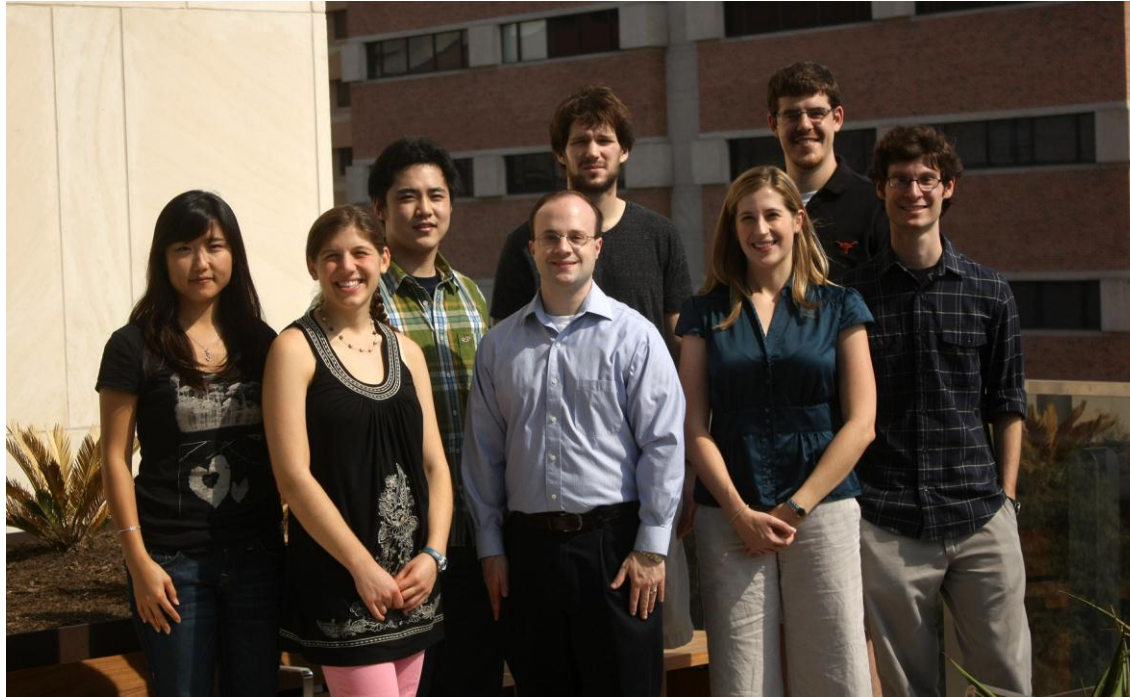
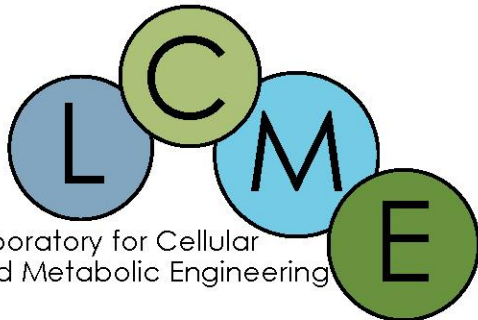


