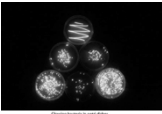


Washington University in St. Louis iGEM  
Presentation on Genetic Engineering


### What we are doing today and tomorrow?

- What is DNA?
- What is Genetic Engineering?
- How is Genetic Engineering being used today?
- What is our group doing?
- Let's make some bacteria that glow!



### Cells

- All living things are made up of cells.
- Cells range in size.
- Some things are made of one cell. Some have a lot.
- Cells have a nucleus that is full of DNA.



### Cells

- How many cells do you think are in your body?

- 5
- 5,000
- 50,000,000
- 50,000,000,000
- 50,000,000,000,000

### Cells

- How many cells do you think are in your body?

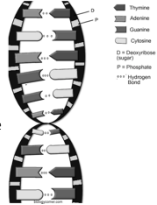
- 5
- 5,000
- 50,000,000
- 50,000,000,000 → 50 Trillion!**
- 50,000,000,000,000

- 50,000,000,000 seconds is over 1500 years!

Source: <http://ask.yahoo.com/20020625.html>

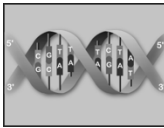
### Deoxyribonucleic Acid aka DNA

- If you lined up all the DNA in your body, it would be 6 feet long.
- DNA is super coiled so that it fits in a cell so small that you cannot see it.



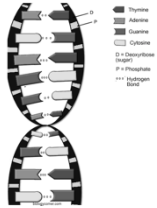
### What is DNA made up of?

- There 4 bases  
– A, C, G, T
- They form a double helix like a spiral staircase.
- The differences in order and number define how the body works.



### Deoxyribonucleic Acid aka DNA


- The genetic recipe for your body.
- It is the same kind of structure for animals, plants, and all other life.



### Similarities?

How similar do you think the DNA is in your body to a fruit fly?



- 22% the same
- 38% the same
- 60% the same
- 72% the same
- 99% the same





### Why mix genes from species:


- Scientists can make things that you can't normally find in nature...
- Lab synthesis versus synthesis through genetic engineering

»We could turn a cell into a factory for our use, and we could control it

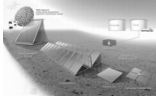

### Current Genetic Engineering Research

- Business is booming
- Efficiency
- Crops, domestic farm animals, cutting CO<sub>2</sub> in atmosphere, drug development, and more!
- Have you guys heard of any genetic engineering projects?




### Case 1: Biofuels

- Algae that take up CO<sub>2</sub> from the environment and produce biofuels
  - Carbon-neutral, the only carbon used in fuels is absorbed from environment
- Some bacteria are being developed to use cellulose that is currently unused in production of biofuels

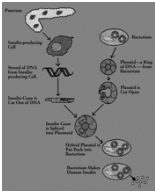
### Case 2: Fragrances

- Perfumes
- Fruity Smells in garden flowers
- Like before:
  - Insert enzymes into a foreign organism




### Case 3: Insulin

- Need: Diabetes
- Insert human genes into a bacteria that spits out insulin
- Harvest insulin for human use
- 1982, one of the first applications of genetic engineering



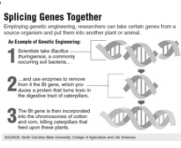
### Case 4: Crops

- Crops that:
  - Increased vitamin content
  - Pest-resistant
  - Herbicide-tolerant
  - Decreased water and energy use
  - Faster growth
- STL company Monsanto is a large developer of GMOs

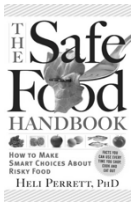


### Summary

- Genetic Engineering is the placement of foreign genes into an organism for the purpose of reproducing a desired function in a more ideal organism.




### Is it safe?



- "The Environmental Protection Agency (EPA) ... is responsible for evaluating the safety, including environmental safety, of the introduced pesticide and all necessary genetic material."
  - The EPA checks the insertion of such things as pesticide resistance.
- "FDA does not consider the method of production, including genetic modification, to be meaningful information which is required to be on product labeling unless the modification results in a significant material change in the food product."
  - The FDA screens food for general safety.
- Both quotes are from FDA website.
- The information is out there. It is up to you to decide if you care to avoid GMOs.

### Brainstorming

- So if we could combine genes from other organisms to make a hybrid...
  - What would you make?
  - Your ideas...



Your Projects:

Let's Take a Short Break


Our Project-iGEM

- "Saffron in a Kan"
  - A cheesy title with a big goal
- A cyanobacteria that produces **Saffron in a KANamycin vector**

Saffron Price

How much do you think a pound of high end Saffron can cost?

- A. \$25
- B. \$50
- C. \$500
- D. \$5,000
- E. \$50,000
- F. \$500,000



Saffron Price

How much do you think a pound of high end Saffron can cost?

- A. \$25
- B. \$50
- C. \$500
- D. \$5,000 → Why? Let's see.**
- E. \$50,000
- F. \$500,000

Other spices' costs by the pound:  
India Tree Rainbow Pepper (to grind): \$10.94 on amazon  
Cayenne Pepper Powder: \$9.89 on amazon  
Cumin: \$10.00 on amazon


Our Project-Background

- Saffron



Our Project-Background

- Saffron



Our Project-Background

- Saffron



Our Project-Background

- Saffron



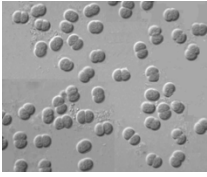
**Our Project-Background**

- Saffron-Can we produce the color and taste without the vast required resources?



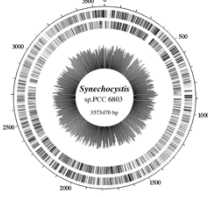
**Our Project-Background**

- Synechocystis
  - Cyanobacteria
  - Autotroph
  - Well-studied
  - Set up well to produce our compound



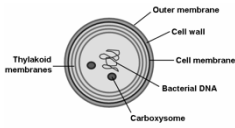
**Our Project-Background**

- Synechocystis



**Our Project-Background**

- Synechocystis




**Syn Size**

- The genetic recipe for your body.
- It is the same kind of structure for animals, plants, and all other life.

**Our Experiments**

- Synthetic DNA to produce saffron ordered from DNA 2.0
- Put gene into Synechocystis
- Hopefully have saffron color and aroma!




**Current Results**

**Today's Experiment: The Fun Stuff**

- We brought some glowing E. coli!
- Plates select for these bacteria
- 4 colors: red, yellow, green, and blue
- Be creative!

**Background-Fluorescent Proteins**

- Most common: Green Fluorescent Protein (GFP)
- Absorbs ultraviolet (UV) light and releases the energy as light you can see! They appear to glow!





### Experiment Time! (Continued)

- Ask questions!
- Be safe!
- Let's look at the plates!



### Results-Did it work?

- Let's talk about it.
- Does anyone want to present their plate?



### Our Results From Preparing this Experiment

### Questions?



### One Last Survey



### Thanks YLC!

Websites used today:  
[http://www.epa.gov/waterscience/images/current\\_scientist.jpg](http://www.epa.gov/waterscience/images/current_scientist.jpg)  
[http://www.scribd.com/reading/1000000000/05/dog\\_presents.jpg](http://www.scribd.com/reading/1000000000/05/dog_presents.jpg)  
<http://ovationconsulting.com/blog/wp-content/uploads/questions1.jpg>  
<http://blog.psu.org/wp-content/uploads/2009/12/survey.jpg>