
**fishPHARM: Bridging the Gap Between Science
and Business**

CORNELL iGEM

A decorative graphic consisting of two overlapping wavy lines, one black and one red, positioned below the text 'CORNELL iGEM'.



The Team

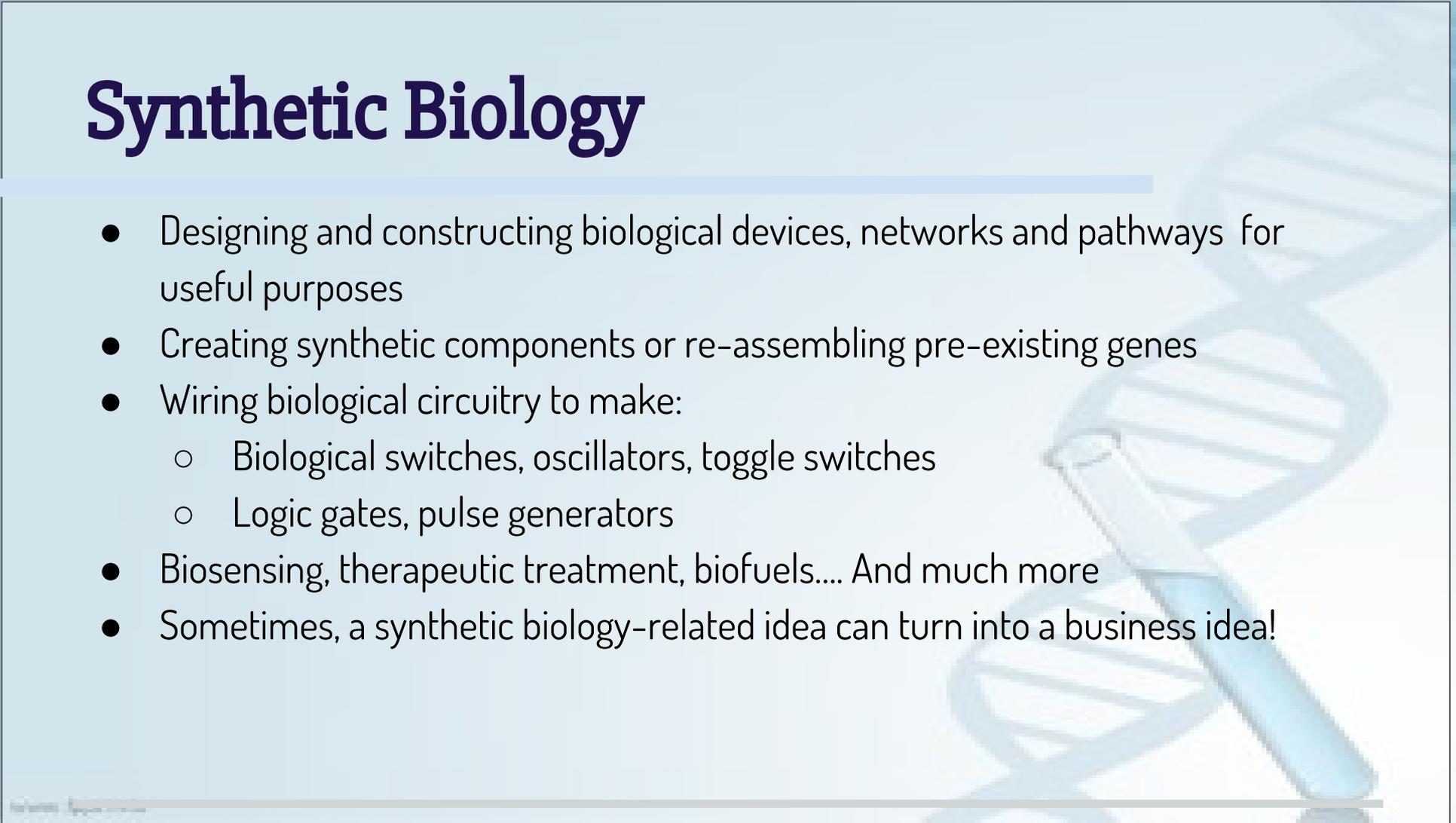
- 32 undergraduates
- Majors: Biology, Chemistry, Bioengineering, Mechanical Engineering, and more!



