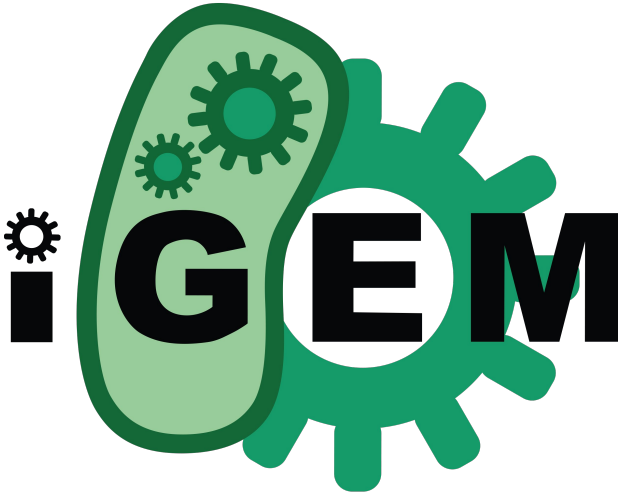
iGEM 2018 at Stony Brook University

What is



?

iGEM Competition?

***I**nternational*

***G**enetically*

***E**ngineered*

***M**achine*

Using techniques in synthetic biology, teams develop creative and innovative solutions to real world problems, ranging from the field of health and medicine, to energy, and even food and nutrition.

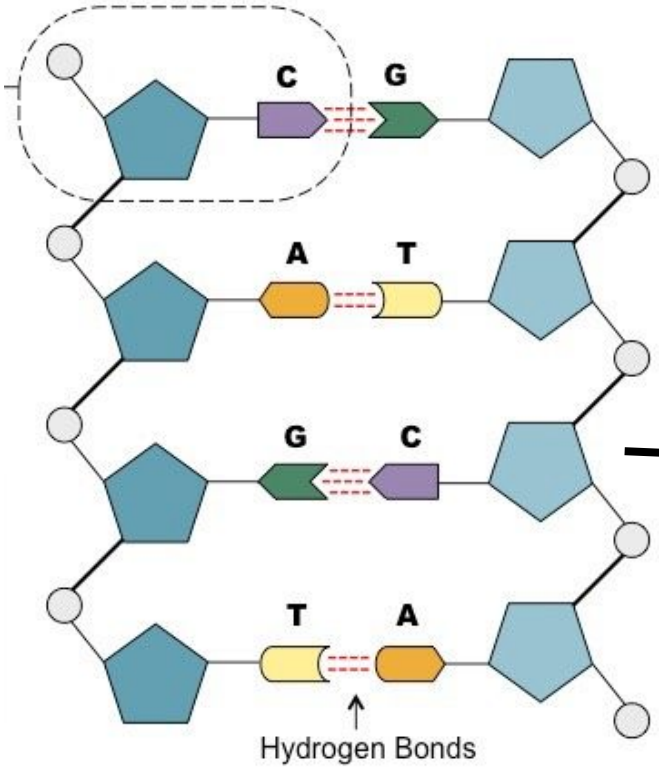
Last Year's Jamboree

Over 45 countries involved in iGEM!

