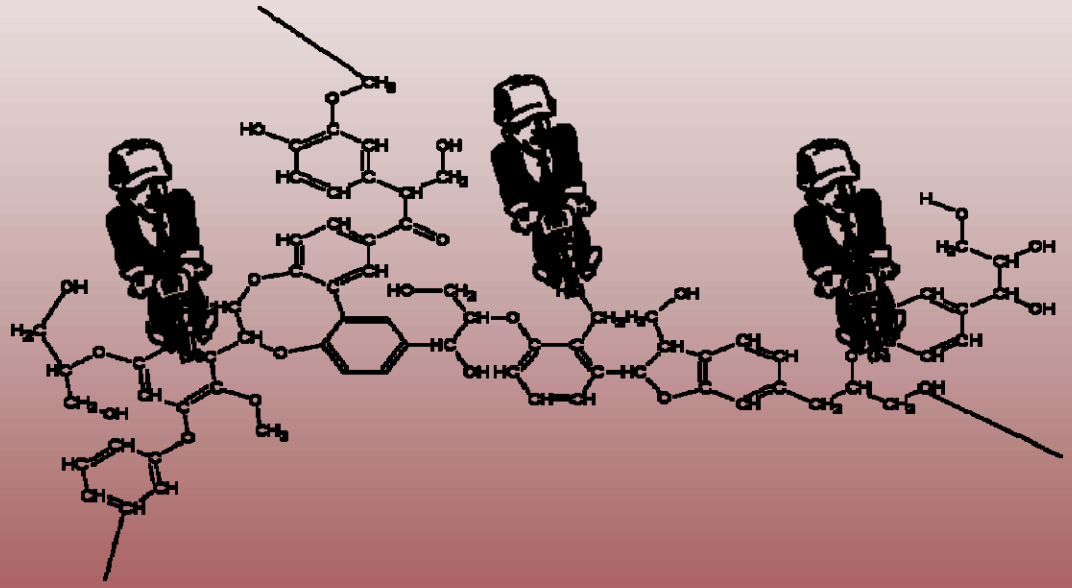
Lignin: It's Degrading



Mississippi State University

Caleb Dulaney, Sam Pote, Robert Morris, Victor Ho, Dr. Filip To, Dr. Din-Pow Ma

Mississippi State University

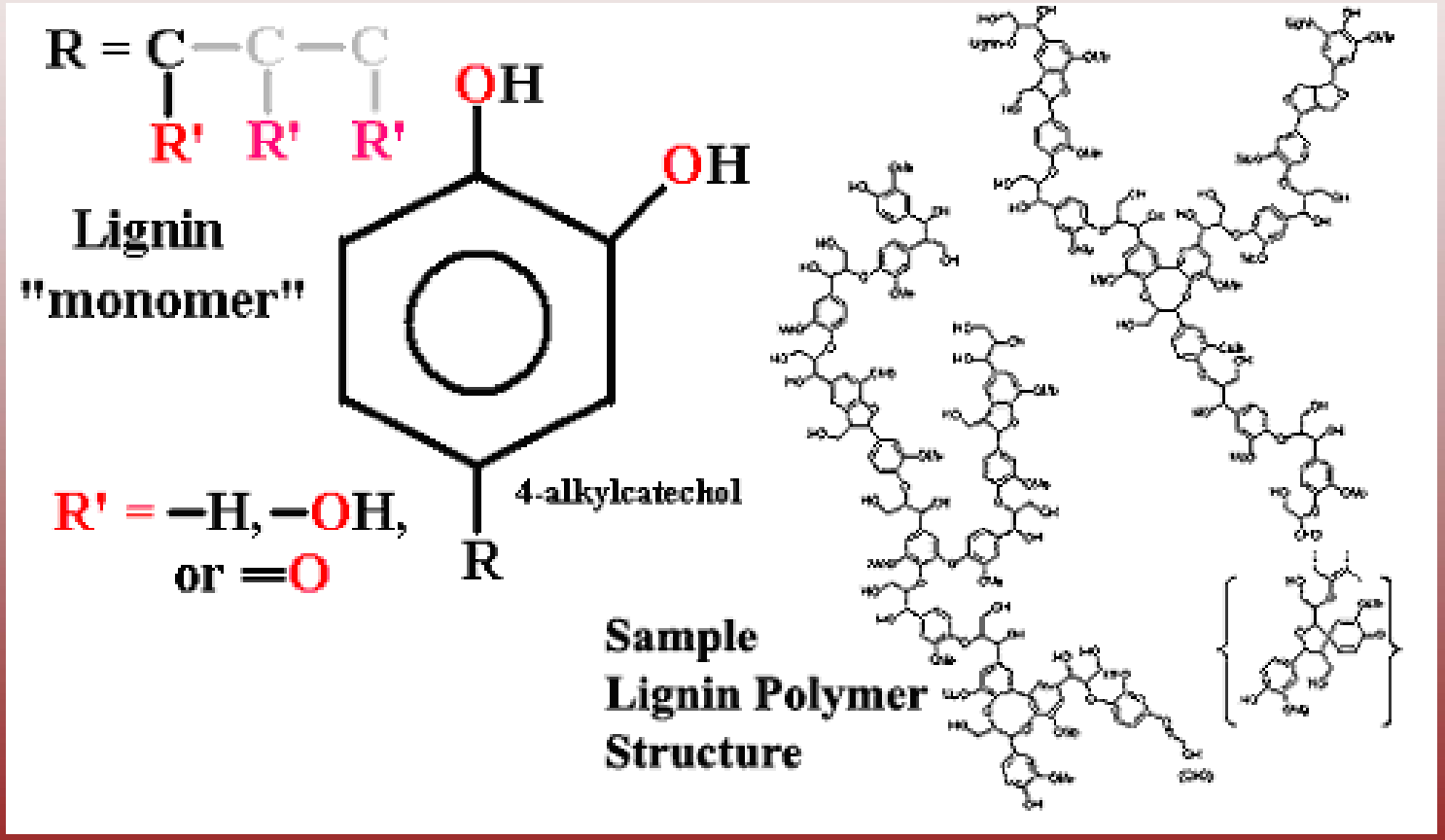
Agricultural & Biological Engineering

James Worth Bagley College of Engineering
Mississippi State University


53%
130,000,000
*2005, Environmental Protection Agency

The Problem:

Lignin


R = C C C
R' R' R'
OH
OH
Lignin
"monomer"
R' = –H, –OH,
or =O
4-alkylcatechol
R
Sample
Lignin Polymer
Structure