What is synthetic biology?



Synthetic Biology



- Designing and constructing biological devices, networks and pathways for useful purposes
- Creating synthetic components or re-assembling pre-existing genes
- Wiring biological circuitry to make:
 - Biological switches, oscillators, toggle switches
 - Logic gates, pulse generators
- Biosensing, therapeutic treatment, biofuels.... And much more
- Sometimes, a synthetic biology-related idea can turn into a business idea!

SynBio Application 1: Diabetes

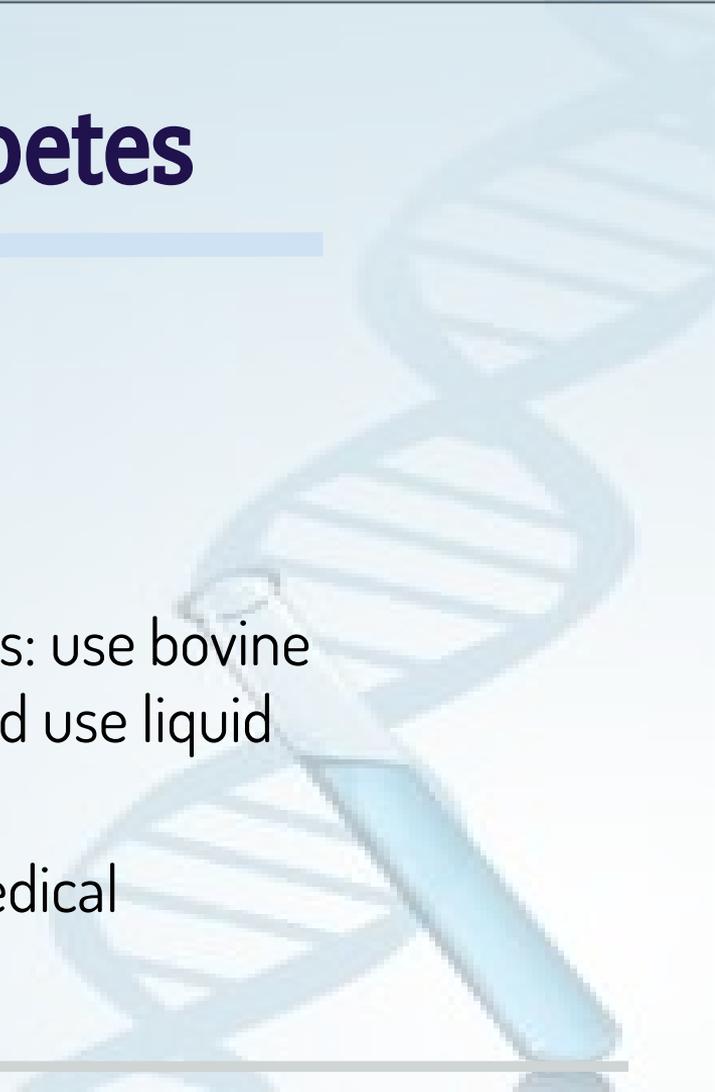
1500 BC: First written report of diabetes

1900: Primary treatment is “oat cure”

1921: Insulin is discovered

1923: Commercial production of insulin begins: use bovine and swine pancreases and pulverize them and use liquid fraction

1978: Arguably one of the most important medical discoveries ever



Problems with initial production

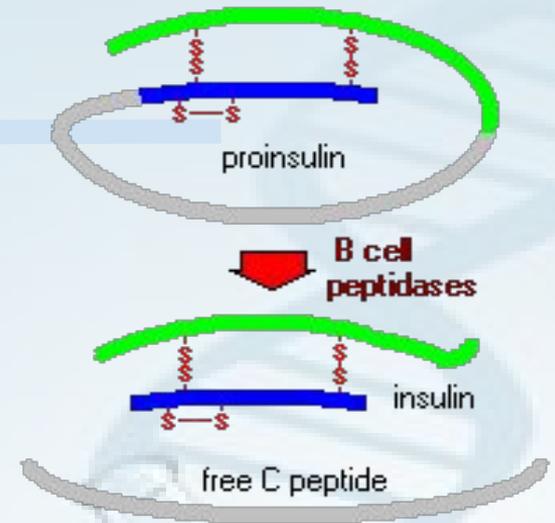
- Animal availability
- Low yields
- Immune rejection



