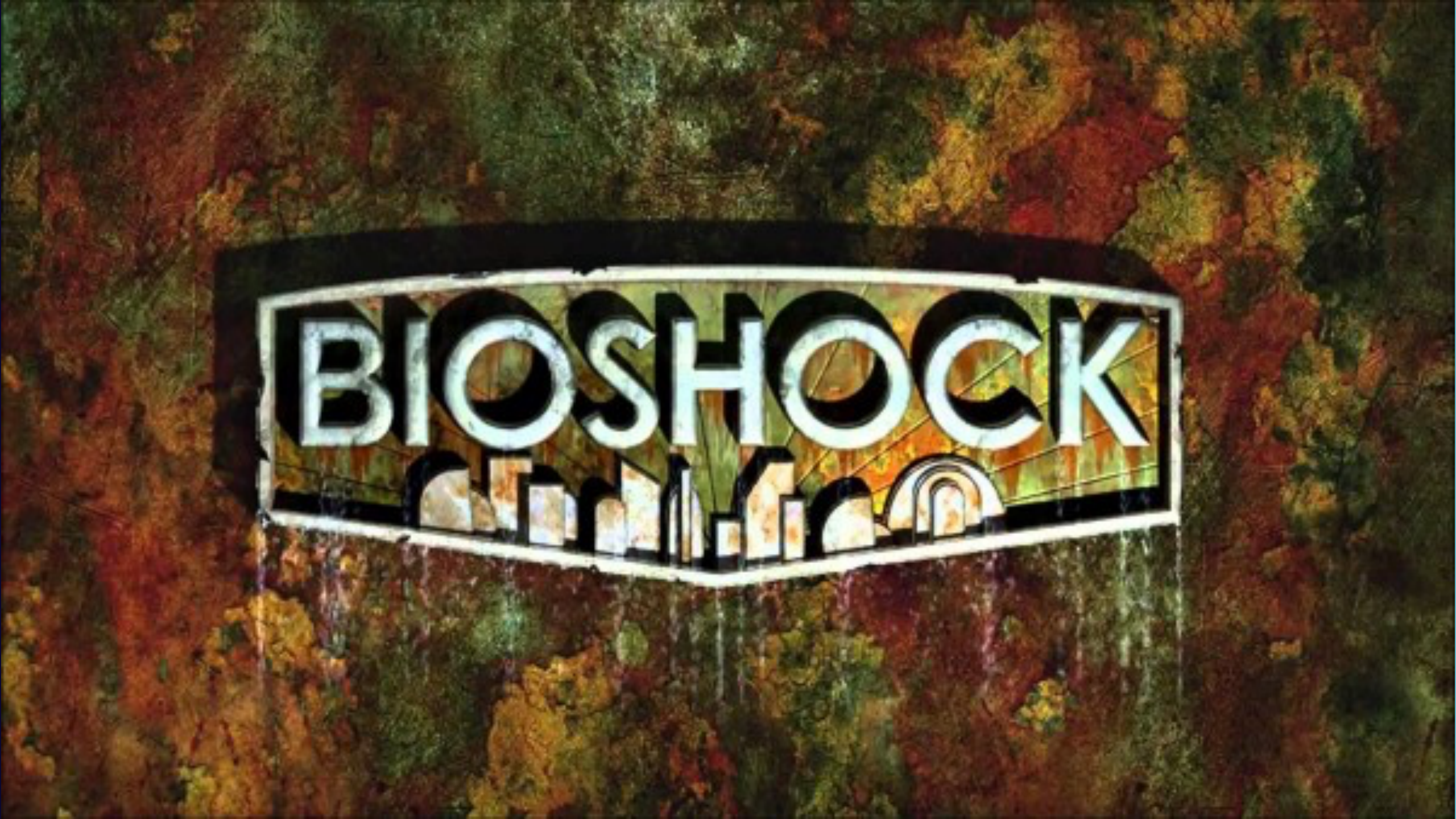
GENETIC ENGINEERING WORKSHOP

Geering Up 2017


BIOSHOCK


JURASSIC PARK

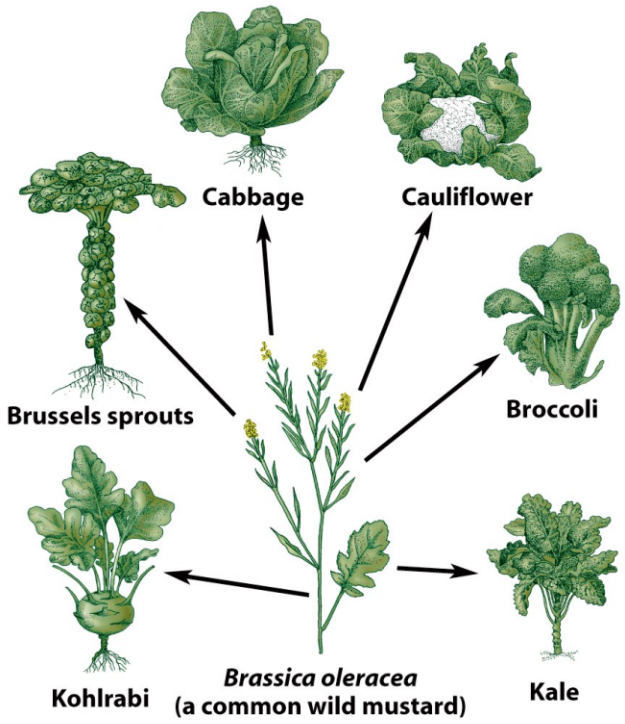


Figure 16-9 Discover Biology 3/e

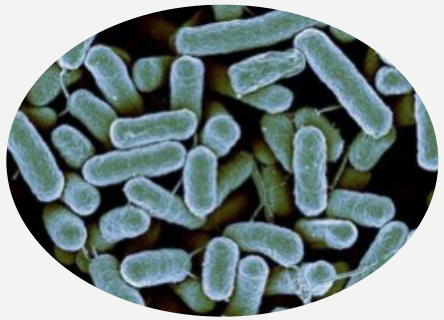
UNDERSTANDING GENETIC ENGINEERING…

…Begins by understanding DNA

People have been trying to alter genetics for a long time before DNA discovery

- Process is tedious (generations!)
- Unexpected results can occur
  No guarantee that breeding is the solution

What if you wanted a completely <u>new</u> characteristic?



First description of a living cell

Genetic rules discovered, "Heredity"

DNA structure proposed, "Double Helix"

Students (us) can engineer life to perform desired functions

DNA discovered

1650 1700 1750 1800 1850 1900 1950 2000 2050

DNA DISCOVERY

Johann Mieshcher (1860's)

- Discovered an unexpected substance during white blood cell research – 'nuclein'

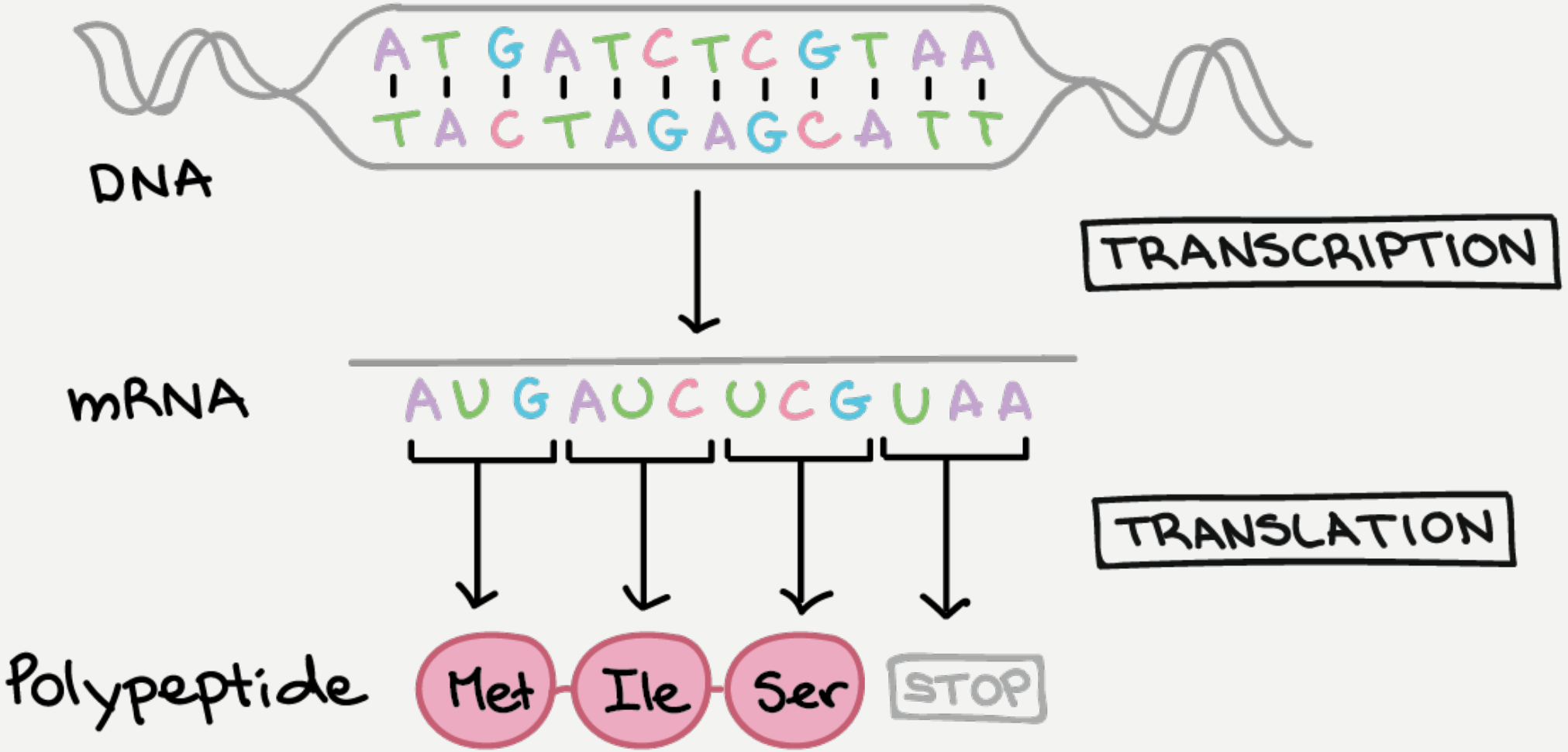
Gregor Mendel (1860's)