# Laboratory for Cellular and Metabolic Engineering

*Engineering biology to produce  
biomolecules, fuels, and pharmaceuticals*



Spring 2011, Alper Lab Graduate Students

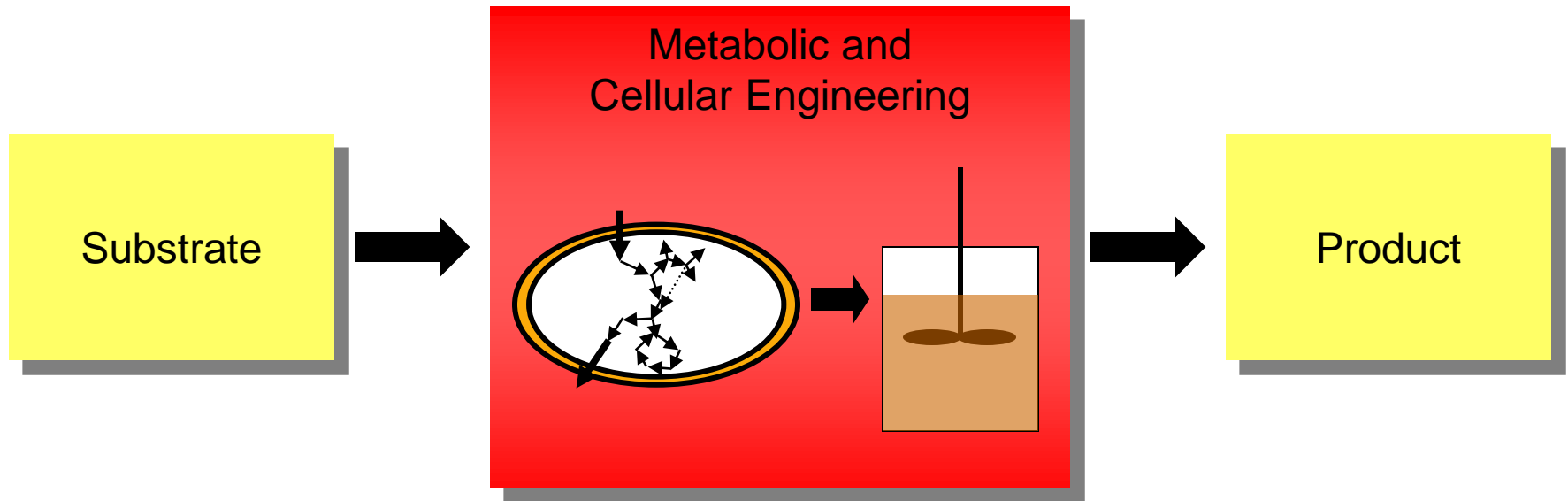


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# Contextual Background



Employing metabolic and cellular engineering as an enabling technology to improve cellular performance.

Our Approach: Traditional pathway engineering is uniquely merged with protein engineering, novel genetic tools, and novel methodologies.

# Realizing the goal of cellular engineering

## Native Organisms

Limited  
Substrates  
(glucose)

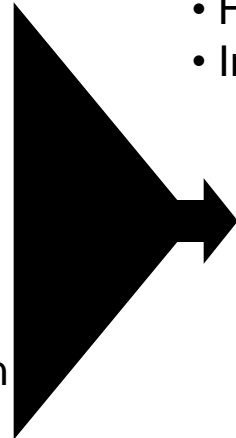


Limited, mixed  
Products  
(acids, alcohols)

## Engineered Organisms

Expanded  
Substrates

- Lignocellulosic Biomass
- Chemical Waste
- Agricultural Byproducts
- Non-conventional carbon



Re-wired Cells

- Higher tolerance
- Improved throughput

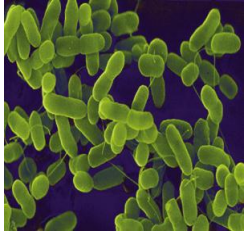


Novel, diversified  
Products

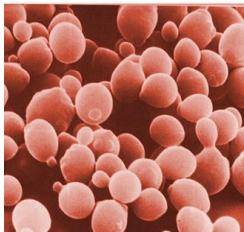
- Next-generation biofuels
- Non-natural molecules
- Commodity and specialty chemicals
- Pharmaceuticals

# Model systems and phenotypes

## Cell Models



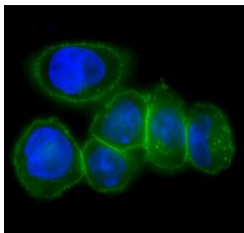
**Microbial Engineering**  
(e.g.: *Escherichia coli*)