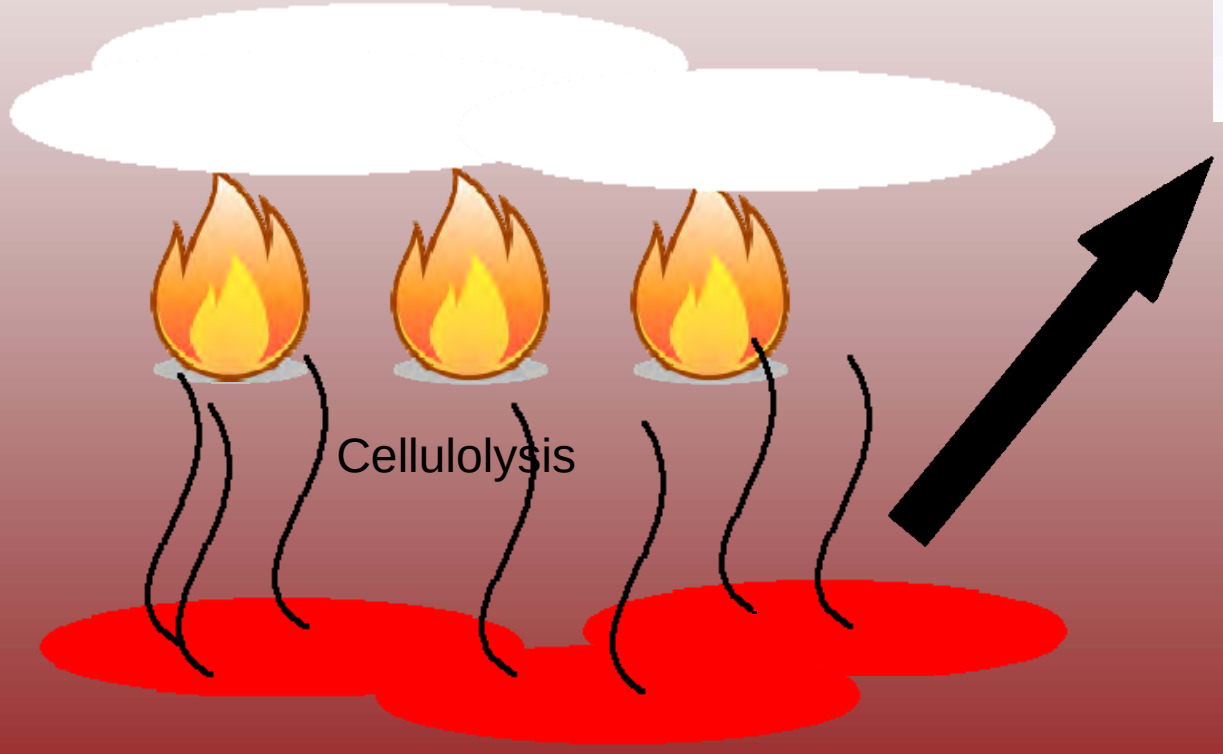
Phanerochaete Chrysosporium

Our Idea:


LipA Yeast
Wood Sample
Mixture of cellulose & hemicellulose

Products = Fuel

Mixture of cellulose & hemicellulose



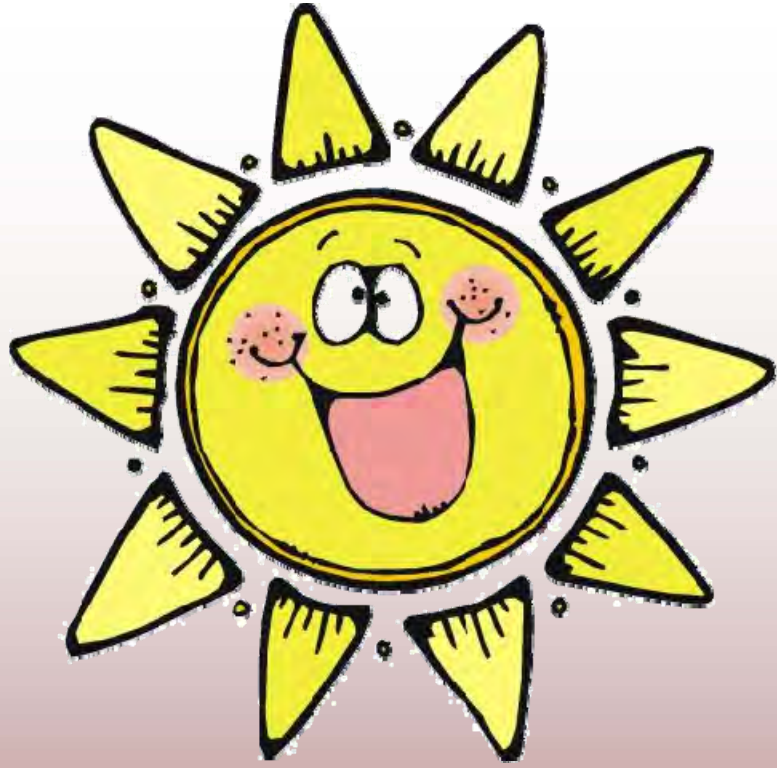
Sugar Compound

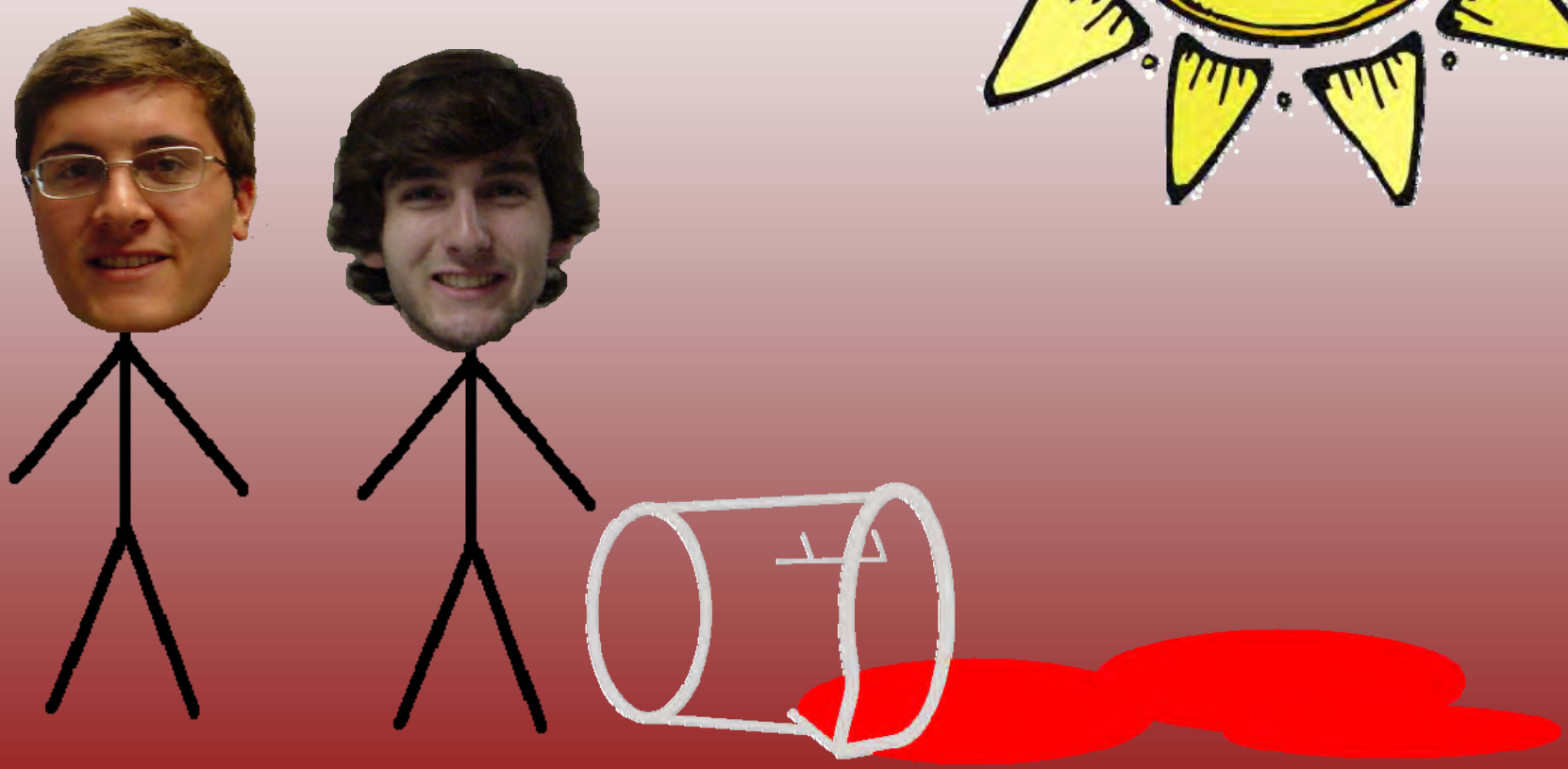
Fermentation

Goals

- Isolate Genes for Lignin Degradation
- Contribute Biodegradation Parts
- Make it easier to engineer Biodegradation system
- Experiment with degrading other materials