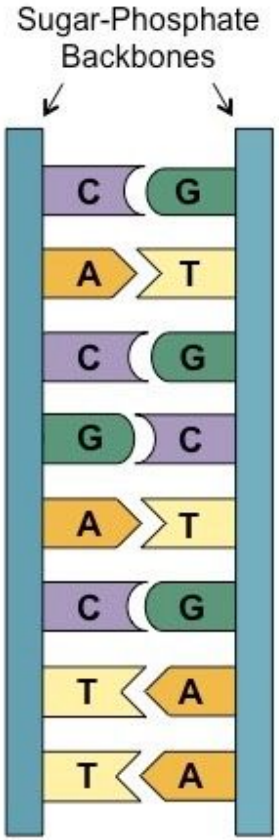

Stony Brook University
OKLAHOMA CITY
35

Crash Course into Synthetic Biology

Nucleotide



Antiparallel DNA Strands



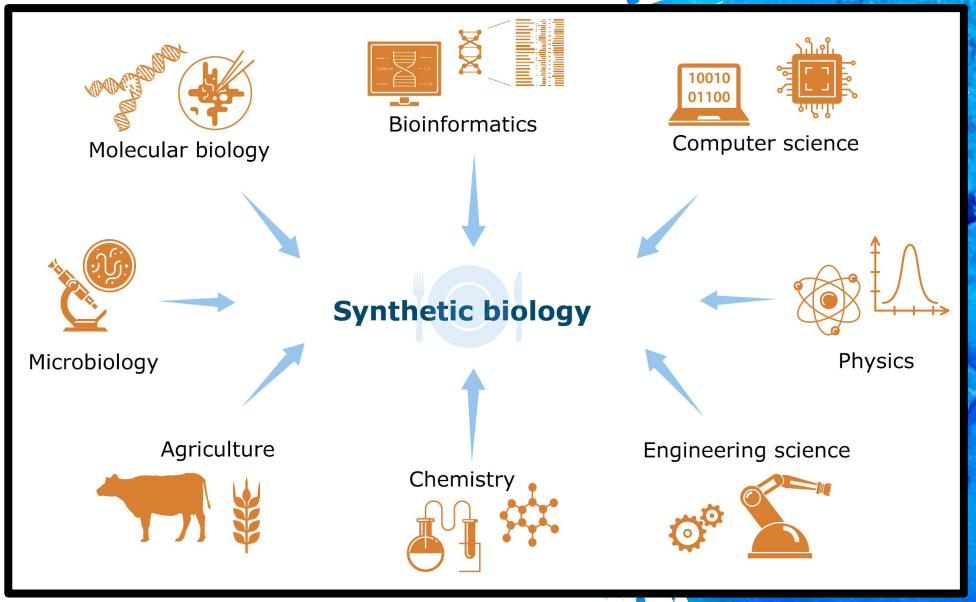
DNA Ladder

Double Helix

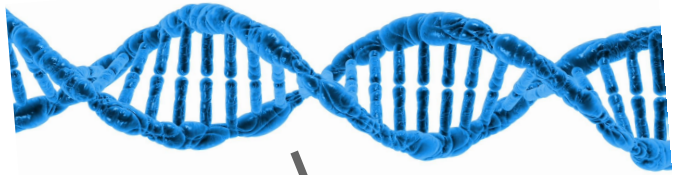
Key:
- Adenine
- Thymine
- Guanine
- Cytosine

Synthetic Biology?

Synthetic biology is the intersection of biology and engineering! It allows us to take advantage of existing natural biological systems and re-engineer them to serve a desired purpose. Some modern applications of synthetic biology include advancements in medicine, industry, and the environment.

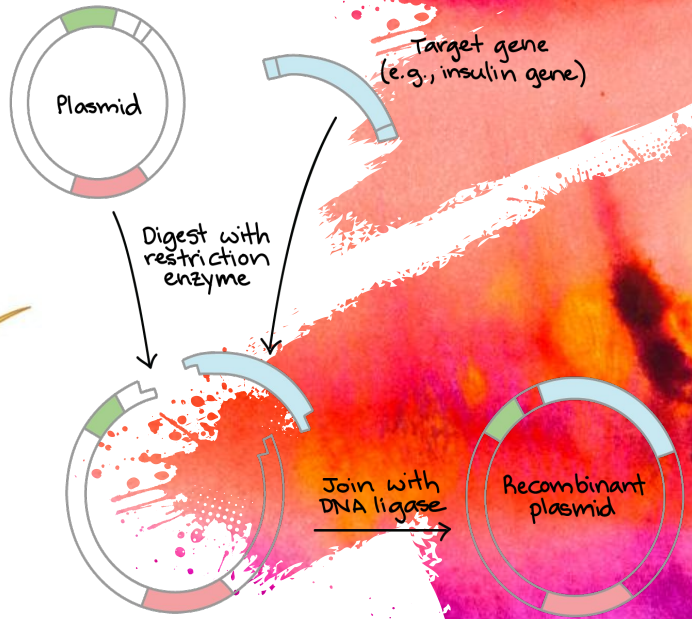


Gene of Interest



Bacterial "Machine"

