

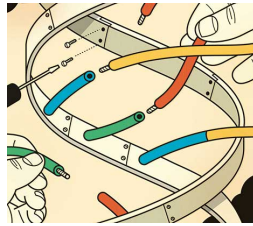
Introduction to Synthetic Biology

Discuss

- What do you think synthetic biology means?
 - Where have you heard the word synthetic before?
 - What does it relate to?
 - What does bio mean?
 - What does “ology” mean?
- With your desk partner, discuss the questions above and be prepared to share your thoughts.

Definition

- Synthetic Biology is the design and construction of new biological components
 - Enzymes
 - Genetic circuits
 - Cells
- Combines biology and engineering
- Understanding how life works and how to use it to benefit society



Dream Big!

- If you could engineer (construct) one living thing to have a new trait or function, what would you make?

Why study Synthetic Biology?

- Microorganisms can help solve some of the world's most complex problems
- The diversity and amount of biological systems is immense
- As we learn more about how they work, biological organisms are becoming easier to engineer

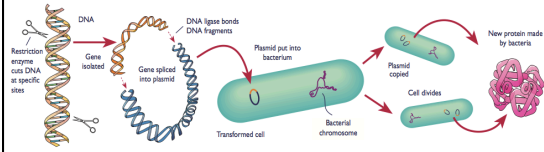


Applications of Synthetic Biology

- Biofuels
 - Engineering microorganisms to efficiently convert biomass
- Vaccine and Antibody Production
 - Sequencing genetic information
- Plant Sciences
 - Genetically engineering food
- Industrial Enzymes
 - Ex. Lactose free foods, laundry detergents
- Bio-based chemicals
 - Biodegradable plastics, plant based cleaning supplies, decrease reliance on oil

Recombinant DNA Technology

- Genetically engineered DNA prepared by cutting DNA with enzymes and splicing them back together
- Can be used to add, modify or delete

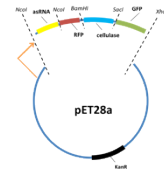


Source Materials

Necessary Components

- Chassis**
 - A host cell
- Vectors**
 - Used to carry the transforming DNA to the host cell
 - Ex: Bacterial plasmid
- Promoters**
 - Acts as a catalyst
 - Location on DNA where transcription of a gene begins

Plasmid Map

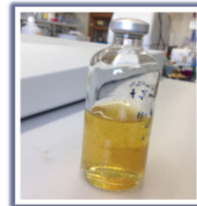


Key Vocabulary

Plasmid	Enzyme	PCR (polymerase chain reaction)	Ligate
Bacterial in origin, extra-chromosomal, circular, double-stranded DNA, much smaller than the genome	A substance produced by a living organism that acts as a catalyst to bring about a specific biochemical reaction.	To amplify a piece of DNA, generating thousands to millions of copies of the sequence	To link two ends of DNA or RNA

Project Workflow in O' Malley Lab @ UCSB

Generate source materials from fungus



Michelle O'Malley, Principal Investigator, UCSB



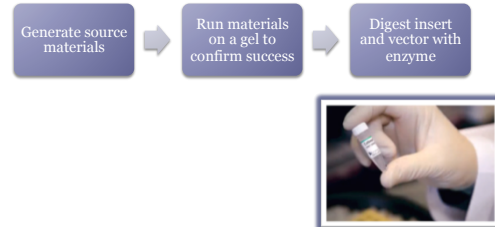
Megan Cotlich, La Colina Jr. High, Dr. Kevin Solomon, UCSB