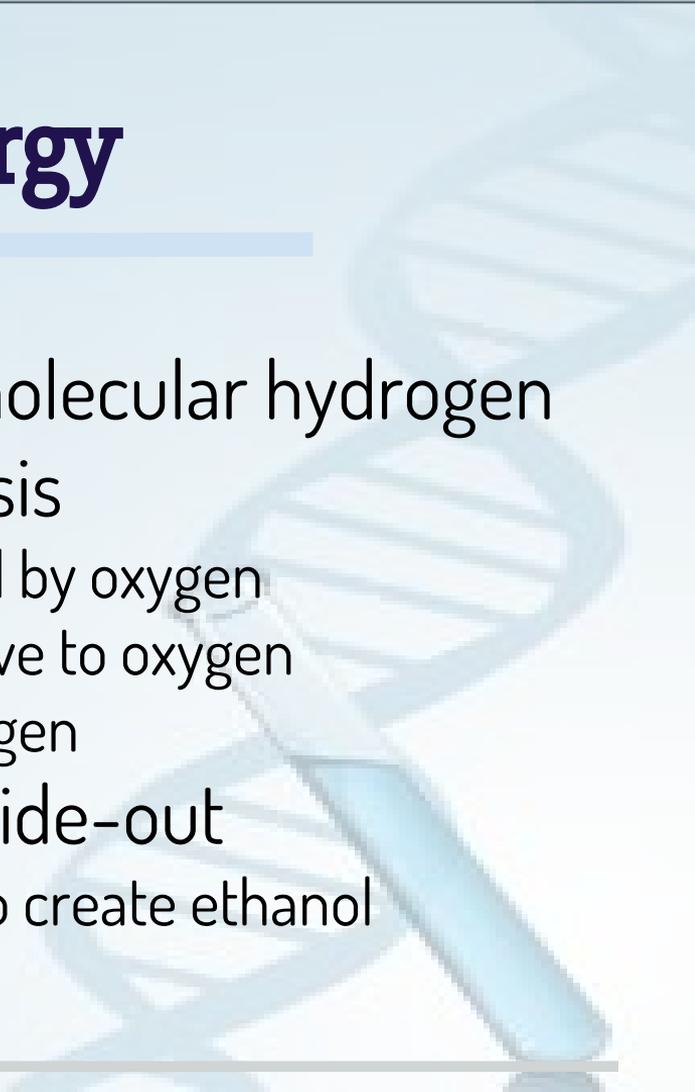
Need: a way to manufacture a lot of human insulin protein at minimal costs.

Solution: Synthetic Biology

- Produce human insulin in bacteria/yeast and do subsequent enzymatic cleavage.
- Allowed us to make human insulin in huge volumes and for very cheap (~1/3 of total protein price per cell)
- Now 29.1 million people in US can live with diabetes (1.25 million with type 1), many of whom couldn't have lived 100 years ago.



