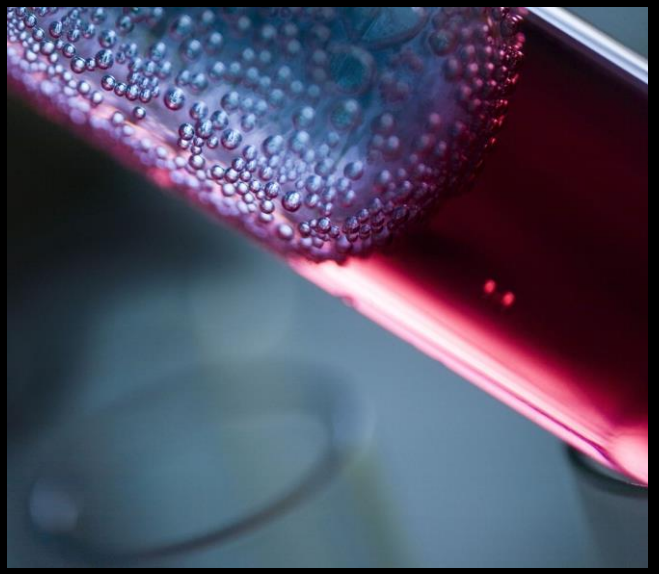
MY SCIENCE FAIR EXPERIMENT:

HEAT SHOCK AND GENETIC ENGINEERING



By Silas Erwin
Hubbell Elementary, 5th grade

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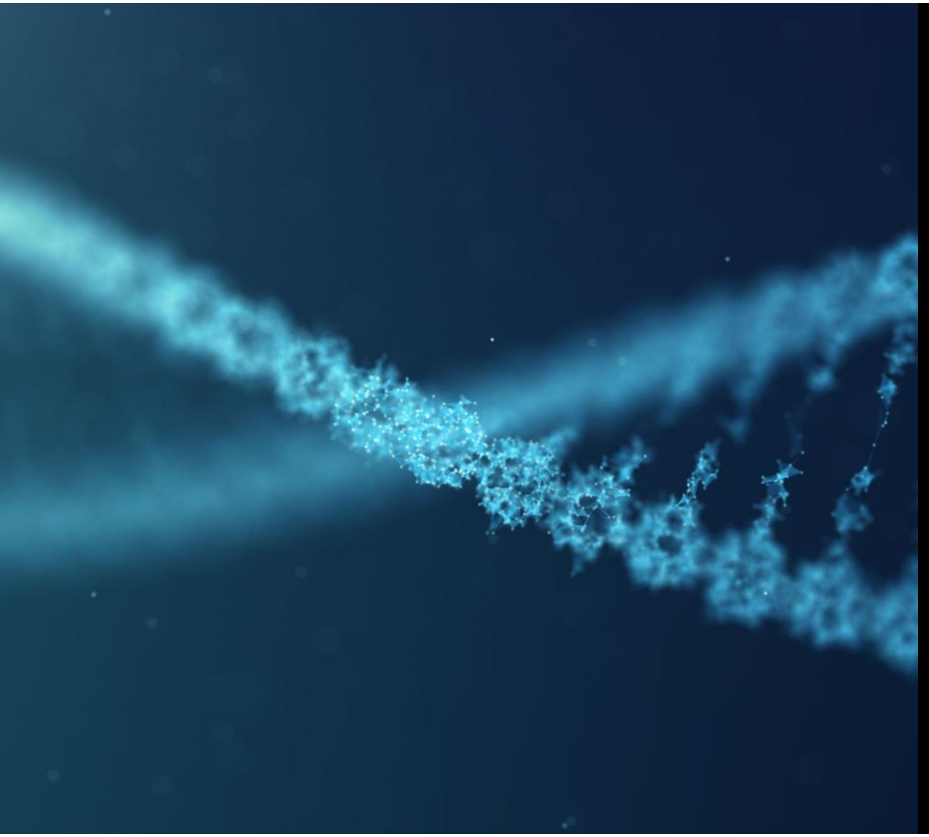
INTRODUCTION



So, I bet you're wondering what my experiment is about. Let me tell you. GENETIC ENGINEERING. Yeah.