**Fungal Engineering**  
(e.g.: *Saccharomyces cerevisiae* and other yeasts)



**Phototroph Engineering**  
(e.g.: *Synechococcus sp.*)



**Mammalian Cell Engineering**  
(e.g.: Chinese Hamster Ovary Cells)

## Cell Phenotypes

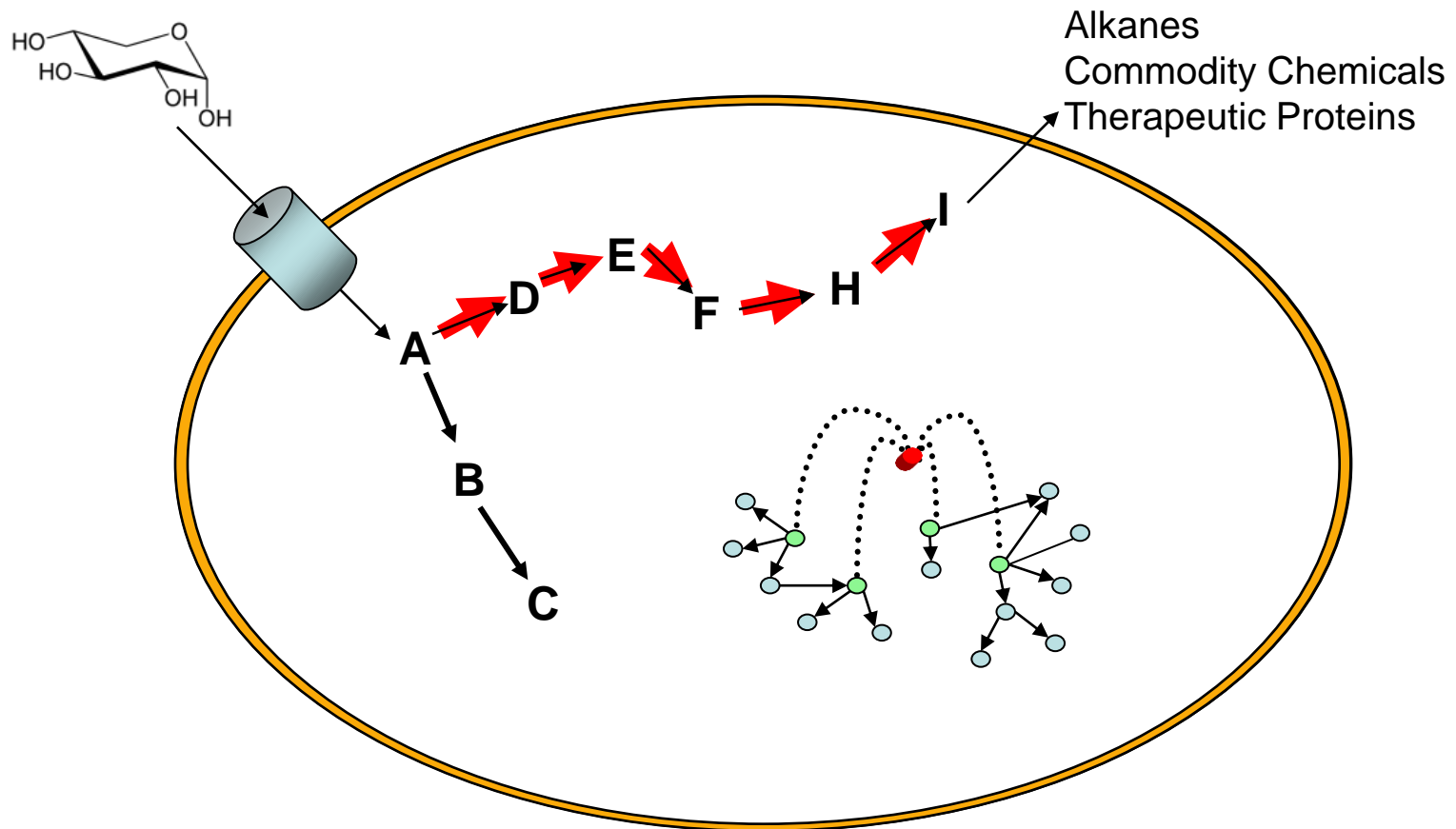
### Production phenotypes

- Ethanol/alternative biofuels
- Hydrocarbons
- Lipids and fatty acids
- Protein drugs
- Commodity chemicals

### Other Phenotypes of Interest

- Chemical tolerances
- Disease states
- Biodegradation capacity
- Alternative sugar utilization

# Examples of Ongoing Projects



# Current/Ongoing Research Areas

- Engineering **biofuels** production
  - Production of novel hydrocarbons and fatty acids in yeast
  - Designing methods for improved biomass utilization
- Developing methods for **metabolic pathway engineering**
  - Engineering proteins in pentose utilization pathway
- **Mammalian cellular engineering**
  - Developing stable mammalian gene expression tools

# Laboratory for Cellular and Metabolic Engineering

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The Alper Laboratory will be offering **2** graduate research assistant positions in **Fall 2011**. These positions will be in the areas of:

- Engineering **advanced biofuels** production.
- Developing approaches for eliciting **complex phenotypes**.

For more information, contact:

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