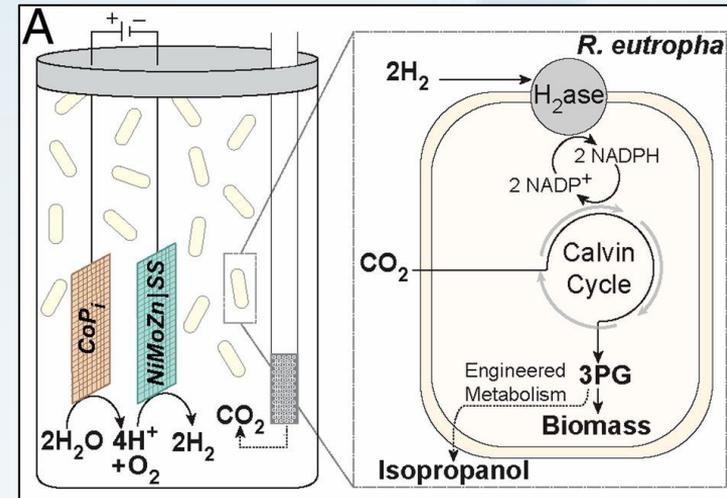
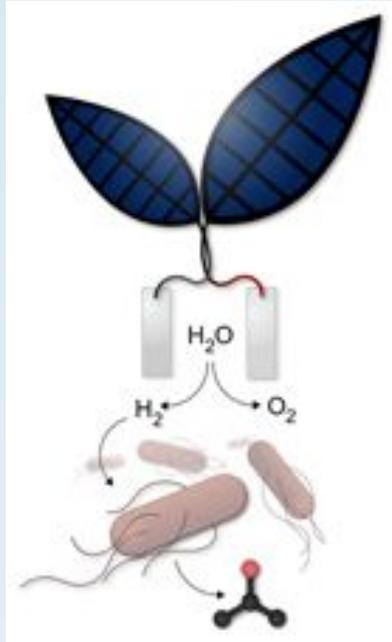
SynBio Application 2: Energy



- Algae/cyanobacteria can split molecular hydrogen from water during photosynthesis
 - Natural enzyme producers poisoned by oxygen
 - Engineering enzymes so less sensitive to oxygen
 - Engineering proteins to remove oxygen
- Engineering corn to rot from inside-out
 - More effective utilization of plants to create ethanol

Bionic Leaf

- Split water into hydrogen and oxygen in bacteria
- Combine hydrogen with carbon dioxide to produce isopropanol in *Ralstonia eutropha*