- Discovers that there are rules to traits (genetics)

For a long time people didn't connect the dots… 'useless molecule'

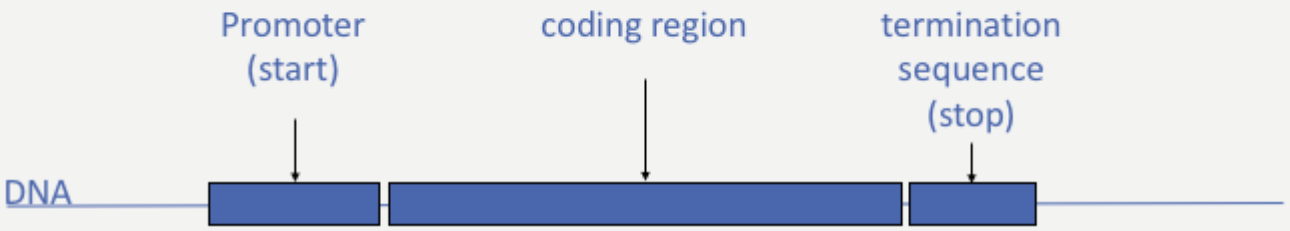
Rosalind Franklin, Maurice Wilkins, James Watson, and Francis Crick determined helical structure

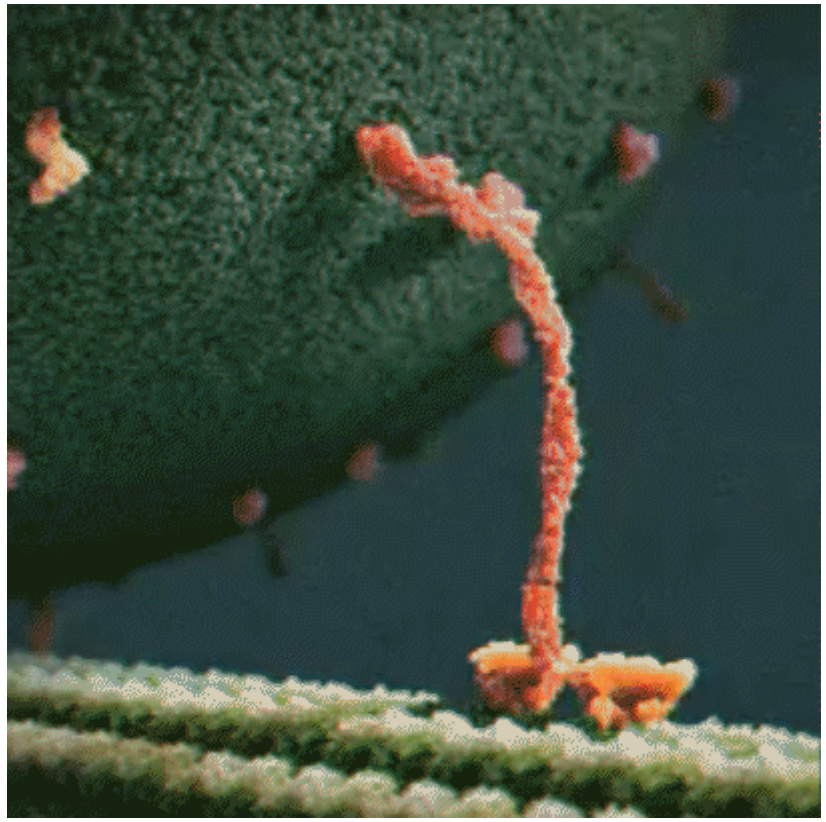
Remember this?



DNA is universal

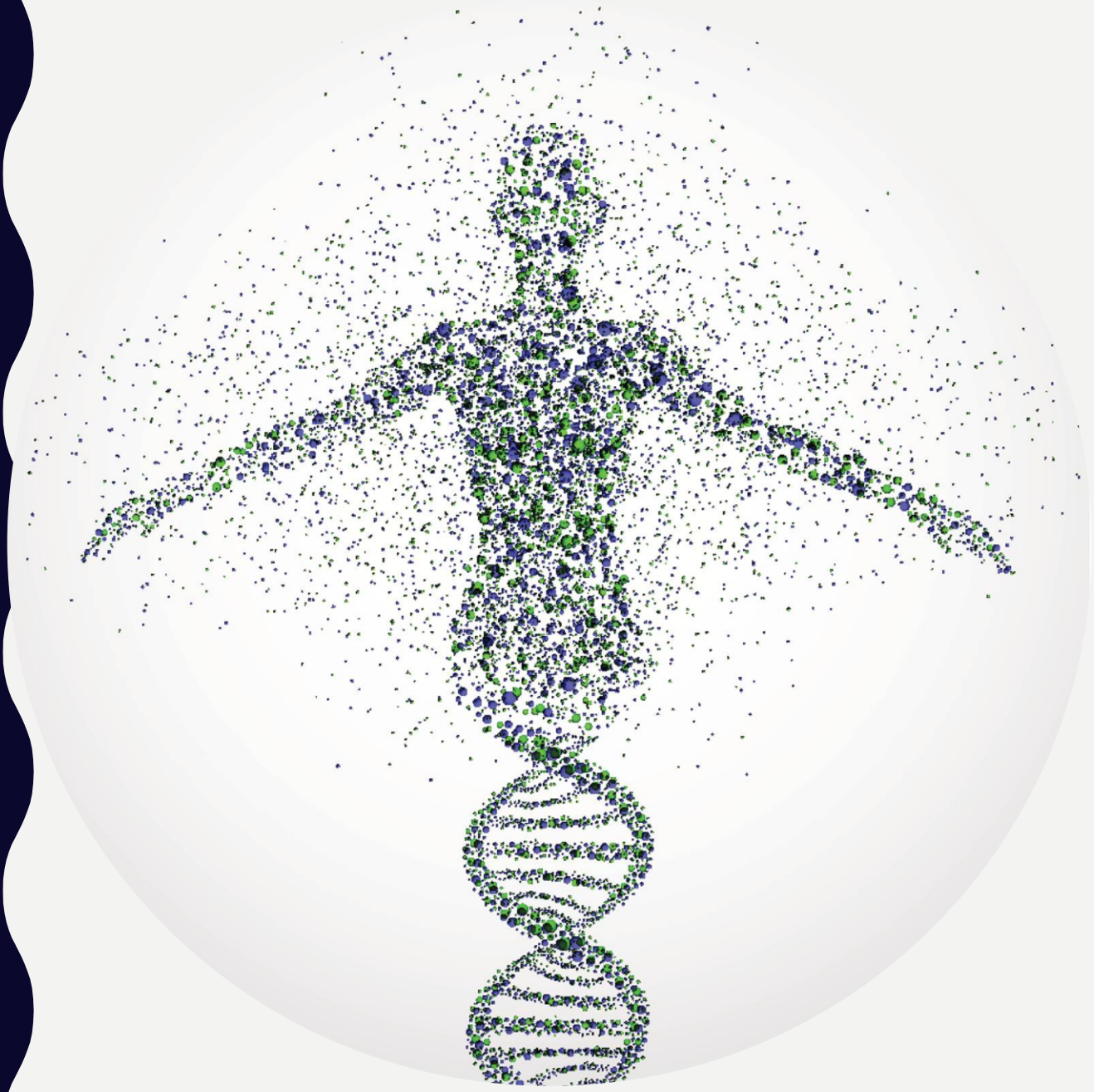
DNA has order





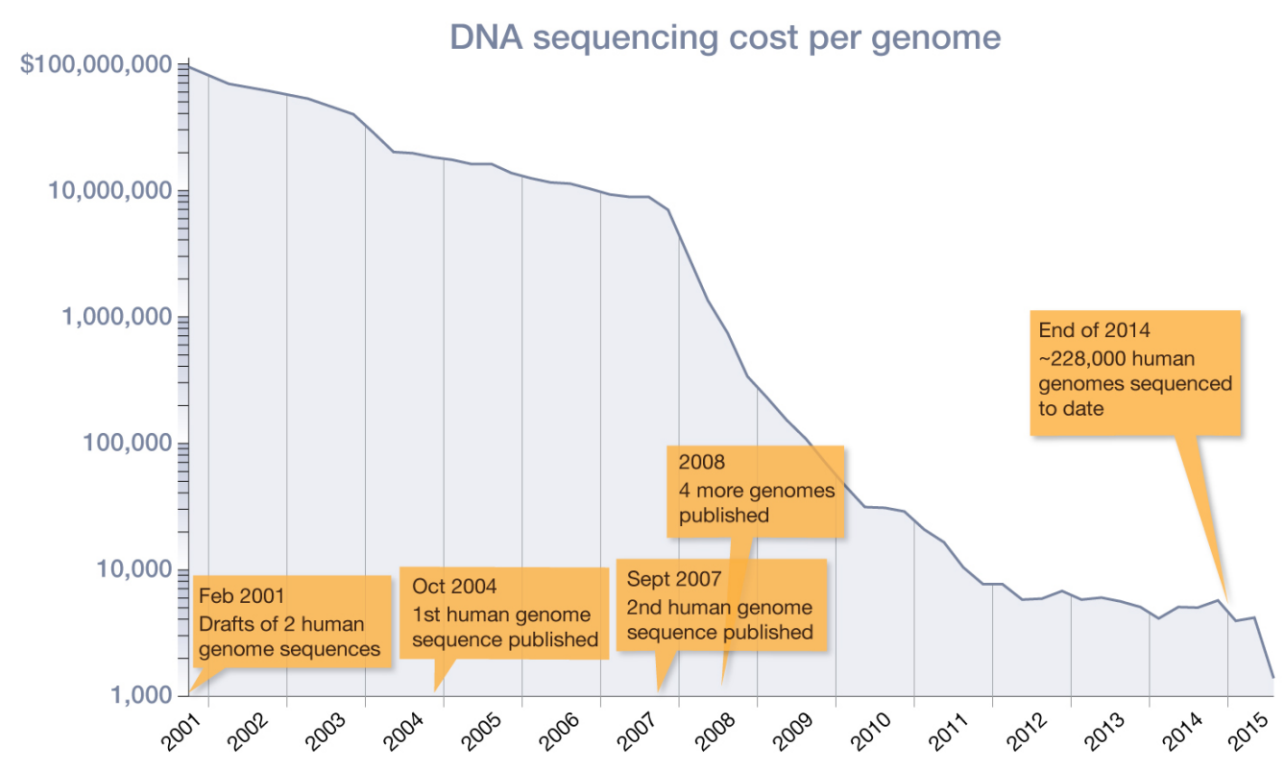
Proteins

- **Hemoglobin** is essential for moving oxygen through your body
- **Insulin** allows your body to use sugar from the food you eat
- **Rubisco** breaks up carbon dioxide for use in plants



Human Genome Project

An international effort to sequence the entire human genome, completed in 2003.
Anonymous volunteers donated blood samples.
Total cost of $2.7 BILLION dollars to complete.