We do this by taking E. coli bacteria and making them competent cells. We then trick the E. coli into taking chunks of DNA called plasmids from another organism. After all this altering the E.coli should glow under blue light.

For my experiment, I tested the process of making competent cells by leaving out the "heat shock" step that scoots the plasmids into the E. coli.

PS!!! There are videos, click when you see me!

HYPOTHESIS

- Inserting plasmids into E. coli depends on the heat shock protocol, and without this step this genetic engineering procedure will not succeed.

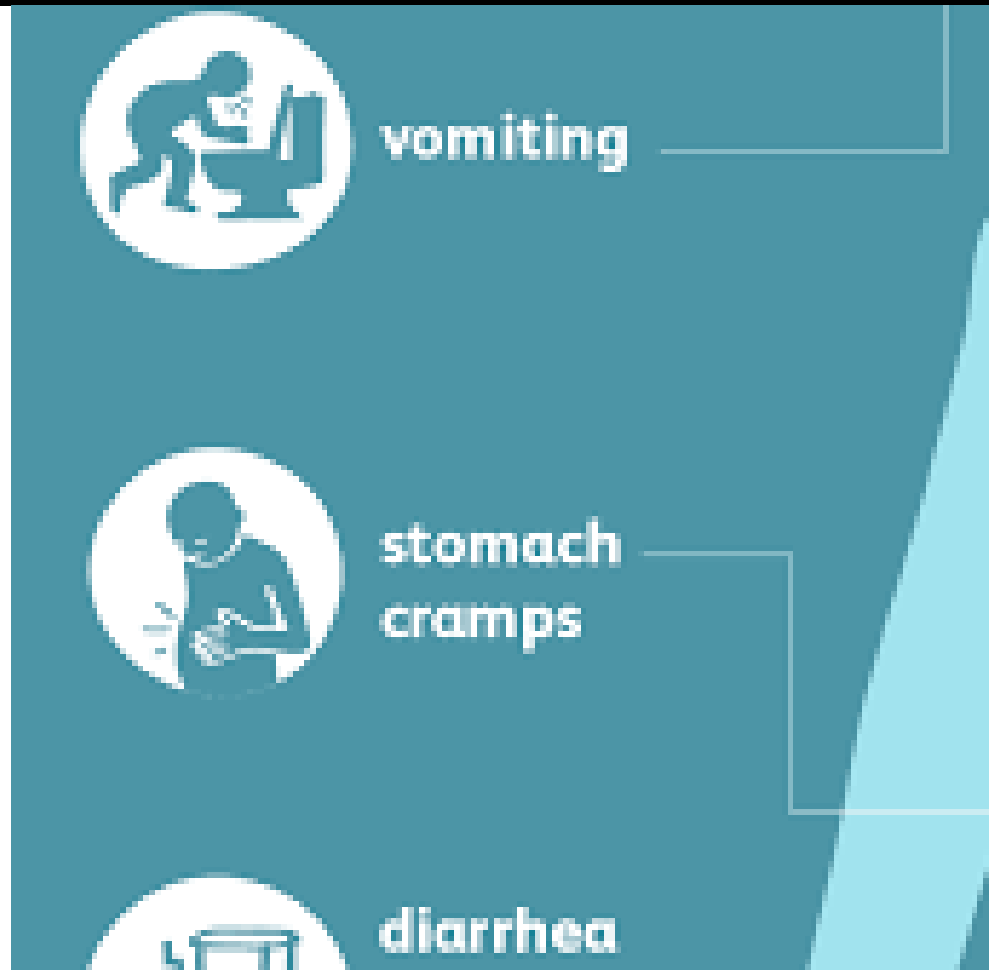
link to video

BACKGROUND: E. COLI

E. coli is a bacteria that can cause extremely dangerous foodborne disease. Mostly because it is antibiotic-resistant and there is no known cure. But the strain I am using is about as harmless as yogurt, even if it's A LOT stinkier!