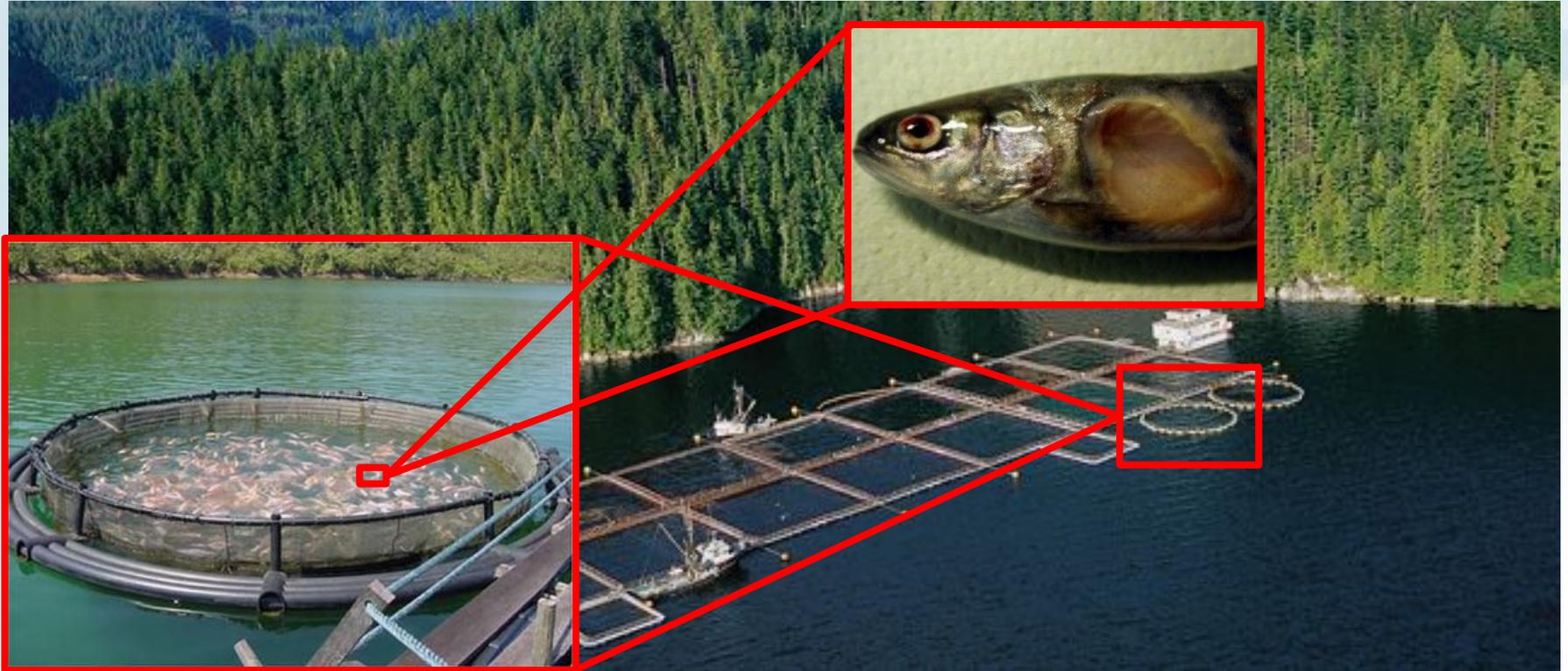


Our 2015 Project



fishPHARM

Bacterial Coldwater Disease



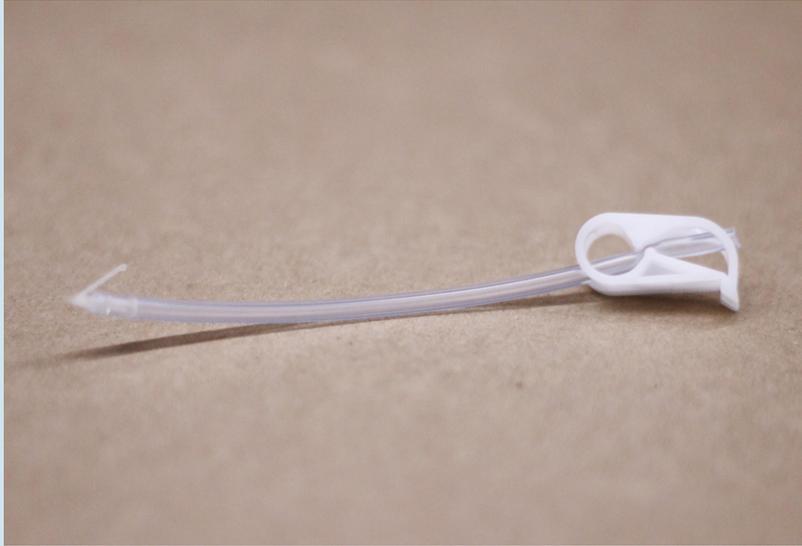
Flavocide

- Engineered *E. coli* to produce ecnB, which decreases the growth of BCWD



fishBIT

- Hollow out a fish tag and put our peptide inside!



Policy & Practices

Outreach



- Worked in collaboration with local upstate NY fish hatcheries for implementation of novel treatment method

App for the Farmers

- Created a preventative monitoring system to be used in conjunction with product



