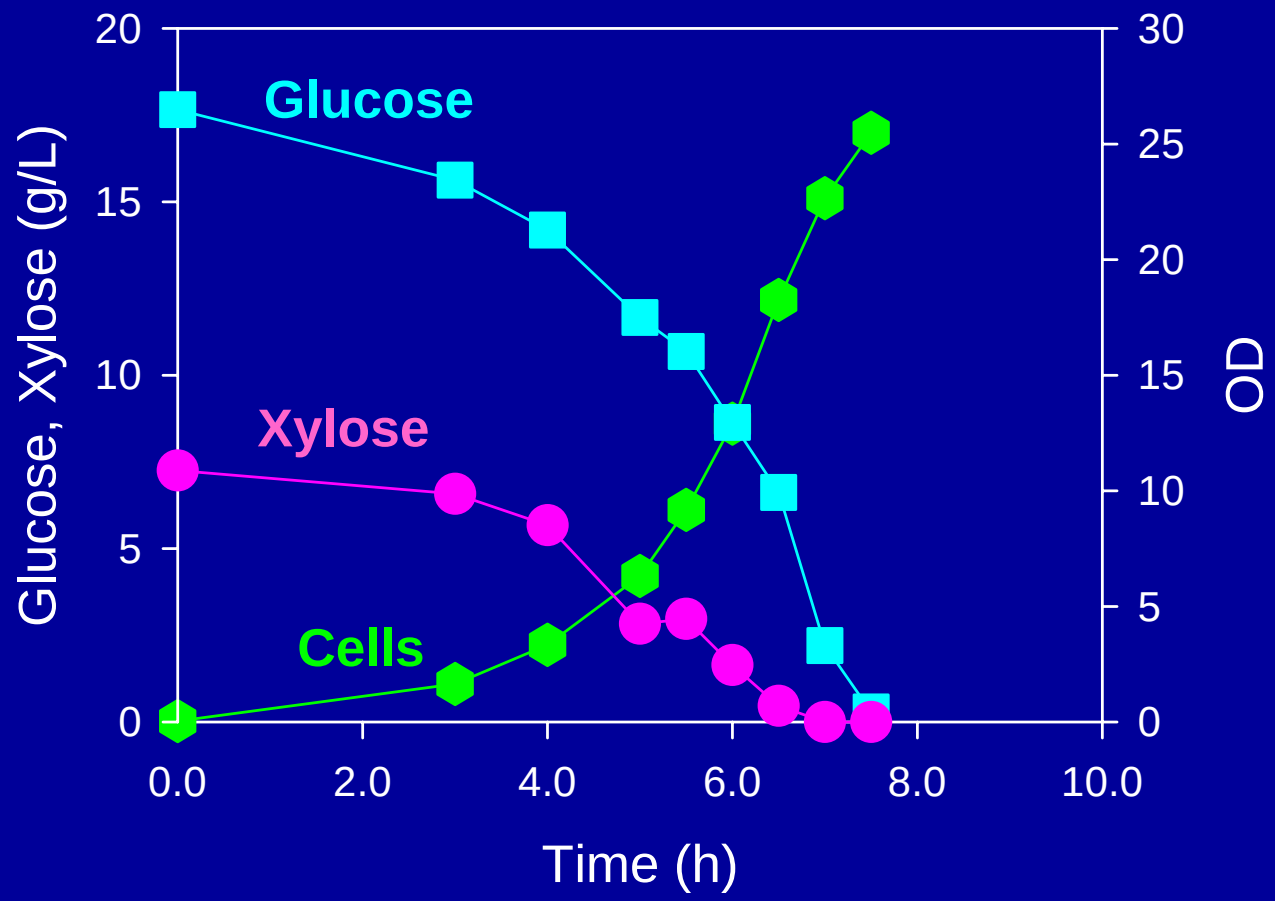


Glucose Consumption



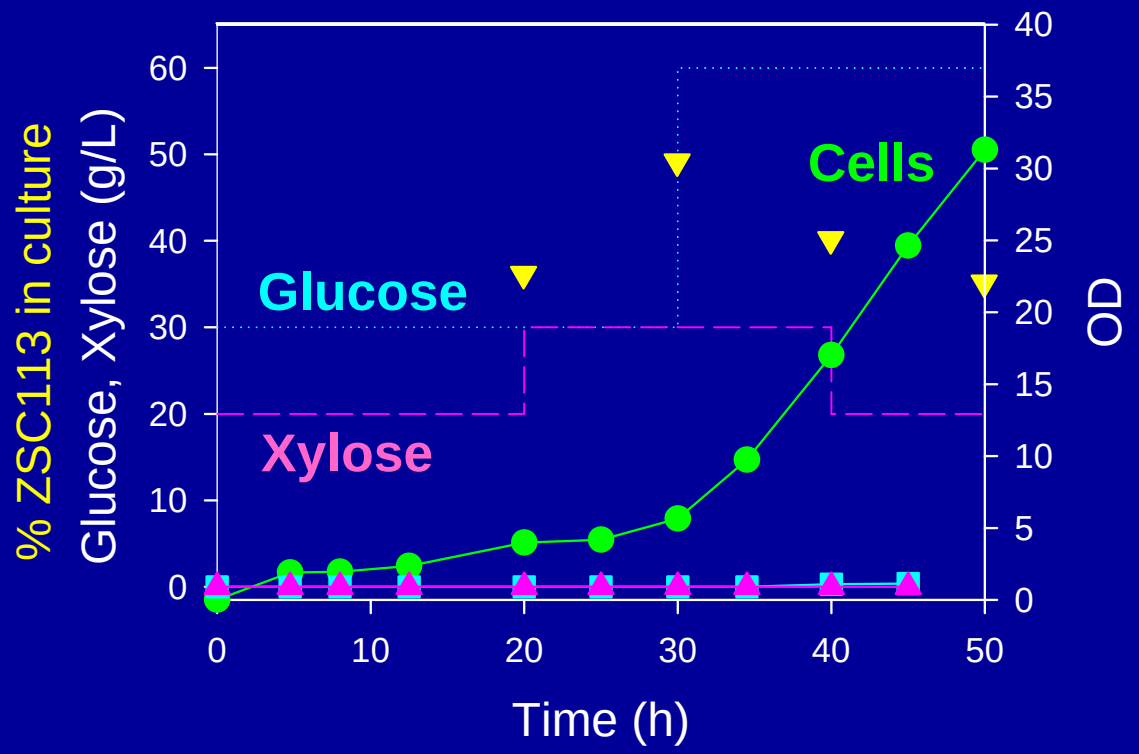
Xylose and Glucose Consumption

ZSC113 and ALS1008

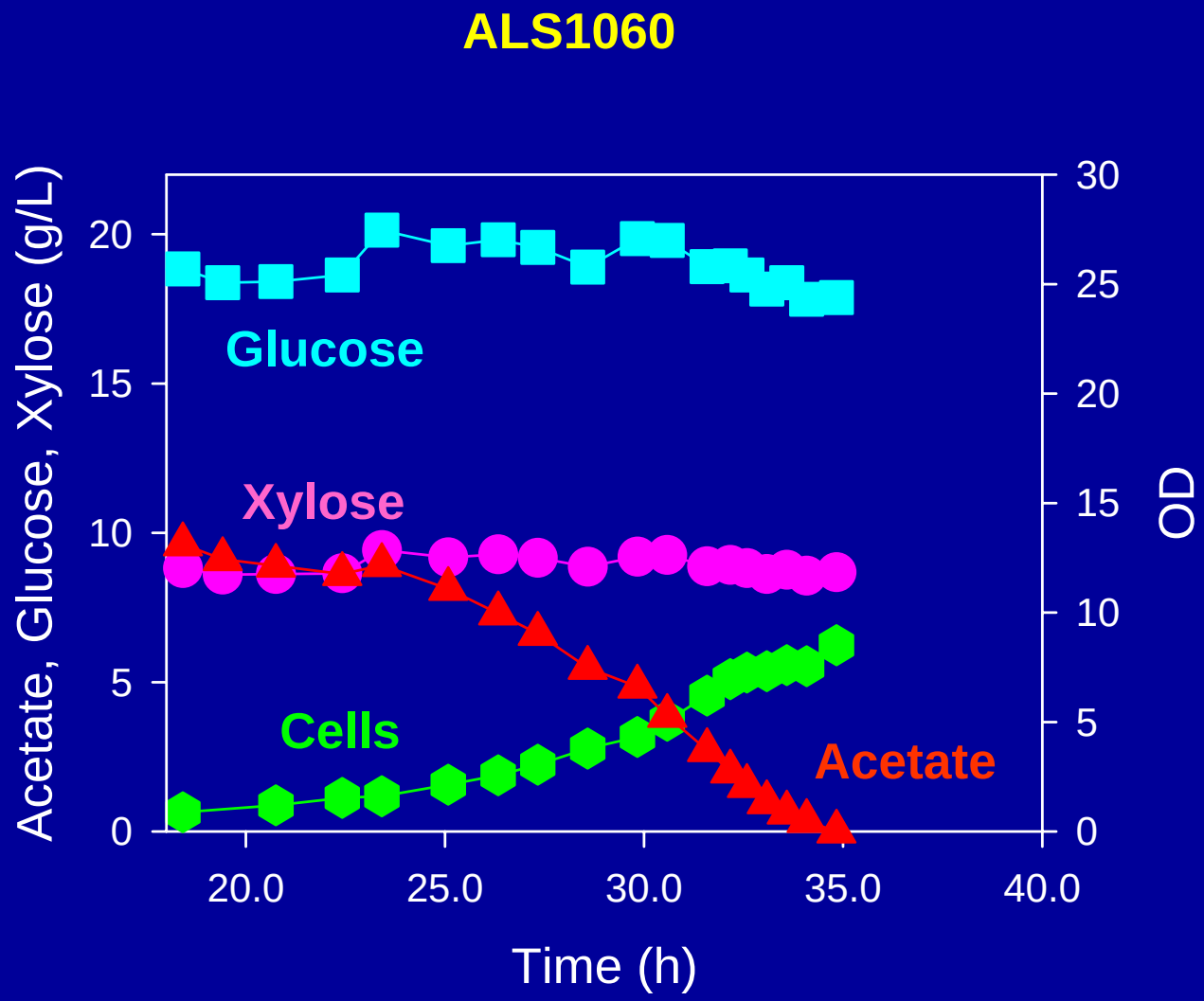


Xylose and Glucose Consumption

ZSC113 and ALS1008



Acetate Consumption



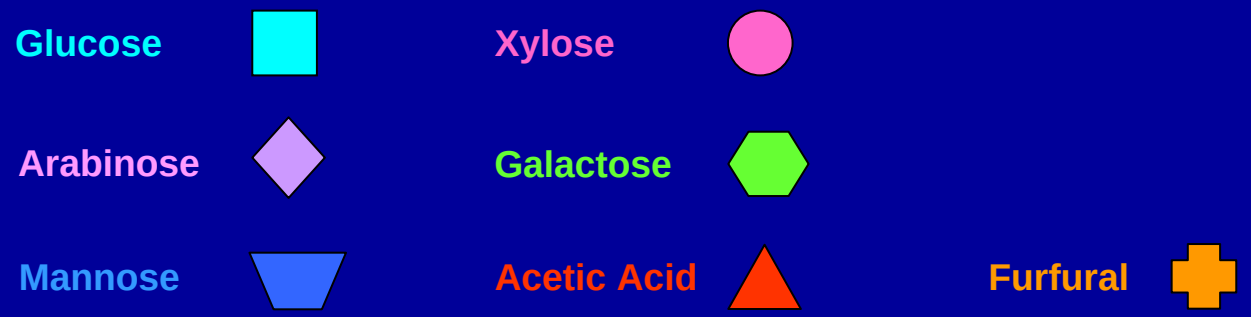
Advantages of Approach

- Cellular nutrients from acetate-selective cells in Stage 1 are available to support growth of cells present in Stage 2.
- Metabolic engineering strategies can focus on improving the individual production strains independently. We do not need to compromise one objective for another.
- The system adapts to fluctuations in the feed stream; that is, cultures actually grow in concert with the feed composition.

Long Term Objectives

Lignocellulosic biomass is a complex mixture which requires special high-temperature/high-pressure processes to generate monomers.

The resulting hydrolysate is complex, and requires multiple strains with specialized abilities to work in concert to convert monomers into ethanol or other bio-based products.



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GEORGIA RESEARCH ALLIANCE

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