E.coli is especially good for this experiment because it is easy to make it into a competent cell.

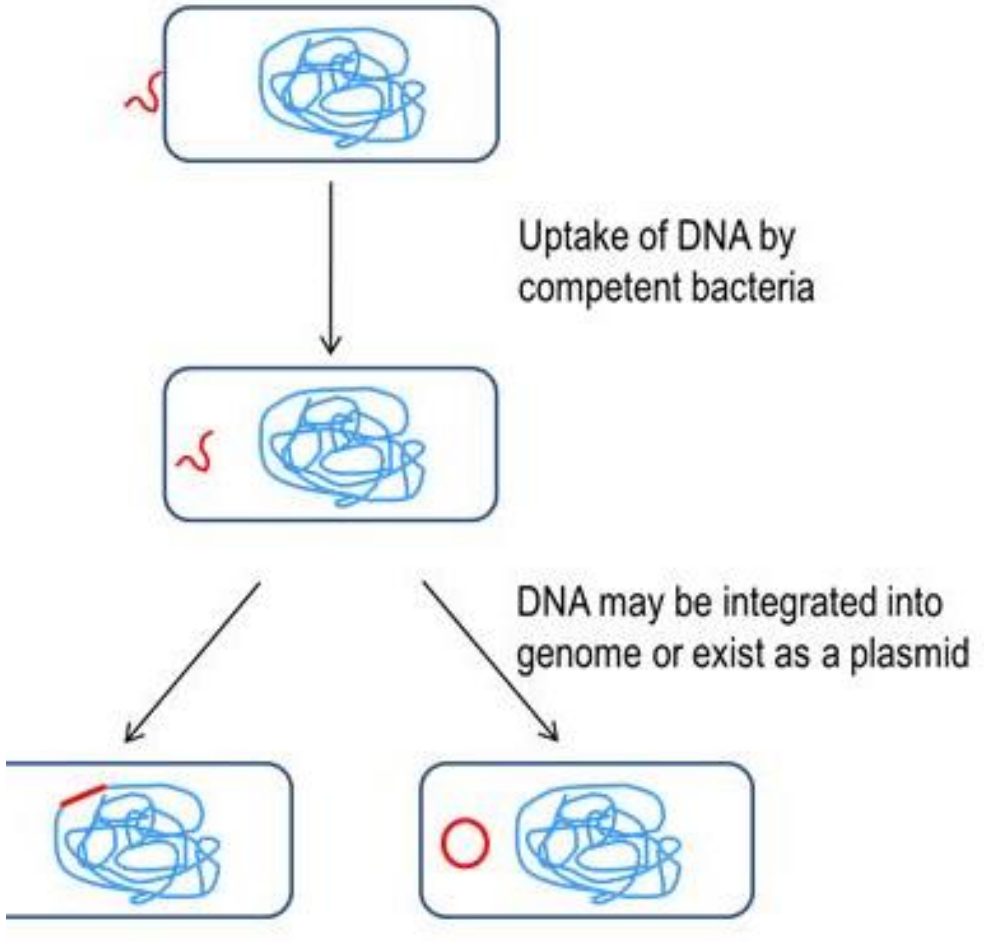
link to video



BACKGROUND: COMPETENT CELLS

Competent cells are (as per their name) easier to alter. They can easily accept foreign DNA (that's called *transformation*).