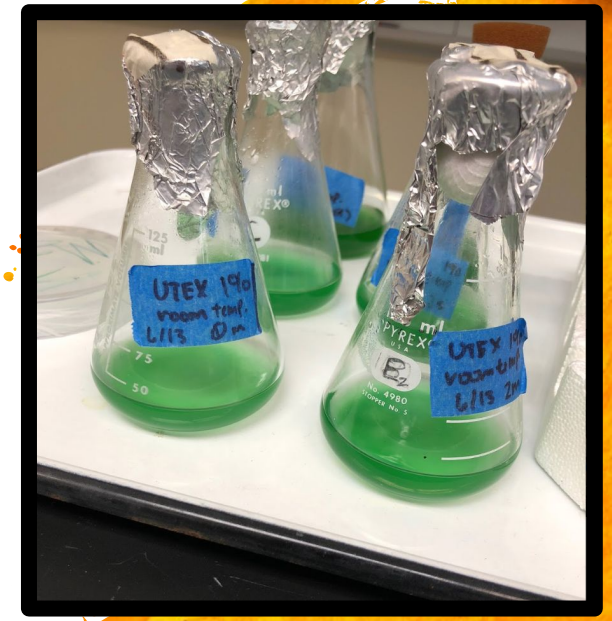
Protein



Our project

Background

- Fuel like ethanol biofuel, which is better for the environment, uses can be manufactured from sucrose.
- This sucrose can come corn or sugarcane but that leads to a bunch of problems.
- Photosynthetic cyanobacteria can produce sucrose naturally and efficiently.
- Our goal is to modify cyanobacteria to produce and export sucrose under specific conditions in order to reduce harvesting costs associated with salt-removal.
- Two genes of interest are the sucrose phosphate synthase (sucrose producing enzyme) and the sucrose permease protein (sucrose secretion protein).

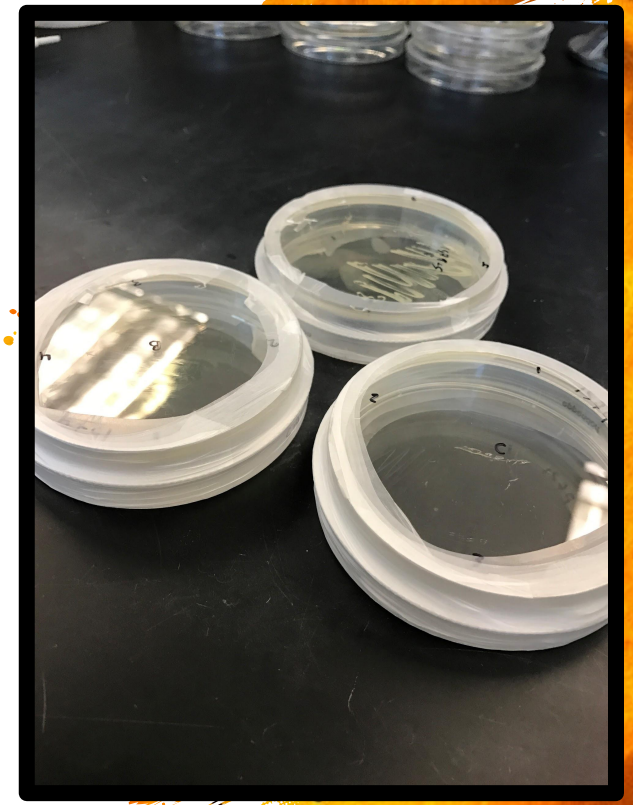


Our Project

1. We will clone our genes into plasmids and transform them in cyanobacteria. Then, make sure that the genes are actually working. After that, compare the effects of our genes individually as well as together.

2. We want to choose a well-suited promoter. We have a bunch of promoters that we want to test out and characterize. They include light-inducible promoters (psbA2) or nutrient-dependent promoters (idiA and isiAB).

3. Lastly, we're going to put the promoters with the genes in the plasmids. We are going to transform the cyanobacteria and measure how much sucrose is produced.