Limitations



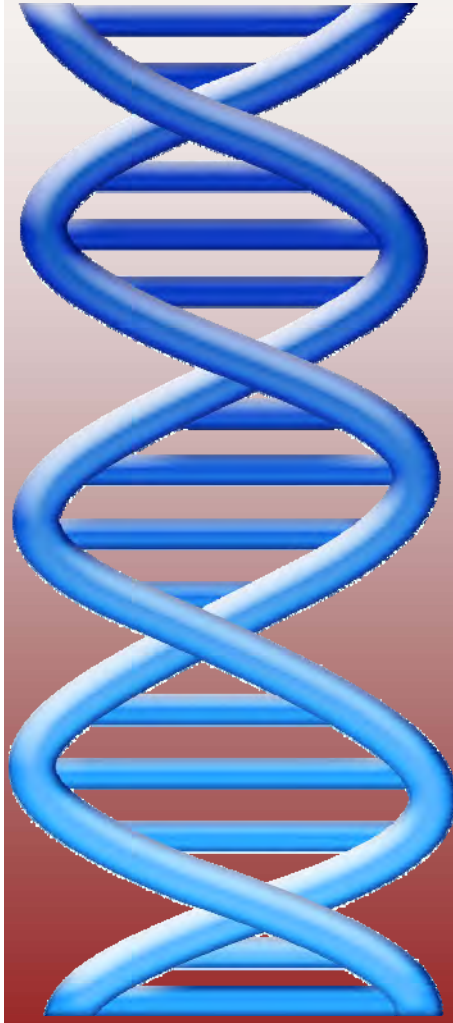


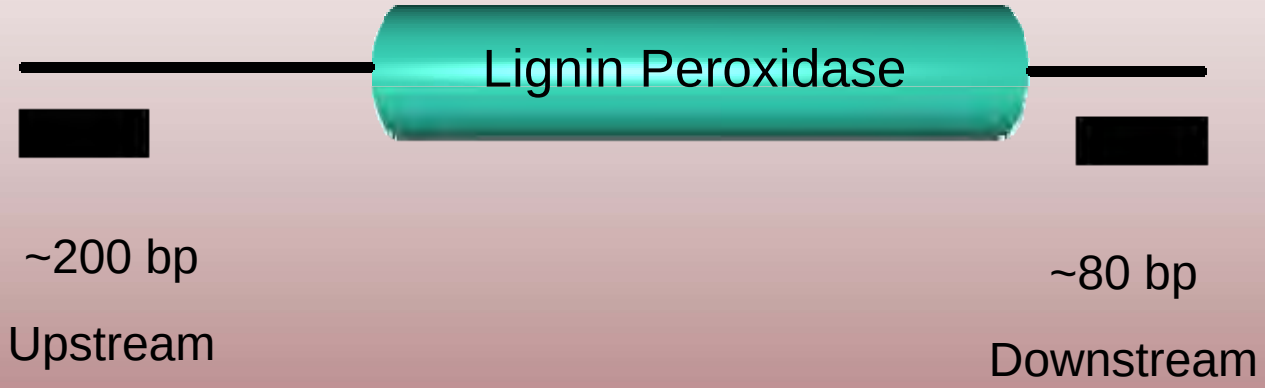
Phase I: Summer 08

Lignin Peroxidase

Step 1:

Isolate LipA Gene

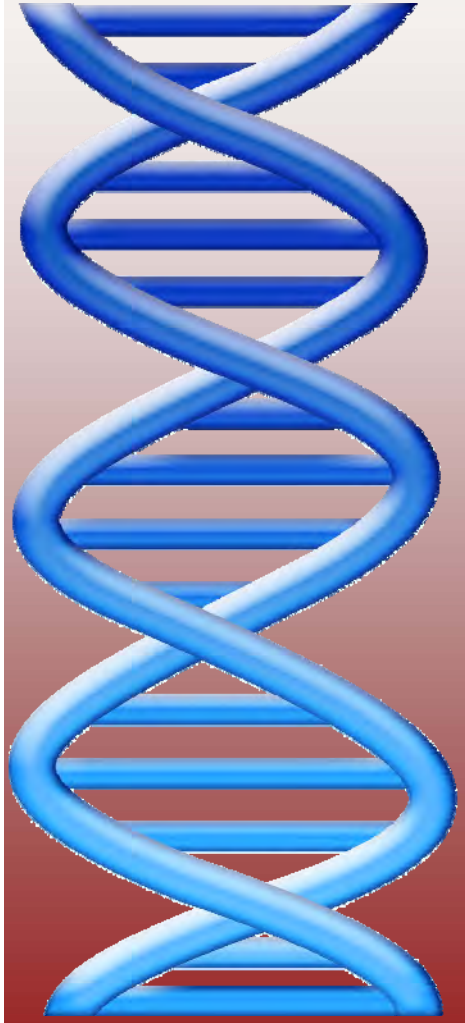


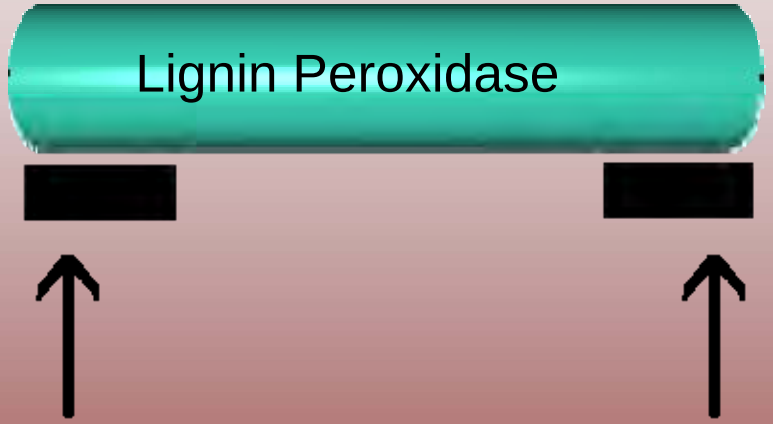


Phanerochate Chrysosporium cDNA grown on Aspen Wood

Step 1:

Isolate LipA Gene

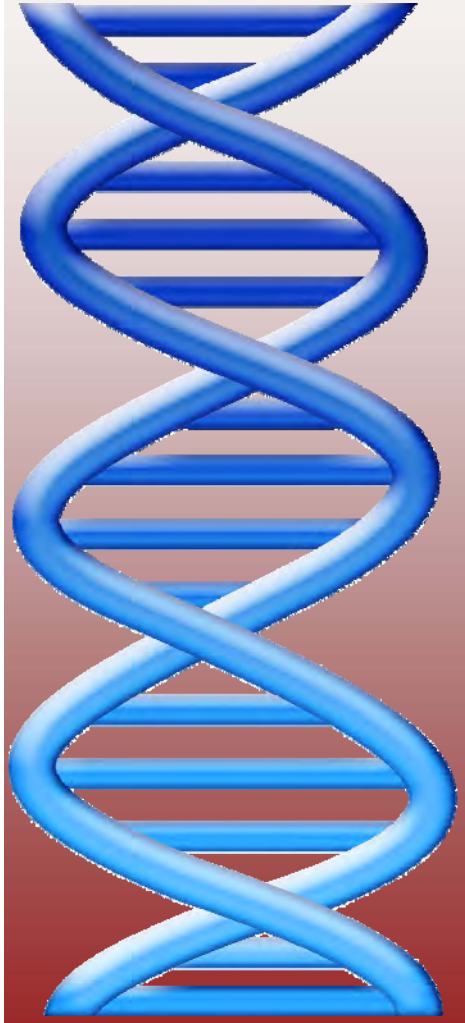




Specific for Coding Region

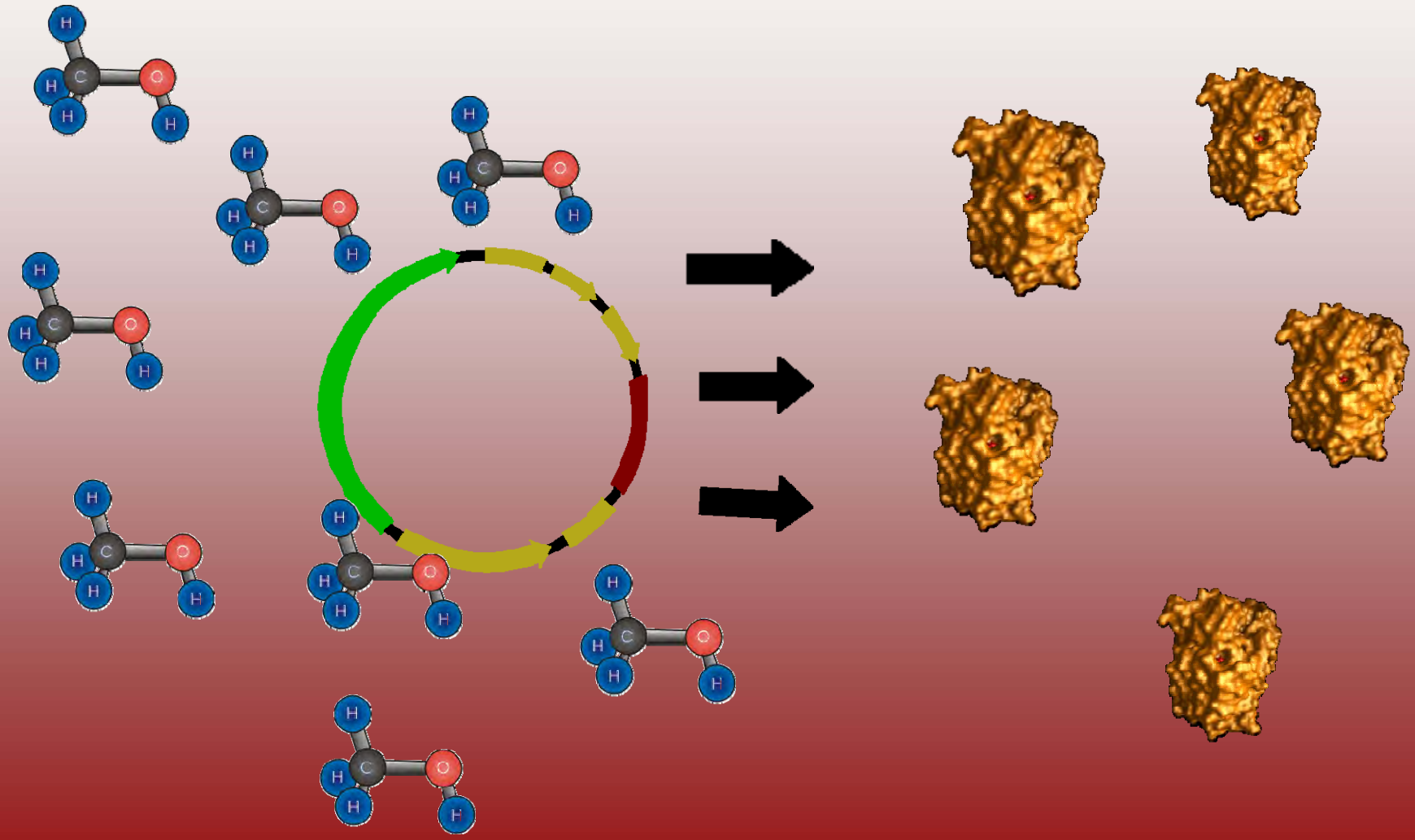
Step 2:

Make Lignin Peroxidase BioBrick



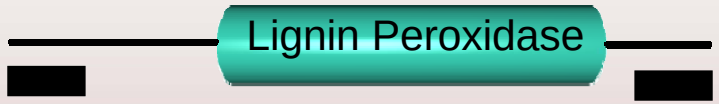
Step 3:

Test For LipA production



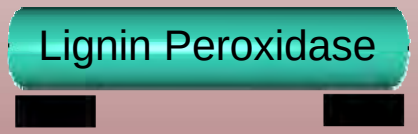
Strategy

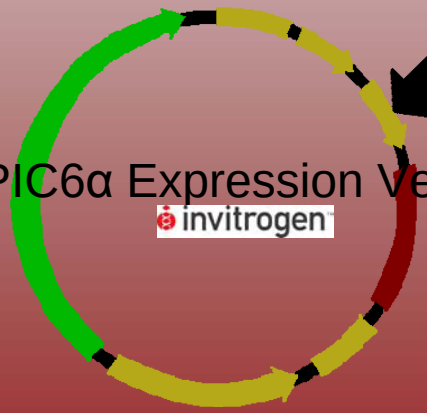
cDNA RP-78 Strain of
Phanerochaete Chrysosporium



~200 bp
Upstream

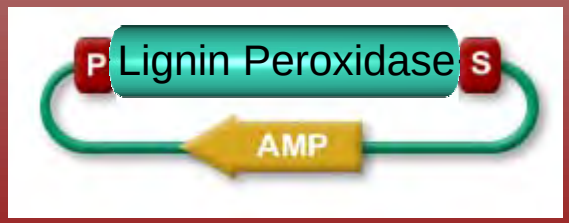
~80 bp
Downstream





pPIC6α Expression Vector

BioBrick Standard Assembly



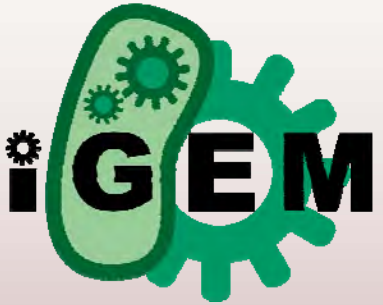
Accomplishments

- Isolated Lignin Peroxidase from Highly Homologous Gene Family
- Cloned into Yeast Expression Vector for Testing
- Submitted Biodegradation Part to Registry
- **Helped make it easier to engineer a biodegradation system.**

Future

- Further test and fully characterize our part
- Develop genetic system around our part for lignin degradation
- Isolate and standardize other genes involved in lignin degradation
- Test our enzyme’s ability to degrade synthetic polymers

Thanks



2008

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MSU Department of Biochemistry and Molecular Bio.

U. of Wisconsin Forest Products Lab

Jill Gaskell