E. coli isn't naturally competent, but it's easy to make it competent by using heat to make pores in its cell membranes.

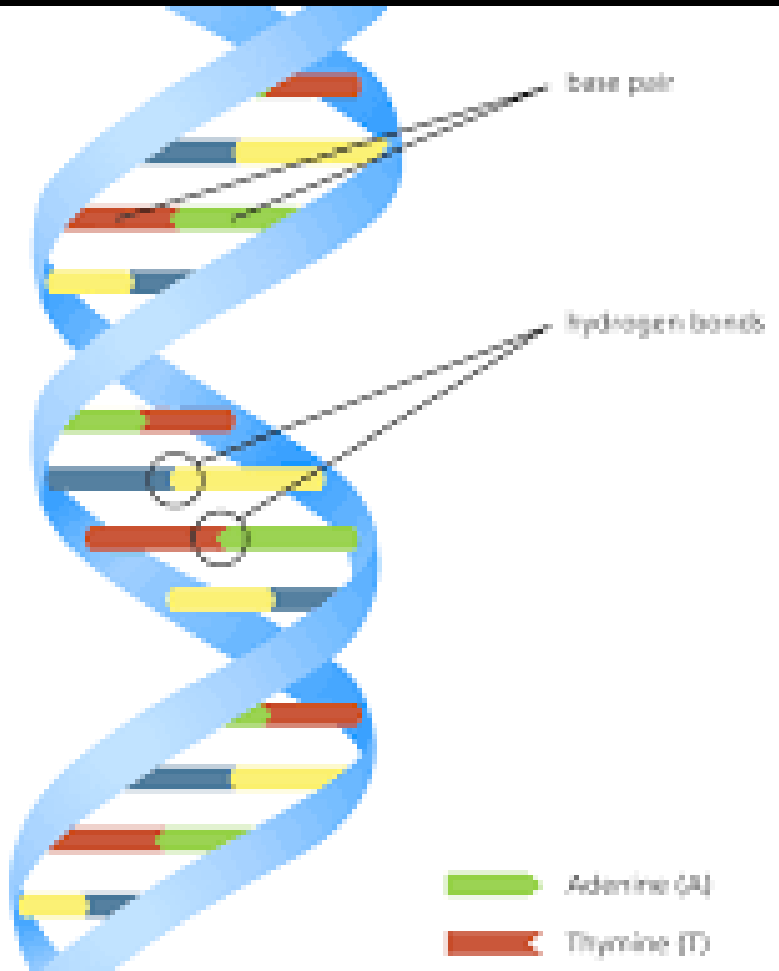


BACKGROUND: DNA

DNA (deoxyribonucleic acid) is… well… just look below this sentence

simplified version: DNA is kind of like an instructor and a library of info for cells. Telling the cell what to do and when to do it. Here are some scenarios where DNA tells cells to make new copies: injury, mitosis, and “eating”

complex version: DNA is stored in the nucleus which is the center of the cell.
DNA also has genetic code in the spiral helix. Some chemicals that would have been simple on their own like, phosphorus and cytosine are extremely complex when forming DNA. Smaller copies called RNA can be made to form proteins for the body’s cells.