Why is this exciting?

Sequencing the full human genome was a major step in understanding our own existence.

The cost of sequencing is going down. That's a BIG deal!

Looking forward. What's next?

What is genetic engineering?

Changing an organism's characteristics by modifying its genetic material - DNA!
What does it mean to modify DNA?

Genetically Modified Organisms

Why genetic engineering?

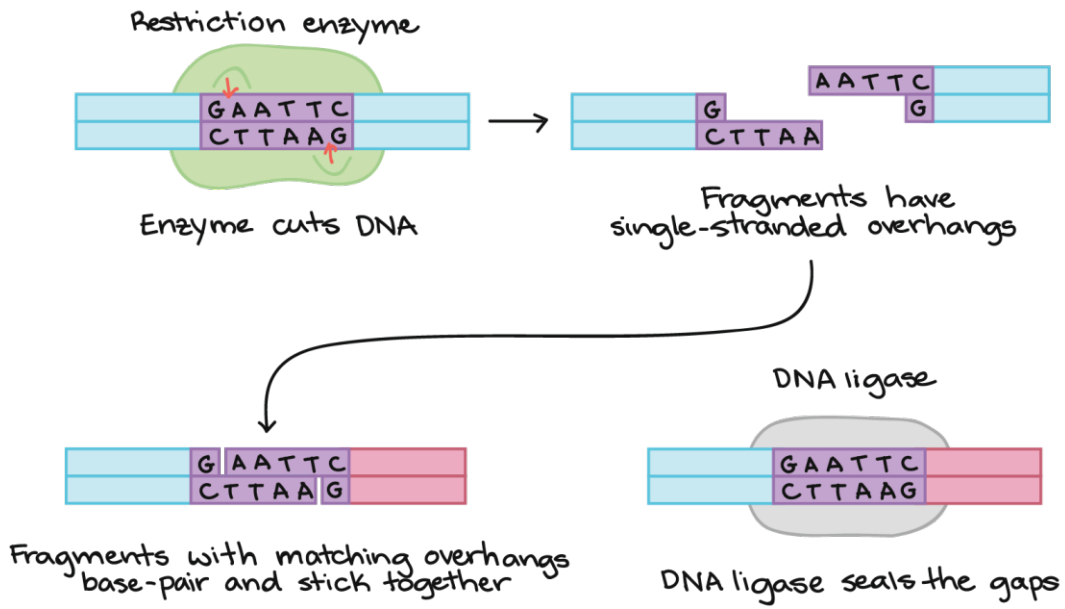
To understand, we need to look at the first instance of genetic engineering: Insulin

Insulin injections is required for diabetes.

Initial proteins developed from natural sources

- Where?
- How?
- What are the issues?

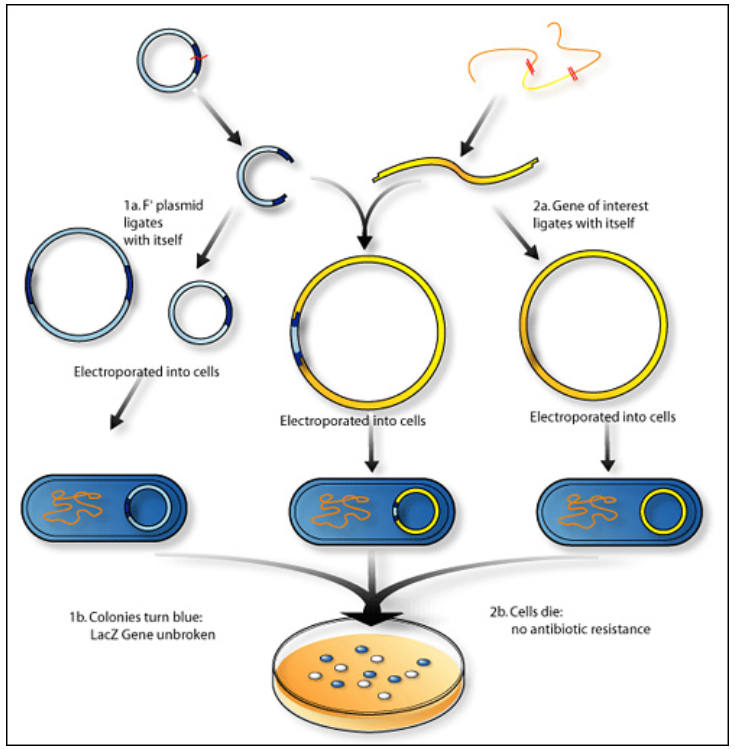
Now, insulin is developed, along with most pharmaceuticals from genetically engineered strains.



New Discovery

Paul Berg discovered two essential technologies for the development of genetic engineering:

- Restriction Enzymes (Molecular tools to cut DNA at a specific location)



New Discovery

Paul Berg discovered two essential technologies for the development of genetic engineering:

- Restriction Enzymes (Molecular tools to cut DNA at a specific location)
- Cloning (allows foreign DNA insertion into a host cell and replication)

With both these tools Genetic Engineering is possible.

New Discovery Leads to a New Application

Stanley Cohen and Herbert Boyer realise the potential of these technologies (1978):

Think:

- Insulin is just a protein
- Bacteria synthesize protein all the time
- Why can't we just insert the gene for this protein with these new tools?

It works! Genius!

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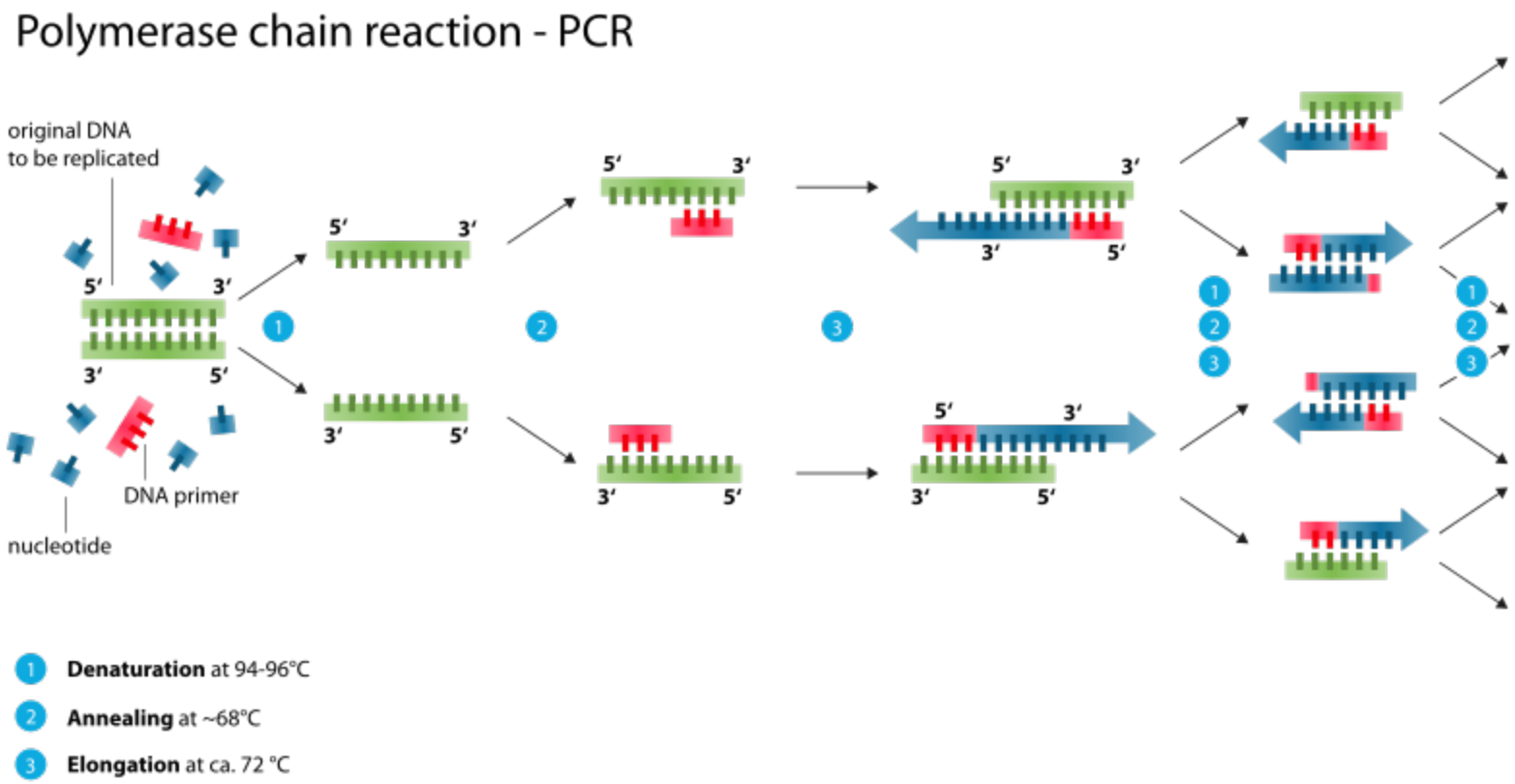