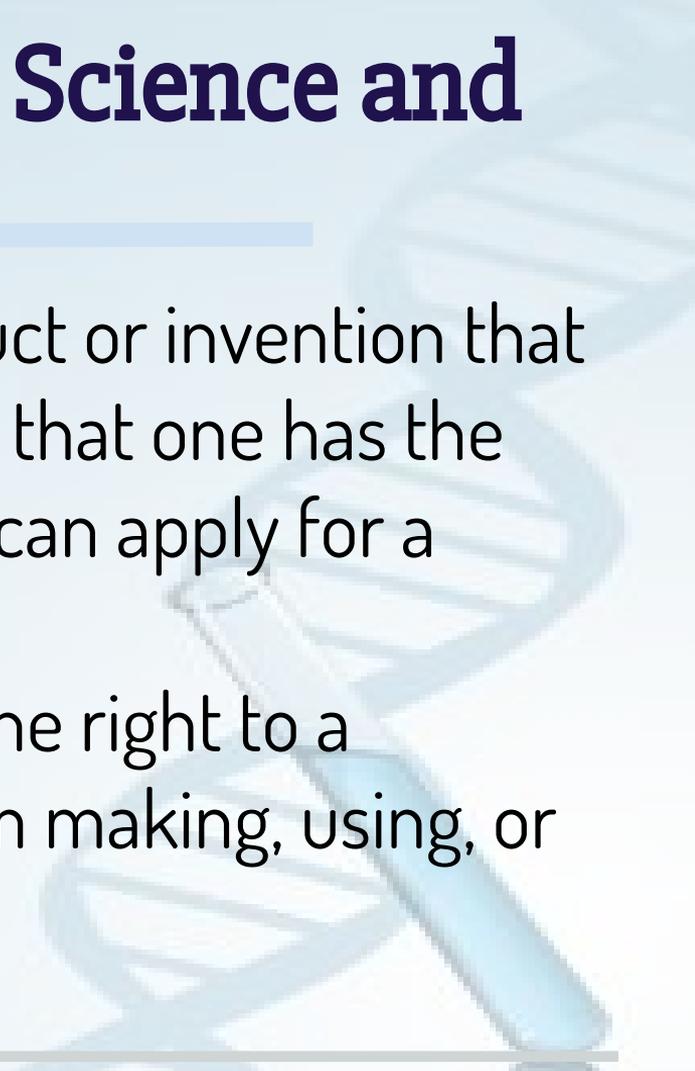
Entrepreneurship

- An **entrepreneur** is an individual who organizes and manages a business or company
 - Typically comes up with a business idea, usually focused on a commodity or a service, that can be used for commercial purposes
 - Obtains resources in order to promote this idea



Bridging the Gap Between Science and Business

- **Intellectual property:** any product or invention that is a result of intellect or creativity that one has the rights for and that for which one can apply for a patent
- **Patent:** a license that gives one the right to a product and prevents others from making, using, or selling that product



Big Companies

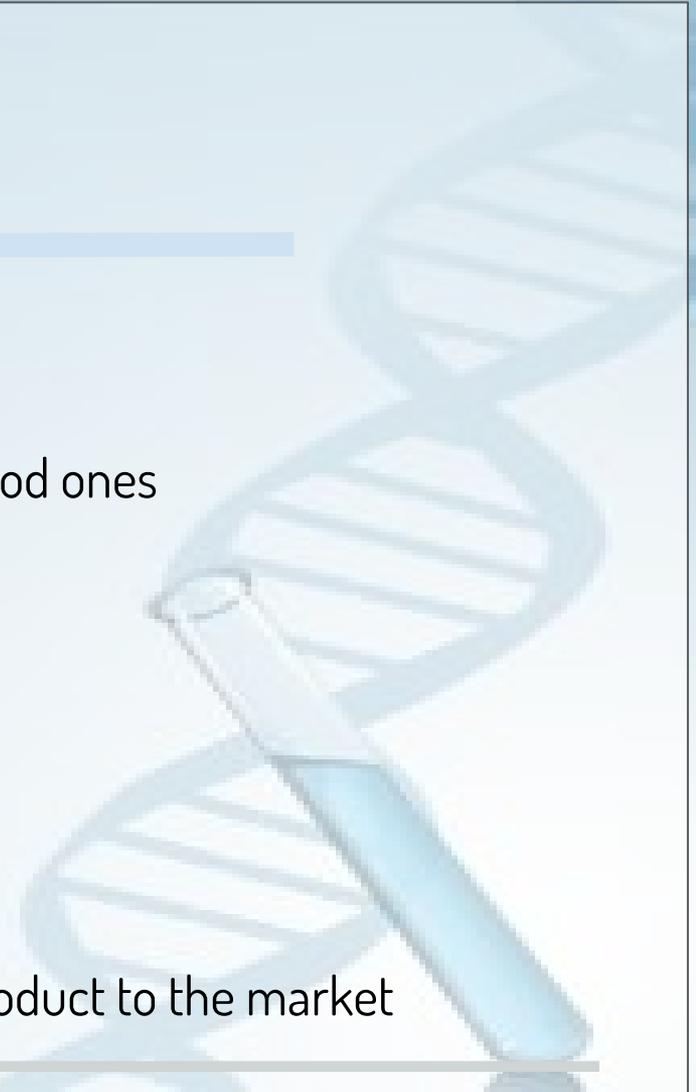
- Biotechnology: Gilead Sciences, Amgen, Celgene Corporation
- Engineering: NASA, SpaceX, Tesla Motors, Inc., Lockheed Martin