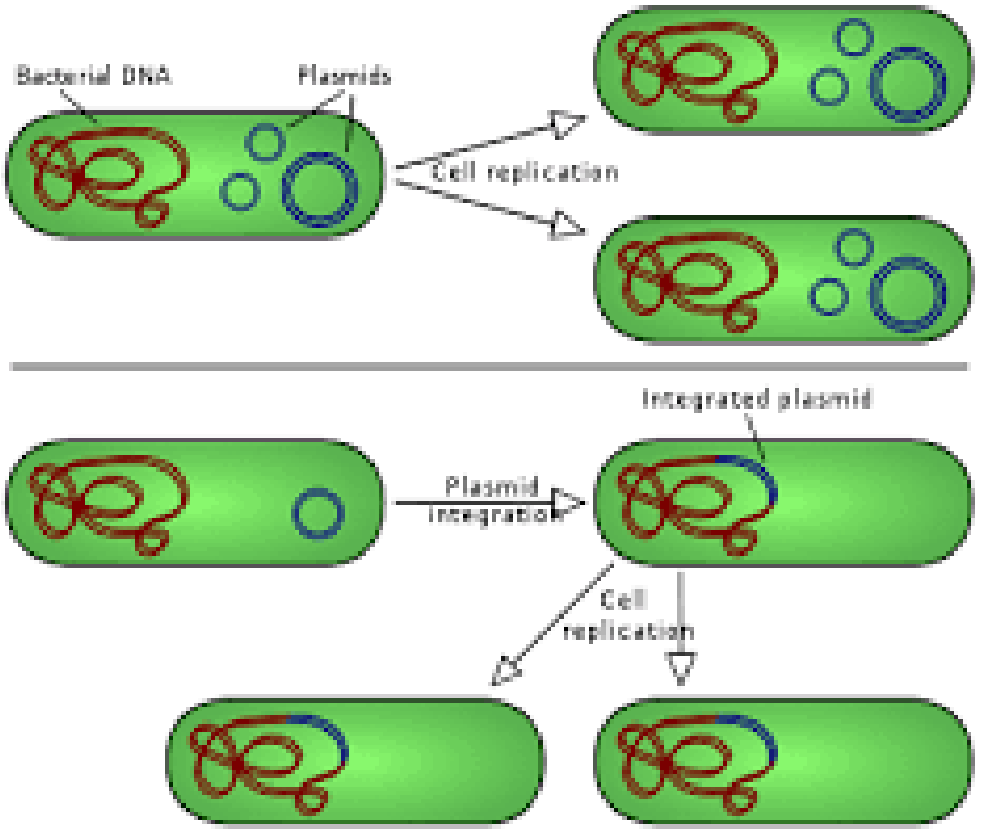


BACKGROUND: PLASMIDS

You know the drill.

Simplified version: plasmids are a small chunk of DNA that can reproduce without a cell.

Complex version: plasmids are part of the double helix in DNA and are independent from the chromosomes and can replicate independently. They are mostly found in less complex DNA but can also be found in archaea and eukaryotic organisms. They are often used in the manipulation of genes.



BACKGROUND: SOURCES

What is DNA?

- https://www.yourgenome.org/facts/what-is-dna

What is a plasmid?

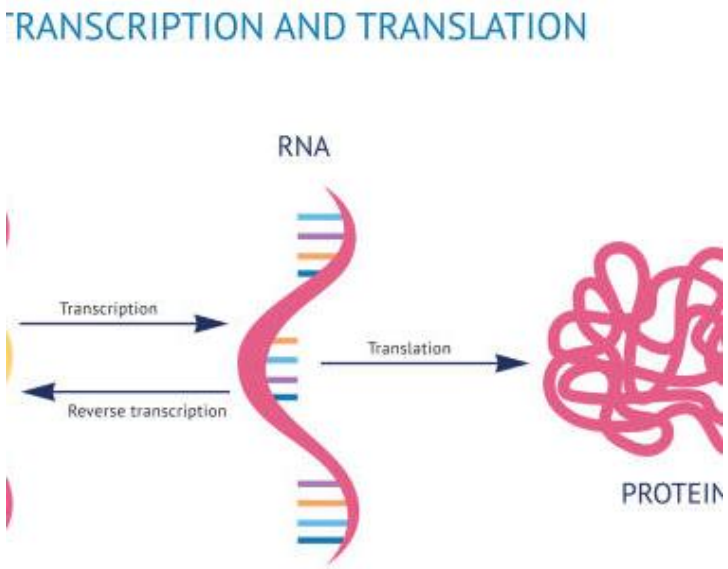
- https://en.wikipedia.org/wiki/Plasmid

What is a competent cell?

- https://www.goldbio.com/articles/article/Introduction-to-Competent-Cells

How do genetic engineers make competent cells?

- https://www.the-odin.com/crispr-bacterial-guide/



DESIGNING THE EXPERIMENT

Steps for simple(!!!) genetic engineering:

1. Make agar plate
2. Incubate E. coli on agar plate
3. Create the mixture! Take E. coli from plate, add plasmids, add transformation mixture (CaCl2 and polyethylene glycol)
4. Put mixture on ice
5. Heat shock
6. Incubate for 24 hours
7. Shine light on bacteria to see if it glows!