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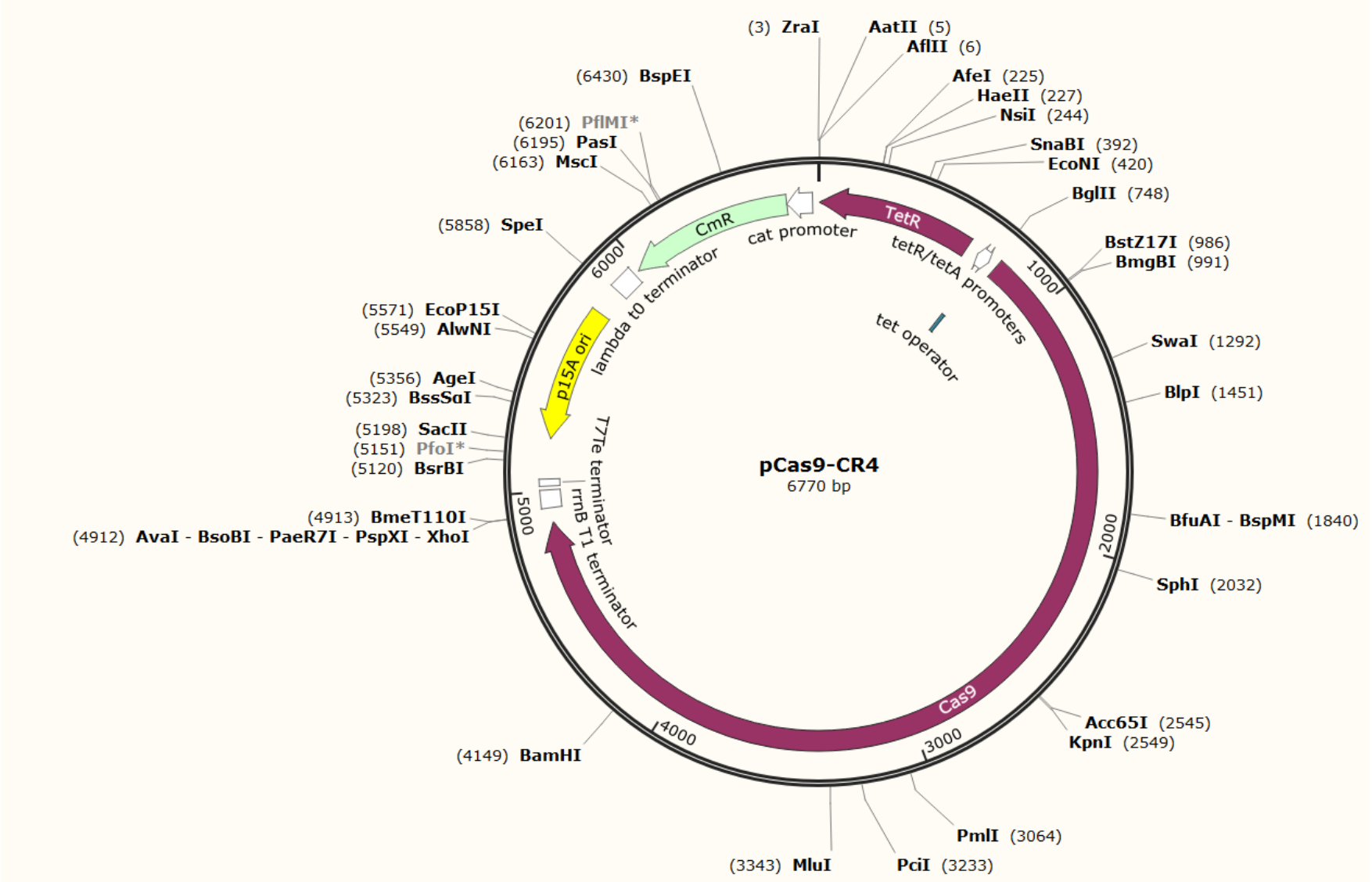

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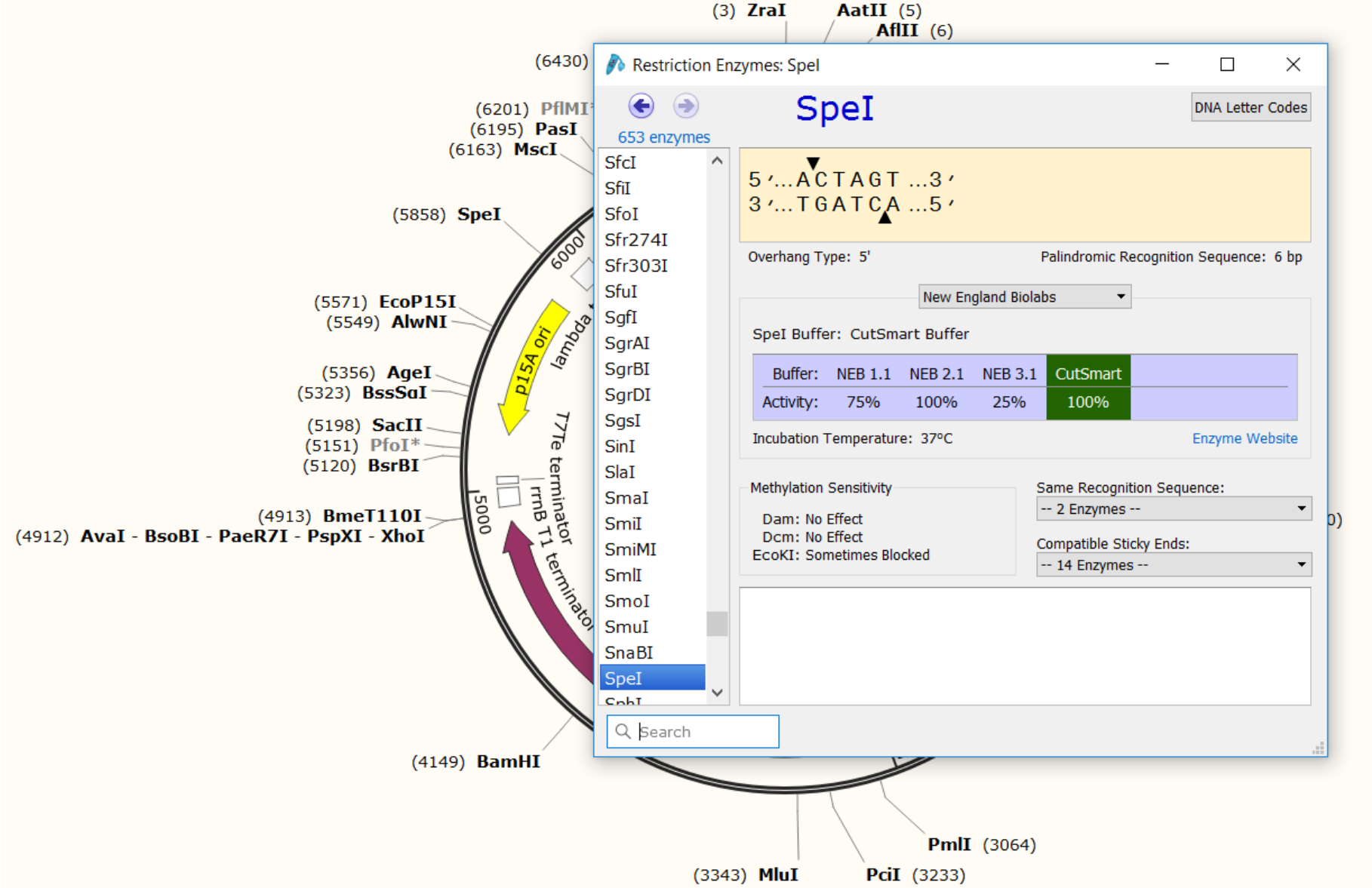

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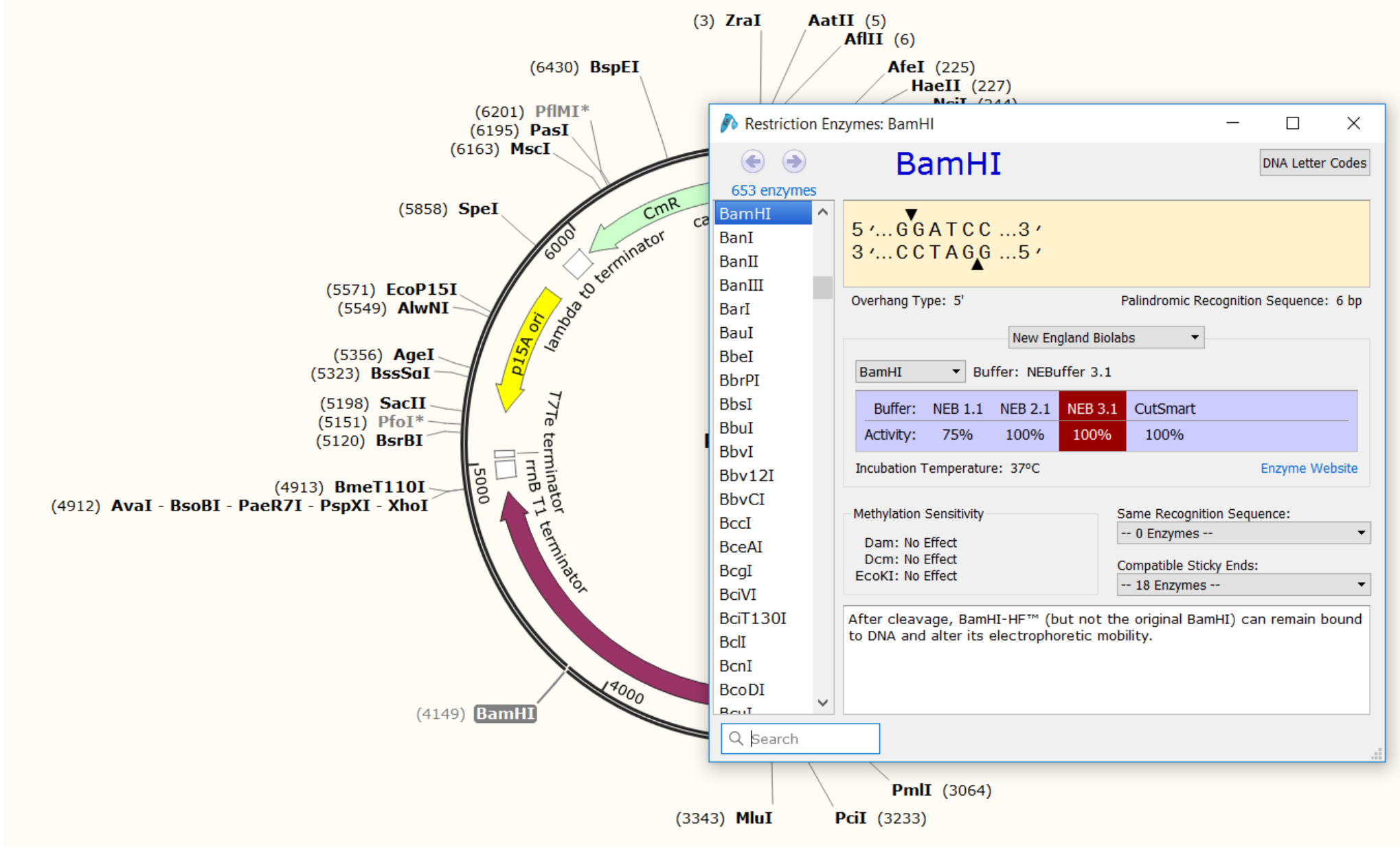