Gaining Research Experience

Research Prep

Cold Spring Harbor Laboratories:

DNA Science Camp: Transform bacteria and get basic wet lab skills.

Bioinformatics:

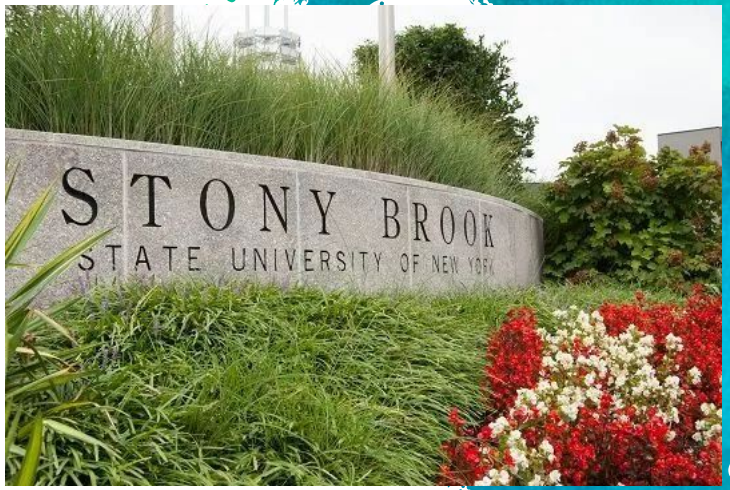
Do some research that involves the NCBI Database, to get some basic dry lab skills.

Programming:

Learn a programming language such as Python, Java/CSS, or R

Summer Opportunities at SBU

- Biotechnology Summer Camp
- Engineering Summer Camp
- Explorations in Forensics Camp
- Garcia Program
- IACS Computes!
- Middle School Math Camp
- Physics Summer Camp
- Middle School Science Exploration Camp



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Any questions?

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igem.sbu@gmail.com

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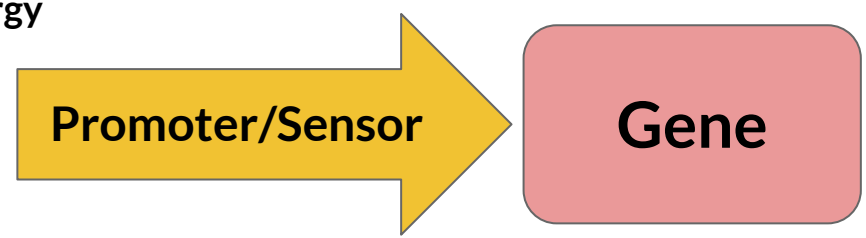
Activity Time

Introduction

We're making our own *gene circuits*!

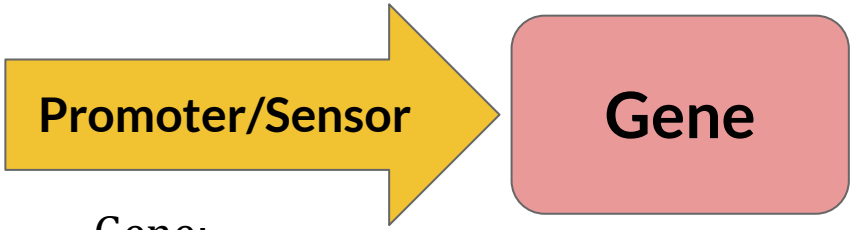
- **Gene circuits are combinations of promoters and genes that can be used to solve a number of problems.**
- **Problems that can be addressed:**
  - **Environmental (oil spills, water, global warming)**
  - **Lack of Blood**
  - **Disease**
  - **Allergens**
  - **Energy**



Introduction

- **Some types of promoters:**
  - **Inducible Promoters (ie: light-inducible, rust-detecting, iron-inducible, cancer-inducible promoters)**
  - **Constitutive Promoters (Expressed all the time, can be weak or strong)**
- **Some sensors:**
  - **Communication sensor (talking to a specific kind of cell)**
  - **Chemical sensors (sensing chemicals in the environment)**
- **Some proteins:**
  - **Chemical-producing and chemical-digesting**
  - **Transport proteins and reporter proteins**

Examples:



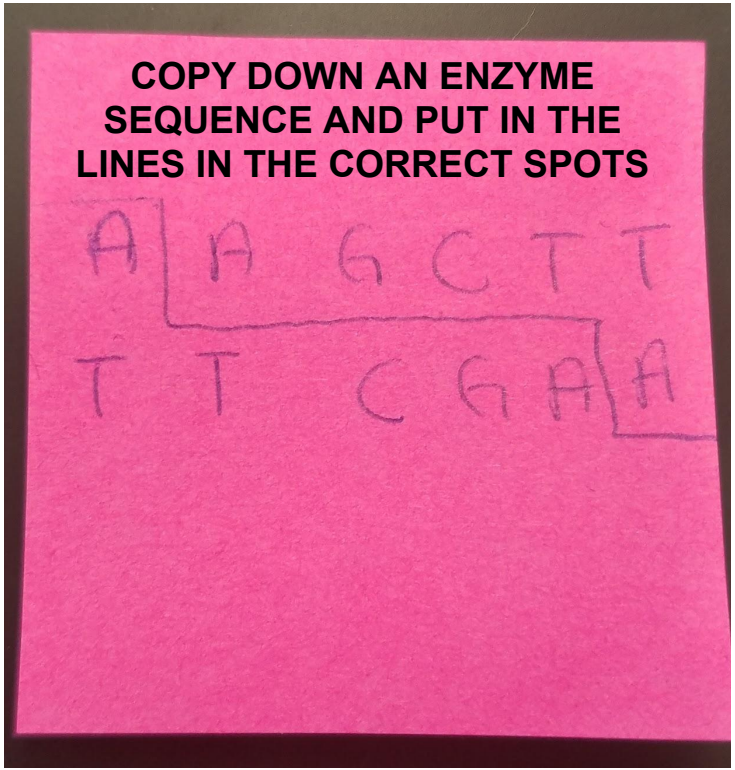
Promoter/Sensor:

- High temperature inducible
- Chemically inducible

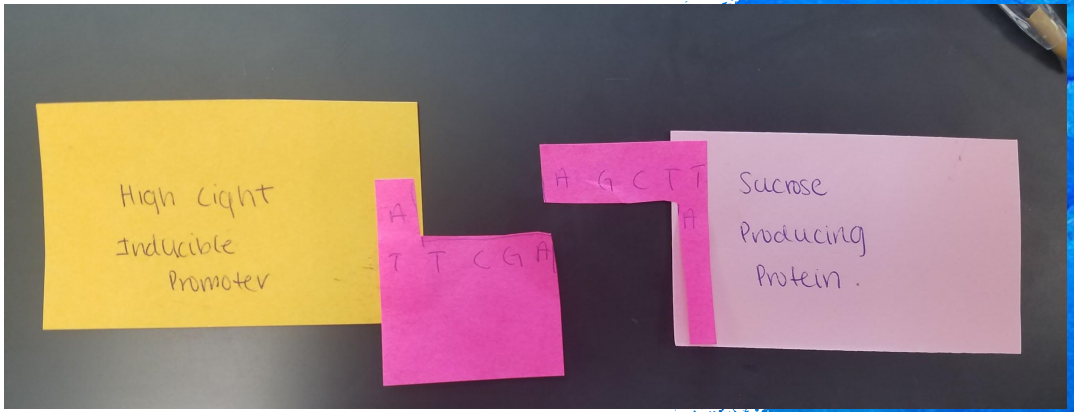
Gene:

- Water secretion
- Toxin degrading

High Light Inducible Promoter	Sucrose Producing Protein
Rust Inducible Promoter	Rust Digesting Protein (Enzyme)



CUT SEQUENCE ACCORDING TO DIAGRAM AND ATTACH THE FIRST END TO THE PROMOTER AND THE SECOND TO THE GENE



Some restriction enzymes

FINAL STEP

- Tie up the plasmid DNA (think about the structure!)
- Put the DNA in the syringe (your pipette!)
- You are ready to go to transform!

Had Fun?

You can find us at:

On Instagram
@igem.stonybrook

igem.sbu@gmail.com

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