link to video

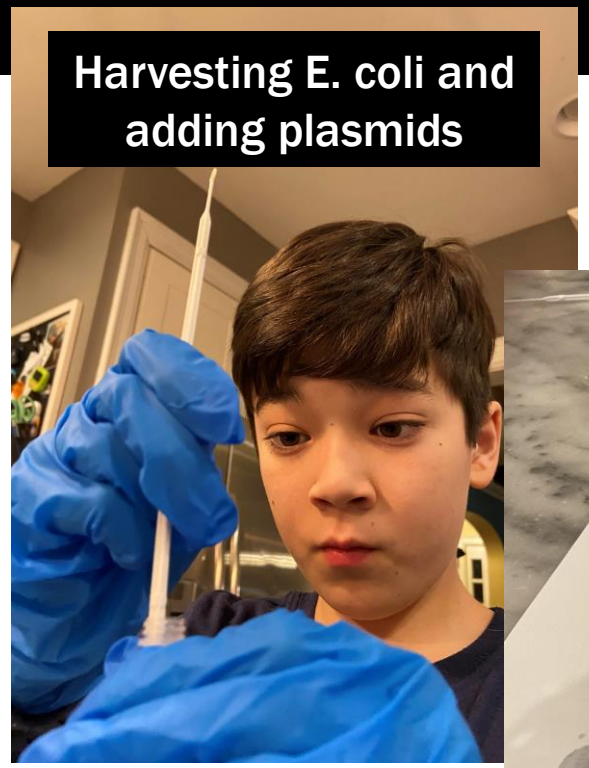
DESIGNING THE EXPERIMENT

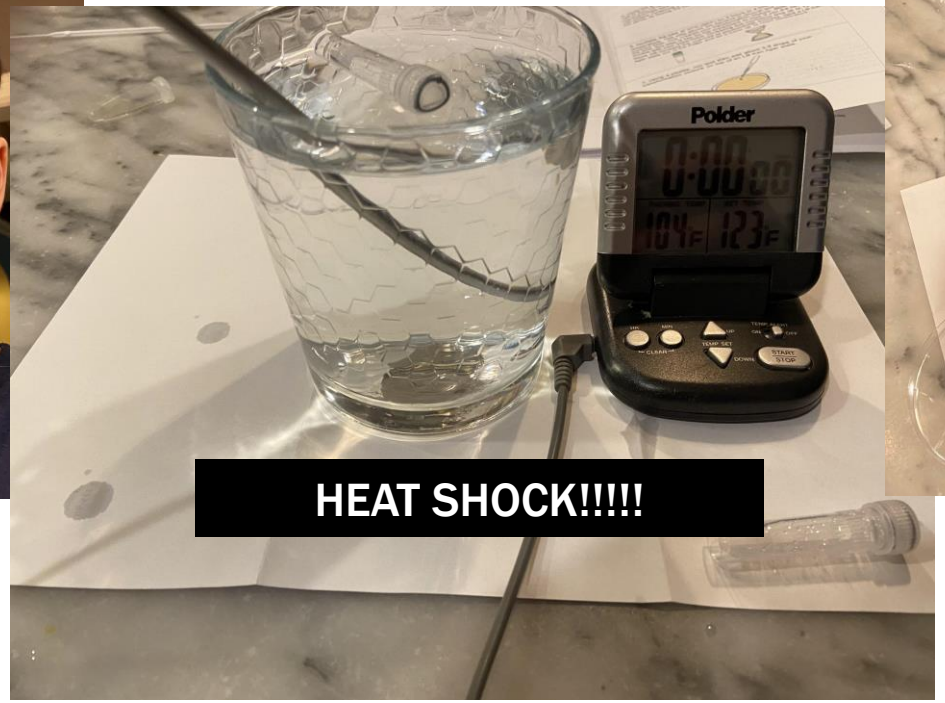
I used a CRISPR genetic engineering kit to insert plasmids of jellyfish DNA into E. coli.

I split the E. coli into two agar plates. The experiment left out the “heat shock” step in the control. In the experimental we did the heat shock. The heat shock weakens the cell membrane of the E. coli, without it I predicted the plasmids wouldn’t go into the bacteria.

See the next page for pictures of the experiment or to just find out what happens click on me!