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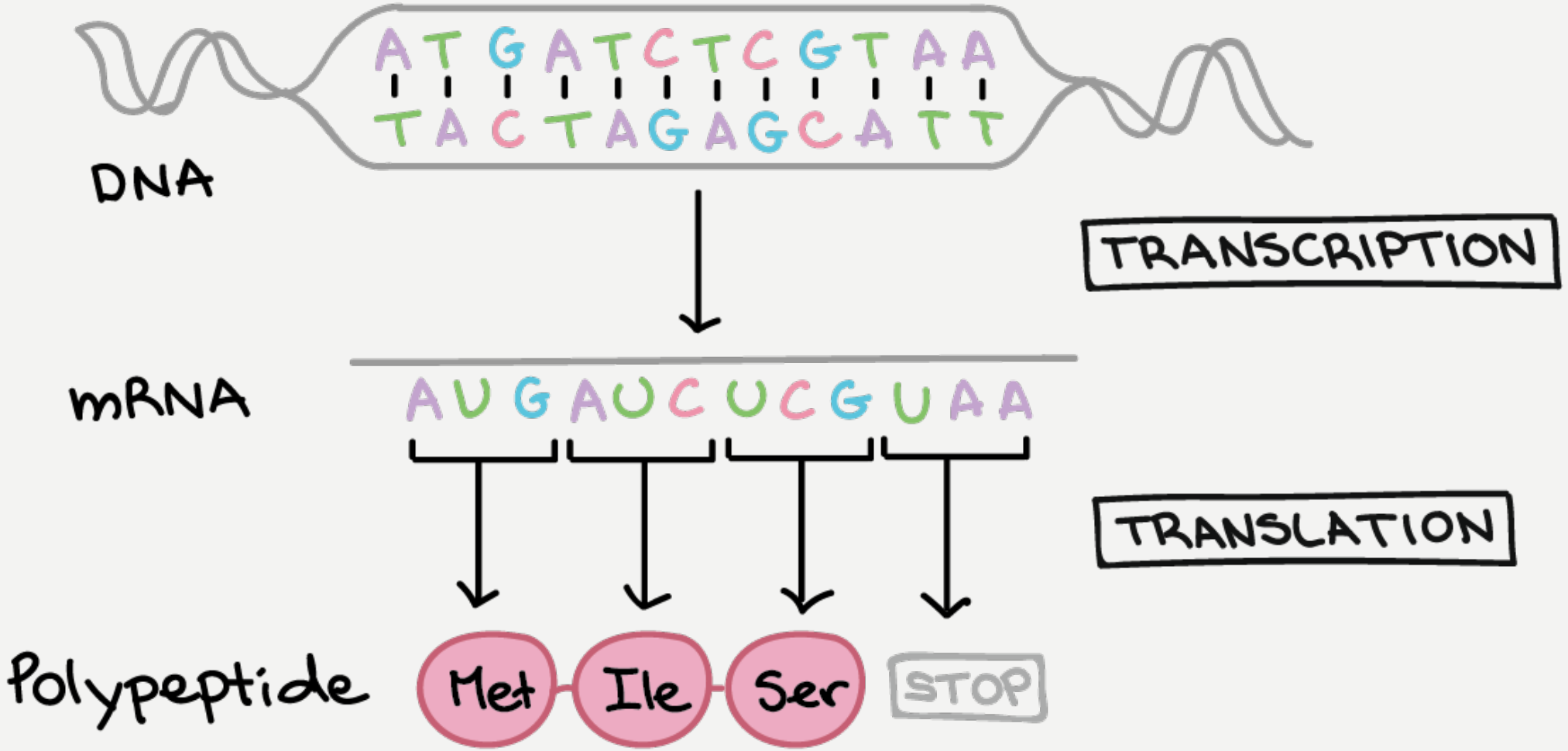
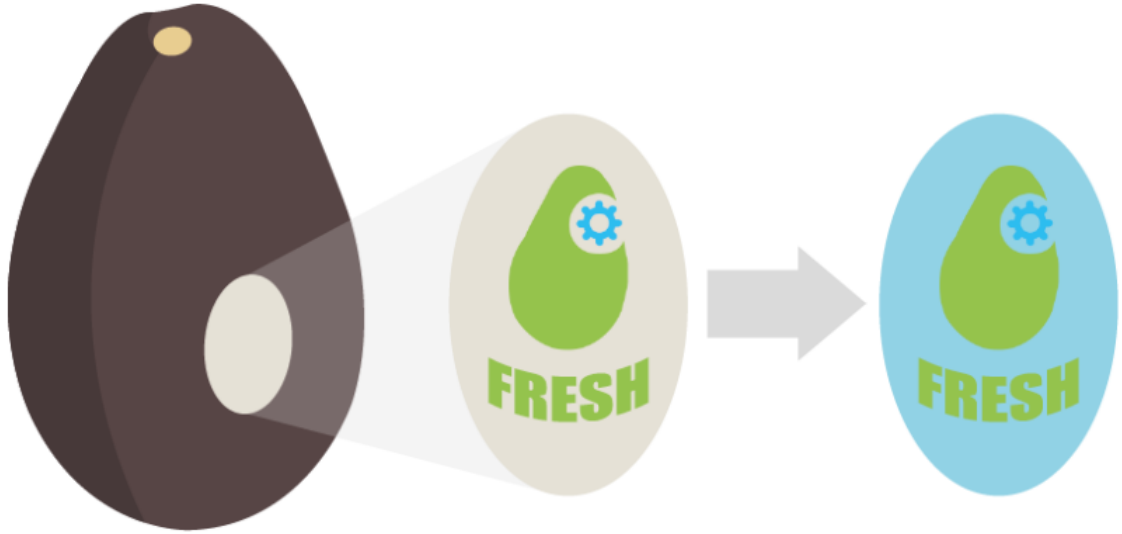


Influential iGEM Projects



Influential iGEM Projects

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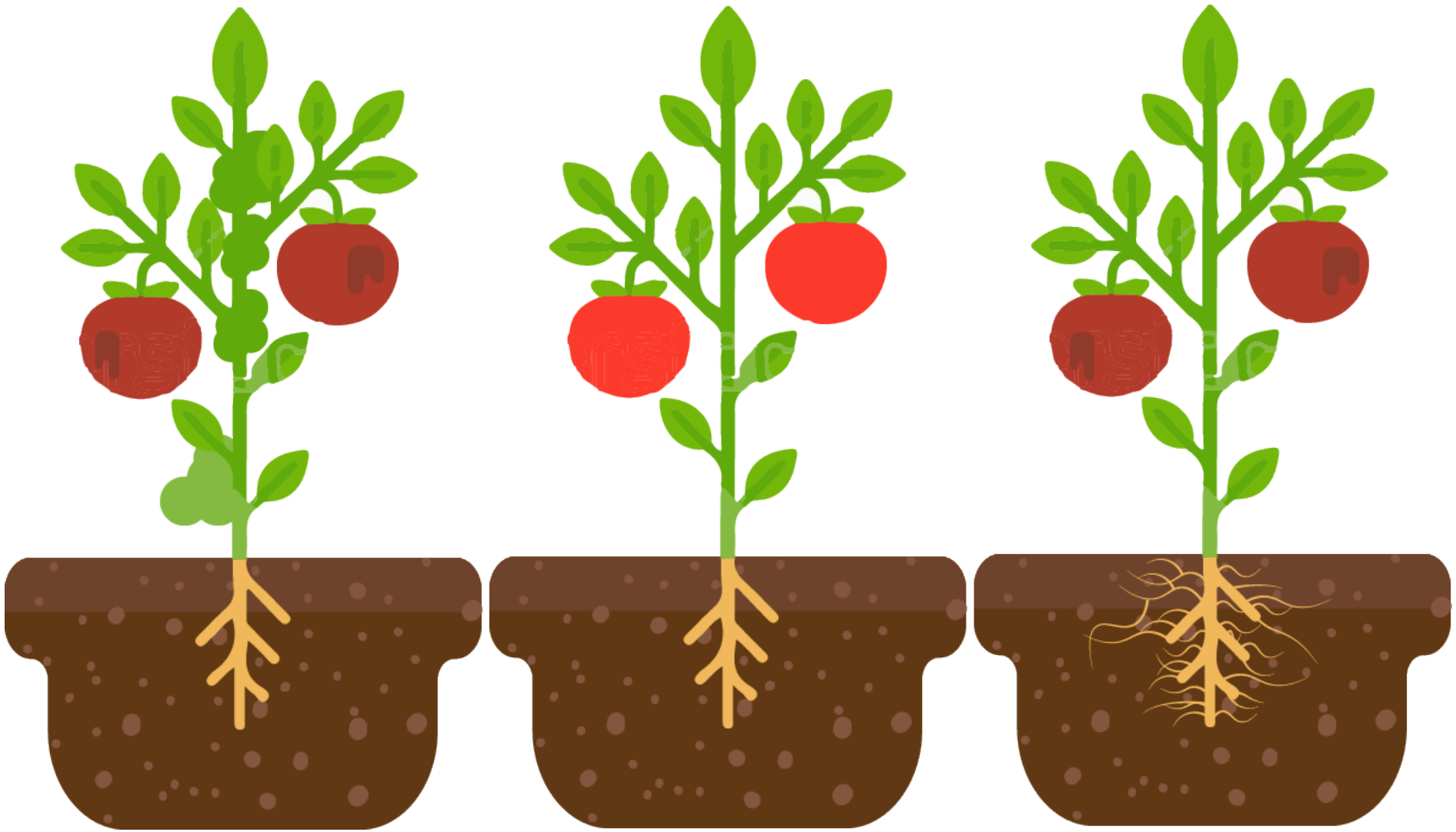
UBC iGEM Projects