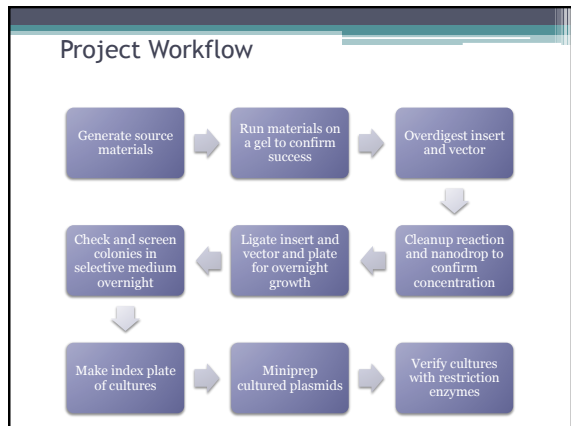
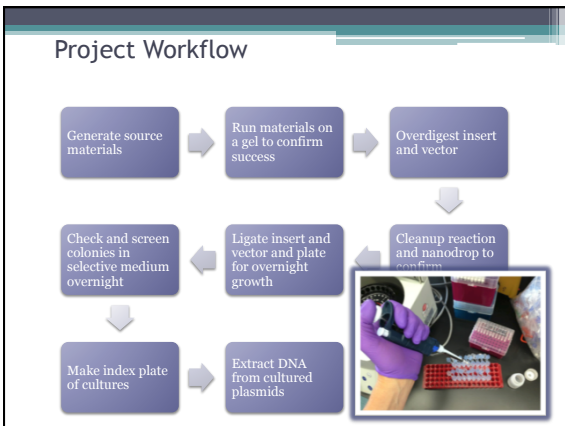
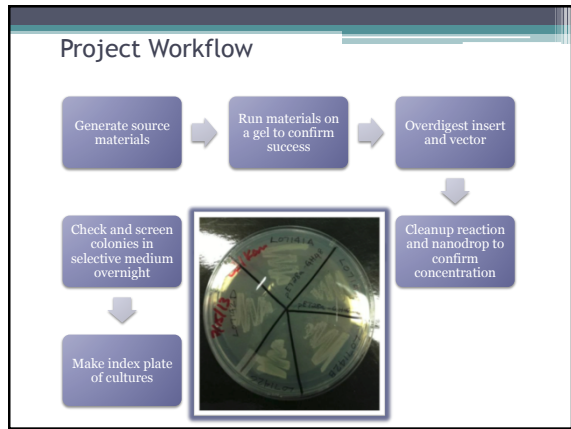
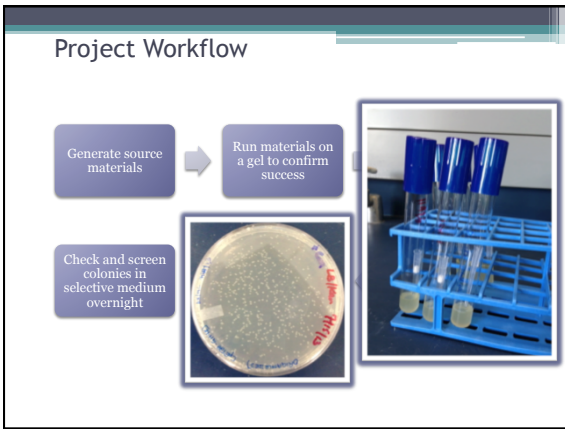
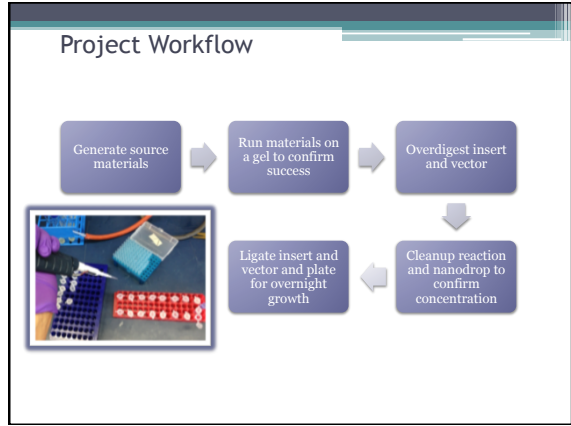
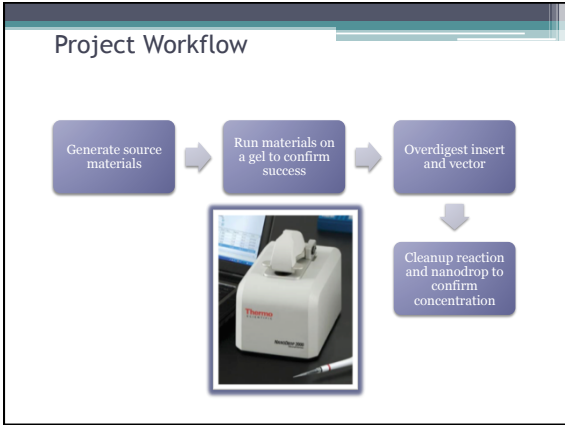
- Using yeast as a model organism, the O' Malley Lab aims to engineer it to more efficiently create plant based biofuels.
- Using agriculture waste as its source would produce higher yields of fuel without the cost, acreage, and societal impacts associated with large grain production.

Project Workflow



Project Workflow





Next Steps

- In order to become a biotech engineer, you need to learn more about the components we will be working with:
 - DNA
 - Enzymes
 - Plasmids
- **Wheat Germ DNA Extraction:** Determine how to extract DNA from a cell
- **It's All in the Family:** Learn how genes transfer from one generation to the next
- **Modeling Recombinant DNA:** Engineer a bacterial plasmid to contain a desired gene