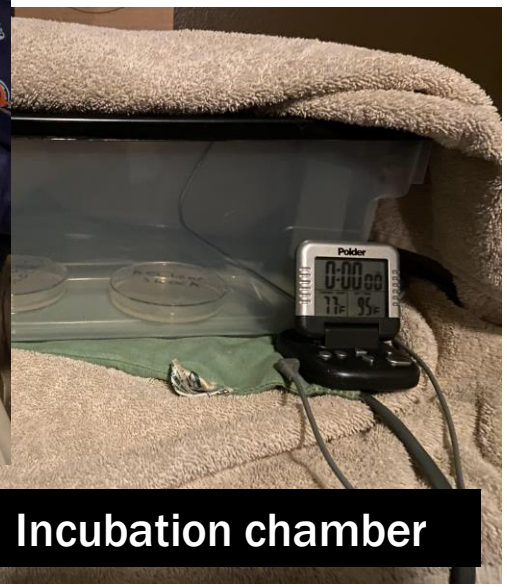
RUNNING THE EXPERIMENT


Harvesting E. coli and adding plasmids



HEAT SHOCK!!!!!

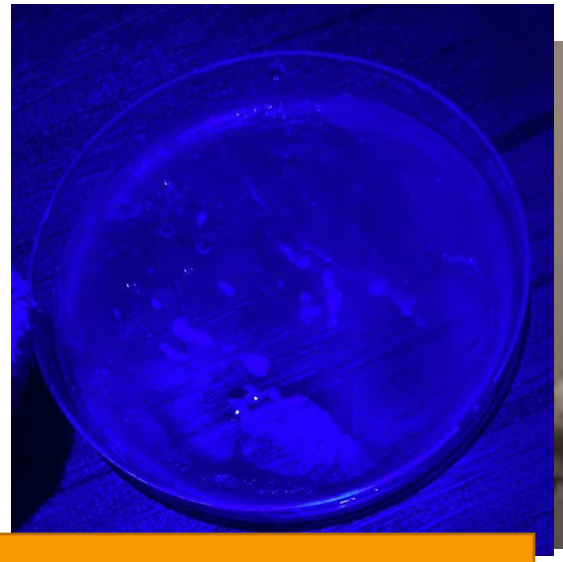

One of these was GENETICALLY ENGINEERED!



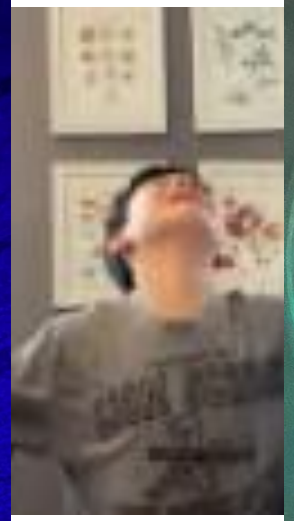
Incubation chamber

THE RESULTS

Control under regular and blue light

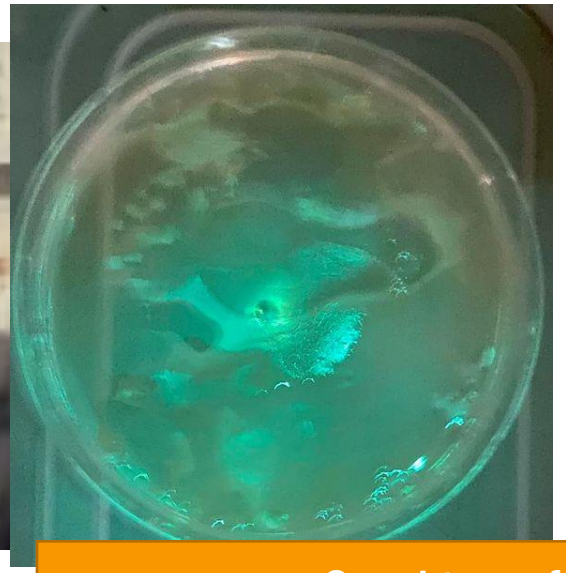


Bad transformation :(



link to video

Experimental under regular and blue light



Good transformation :)

CONCLUSION

The experiment confirmed my hypothesis! (insert applause) Genetic engineering is fun! But maybe I'll stick to a less stinky bacteria next time! (canned laughter)

link to video