THIS YEARS PROJECT



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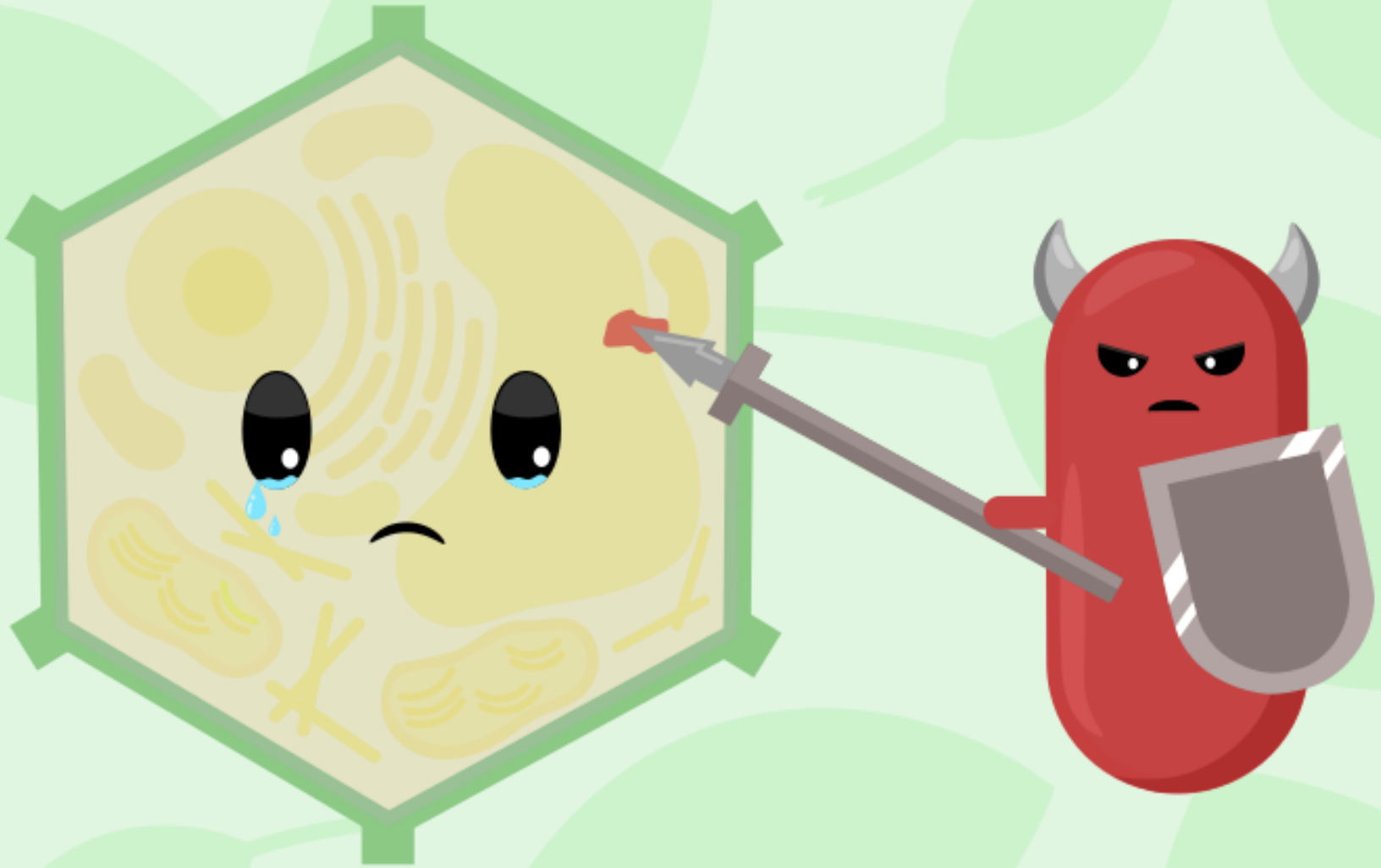

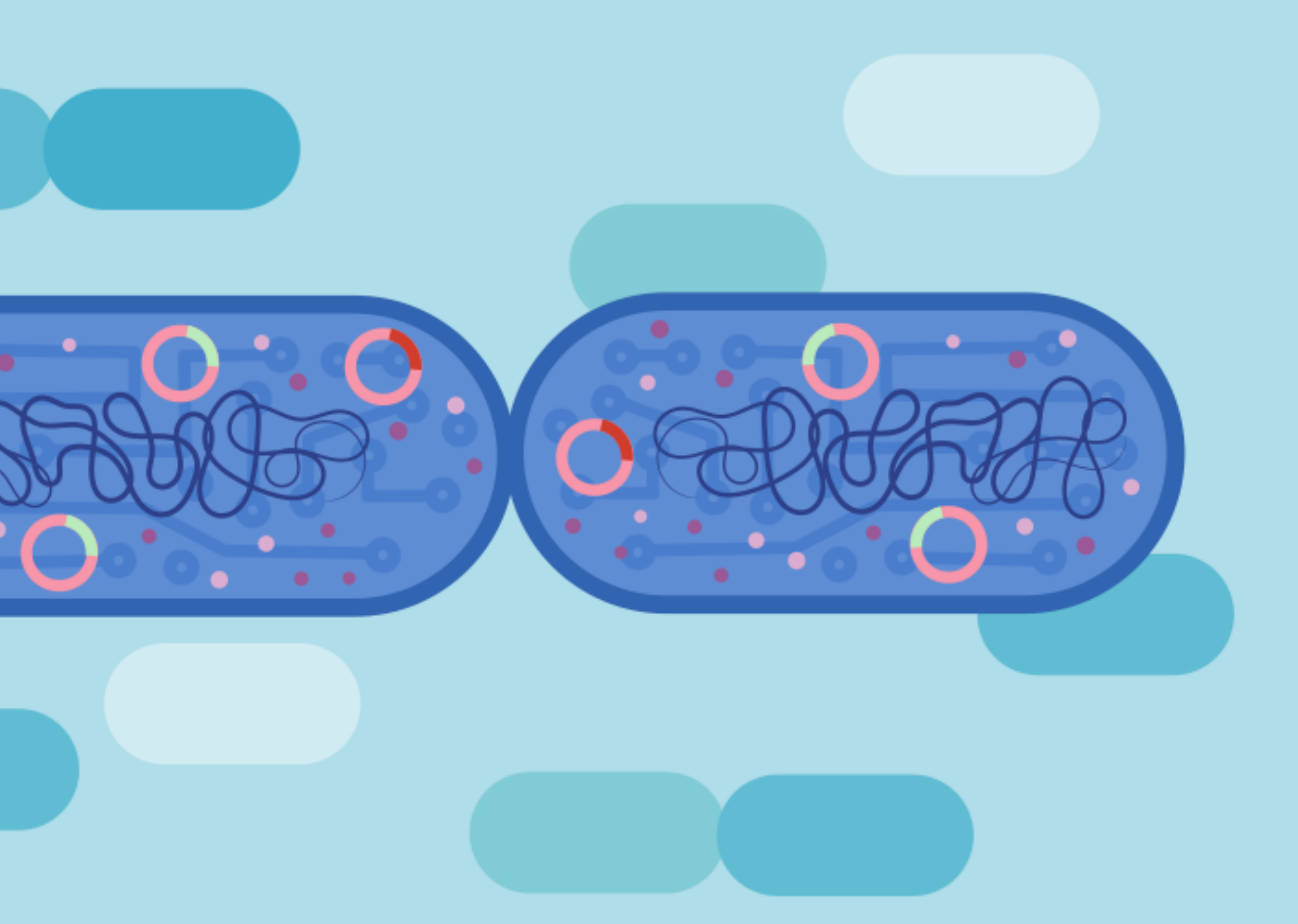

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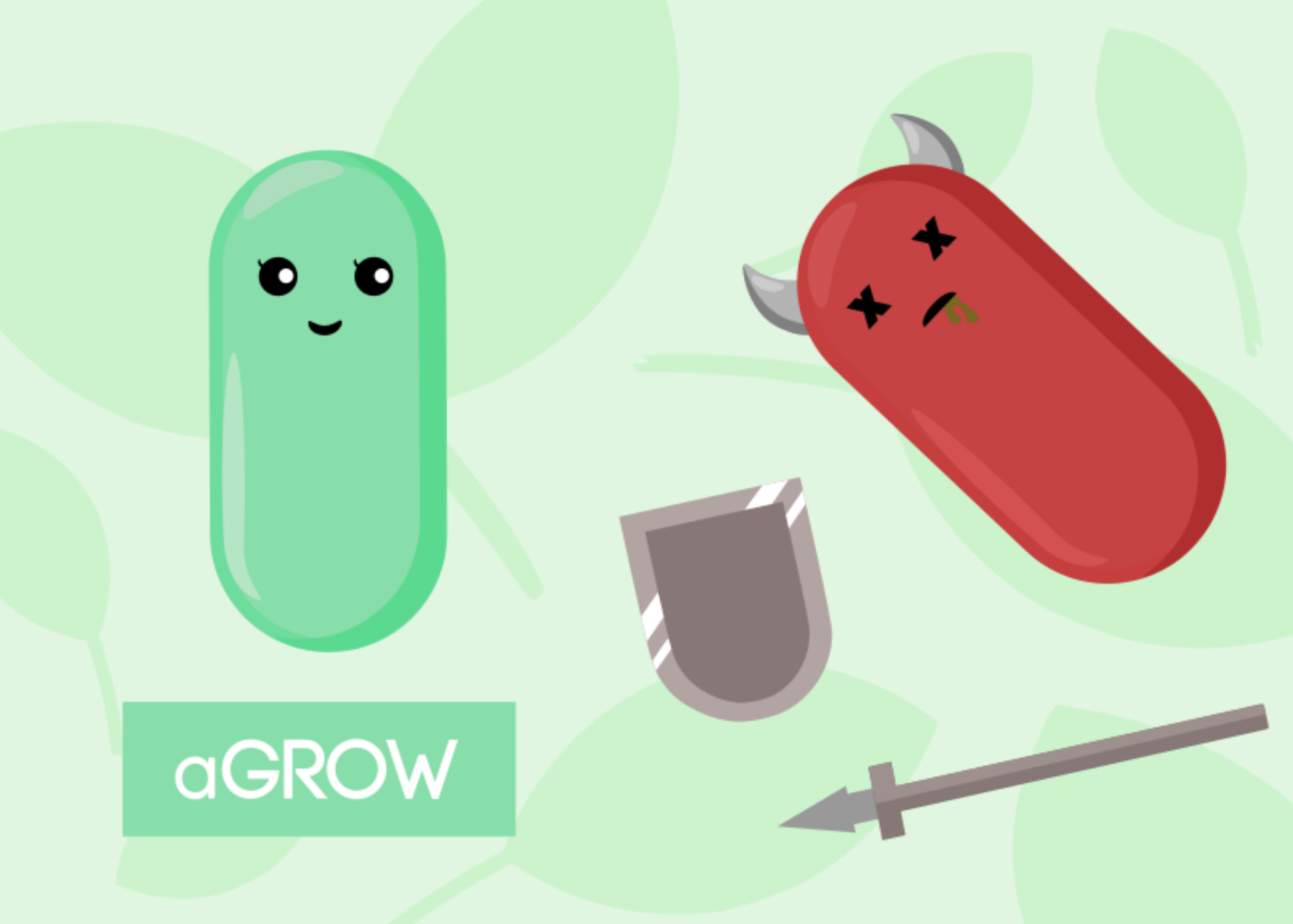

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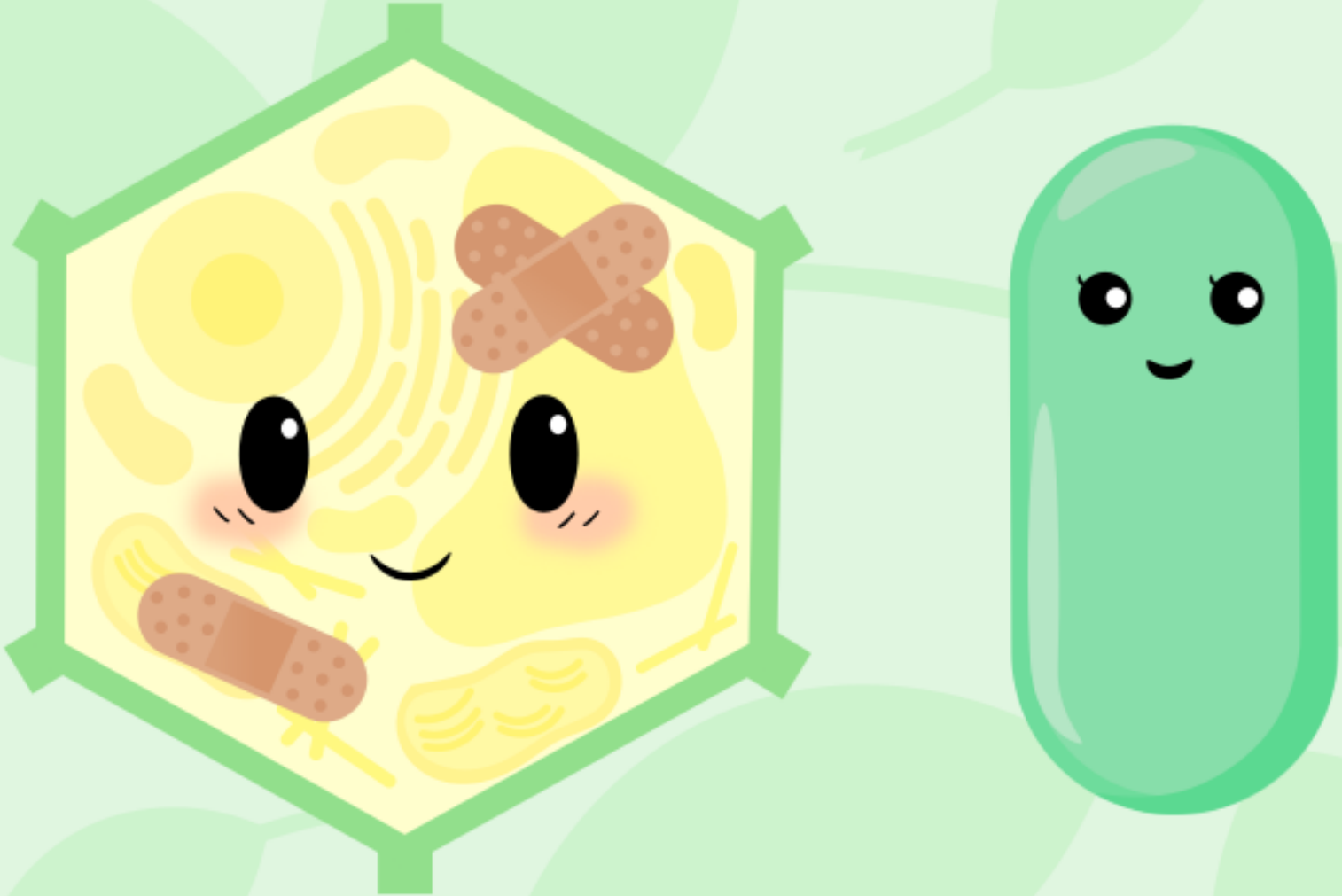
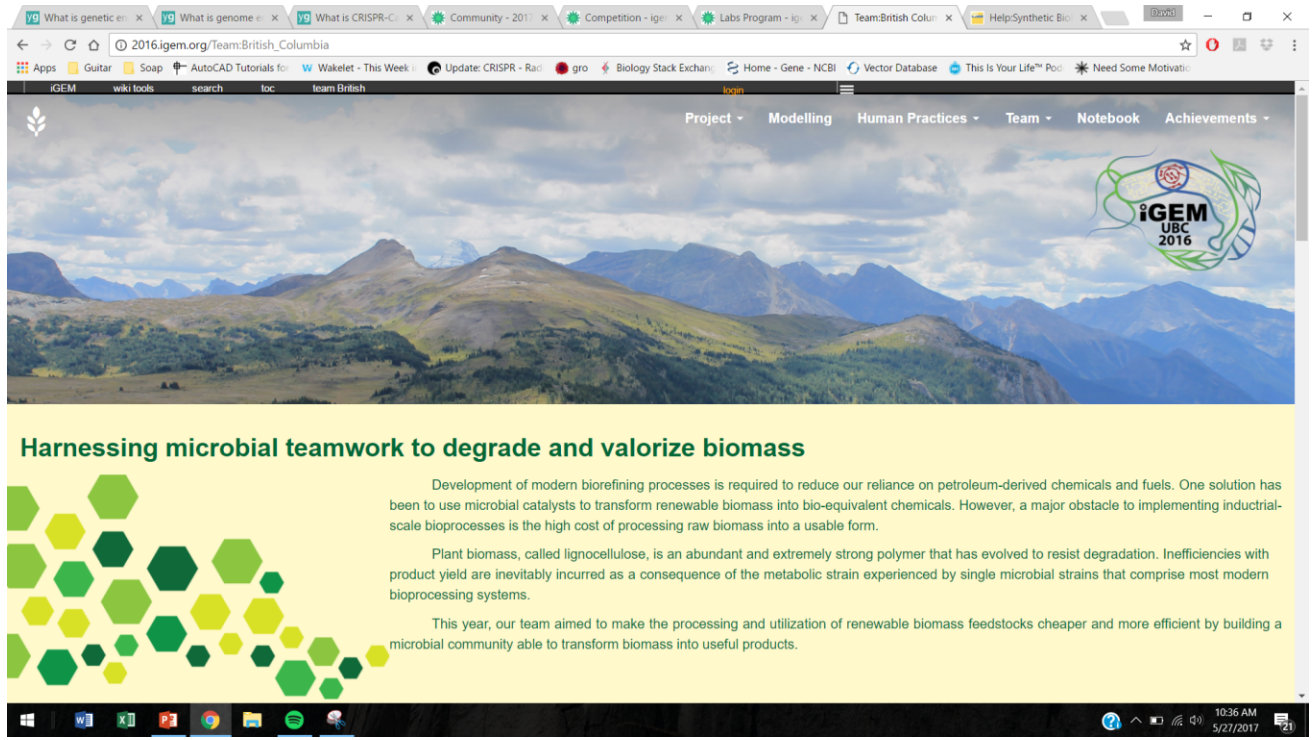


WHAT DO YOU ACTUALLY MAKE?

A bacteria (usually) that uses DNA adjustments to do something entirely new!



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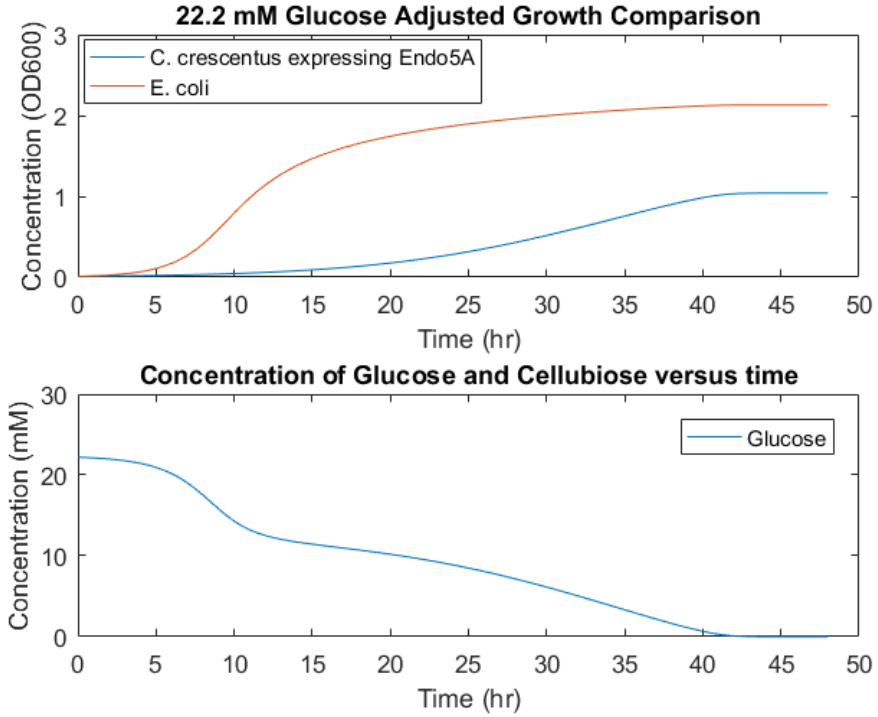
A fundraising package (similar to what is made by start up companies)



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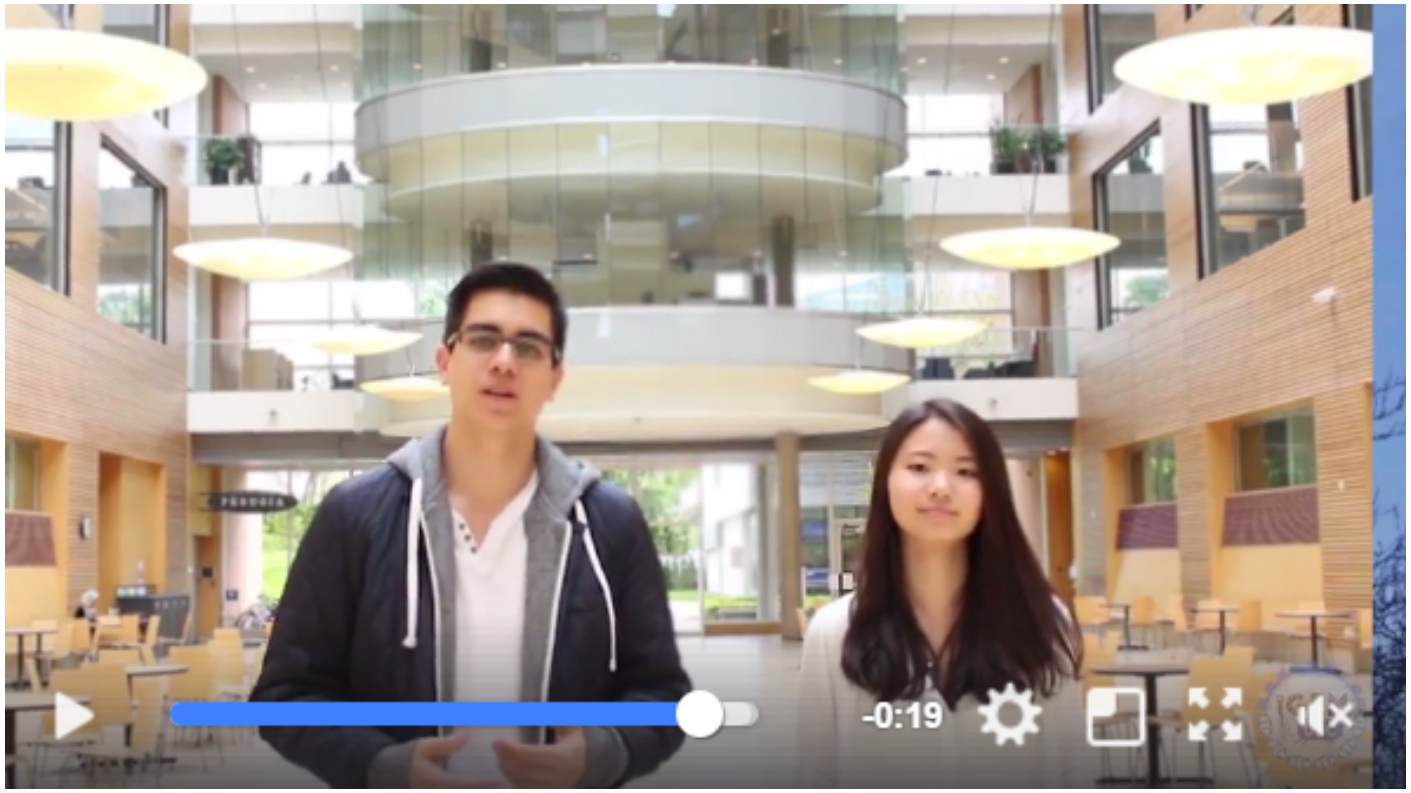
A 20 minute presentation and a poster

Interactive workshops for students in the community



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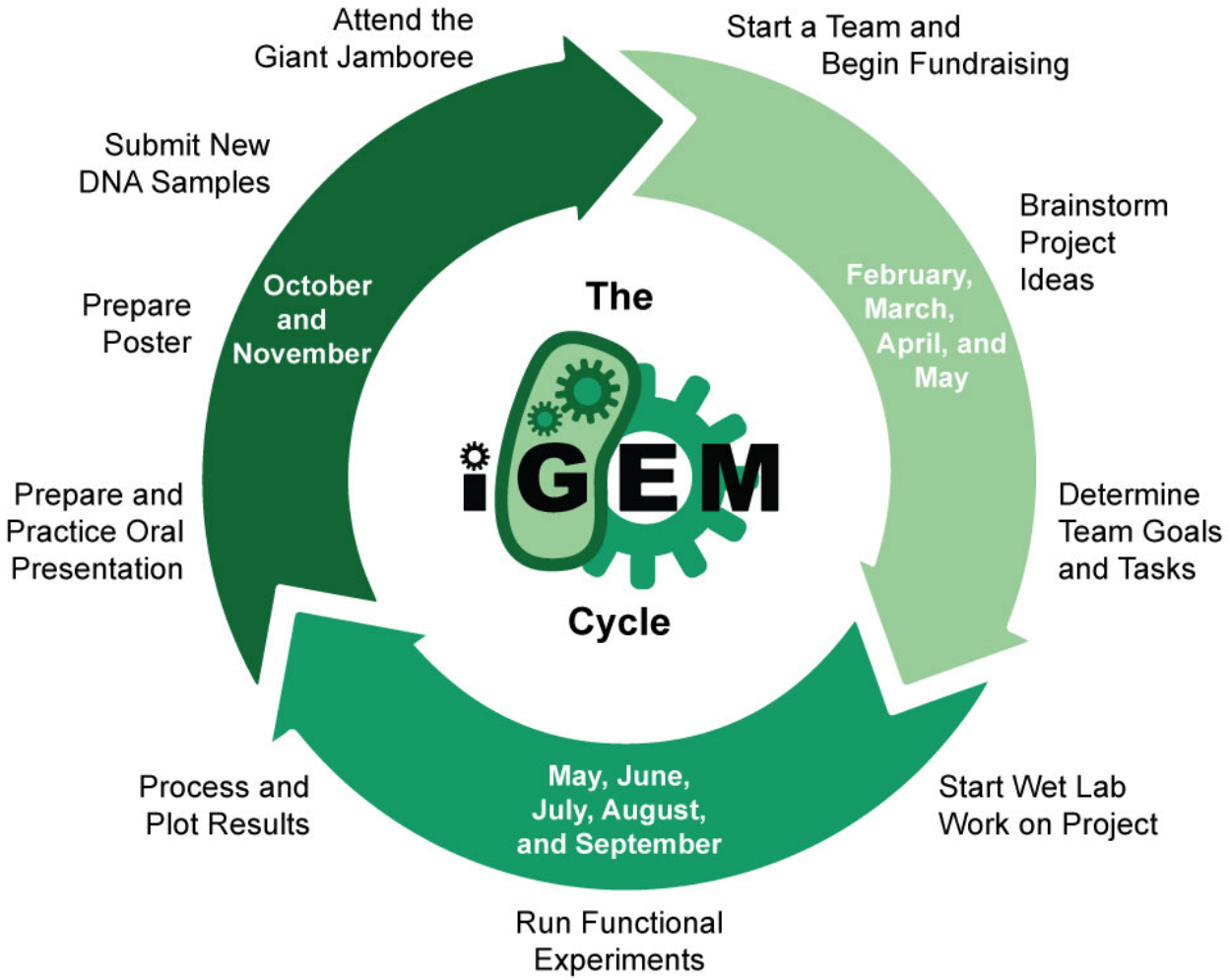
Interactive workshops for students in the community

Videos detailing our team and our project



TIMELINE

Recruitment begins in the beginning of the year.

Teams not only design a project and do the research, they make the product

AFTER THAT…

The team travels to Boston, USA to present their projects and compete for prizes.

Over 300 teams competed last year!

This year UBC iGEM was nominated for best manufacturing project and won a gold medal!

WHY IGEM?

1

High school students can actually make teams and participate – You don't have to wait

2

Participate in a rapidly growing and important field

- Elon Musk (Tesla, SpaceX, PayPal) said that Artificial Intellegence and Genetic Engineering are the two most important emerging fields right now

3

Meet new people from around the world with similar interests

WHAT NEXT?

1

Follow the UBC iGEM Facebook Page:
@UBCIGEM2017

2

Consider joining a team WHEREVER you go

3

Keep updated with Genetic Engineering