GILEAD

Coming Up with an Idea

1. **Identify** the problem
2. **Think** about potential solutions - “Yes, and...”
 - a. Brainstorm and keep track of all ideas
 - b. Say all ideas and then decide which are the good ones
3. **Assign** roles (i.e. scribe, discussion facilitator)
4. **Research**
5. **Consider**
 - a. How to move forward with the ideas
 - b. Consumers’ wants and needs
6. **Ask**
 - a. How to market the idea - framing/advertising
 - b. How to pass necessary regulations to bring product to the market



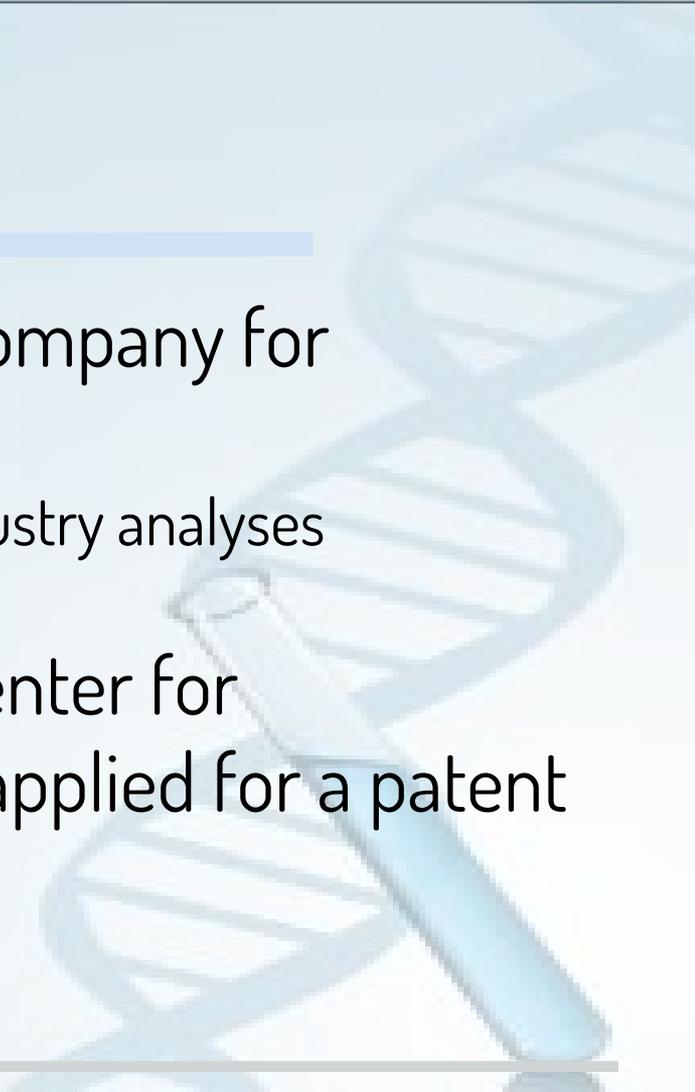
Cornell iGEM - Project Management

- From brainstorming to final project

Week of:	4/10/2016	4/17/2016	4/24/2016	5/1/2016	5/8/2016	5/15/2016	5/22/2016	5/29/2016
Key events:								
	-> Completed	-> In Progress	-> Behind Sched	-> To Do				
Product Development								
Task Name								
Decide on 3 specific contacts + backups								
Compile list of questions for each contact								
Conduct interviews with contacts								
Compile user feedback								
Identify problem statement								
Identify needs								
Determine specifications								
Initial brainstorming								
Morphological chart								
Pugh Decision Matrix								
Decision on direction to proceed								

Cornell iGEM - Business

- We created an entrepreneurial company for fishPHARM
 - Performed market, financial, and industry analyses
 - Conducted market research
- We pitched our idea to Cornell Center for Technology Licensing (CTL) and applied for a patent for our fish tag prototype



Questions?



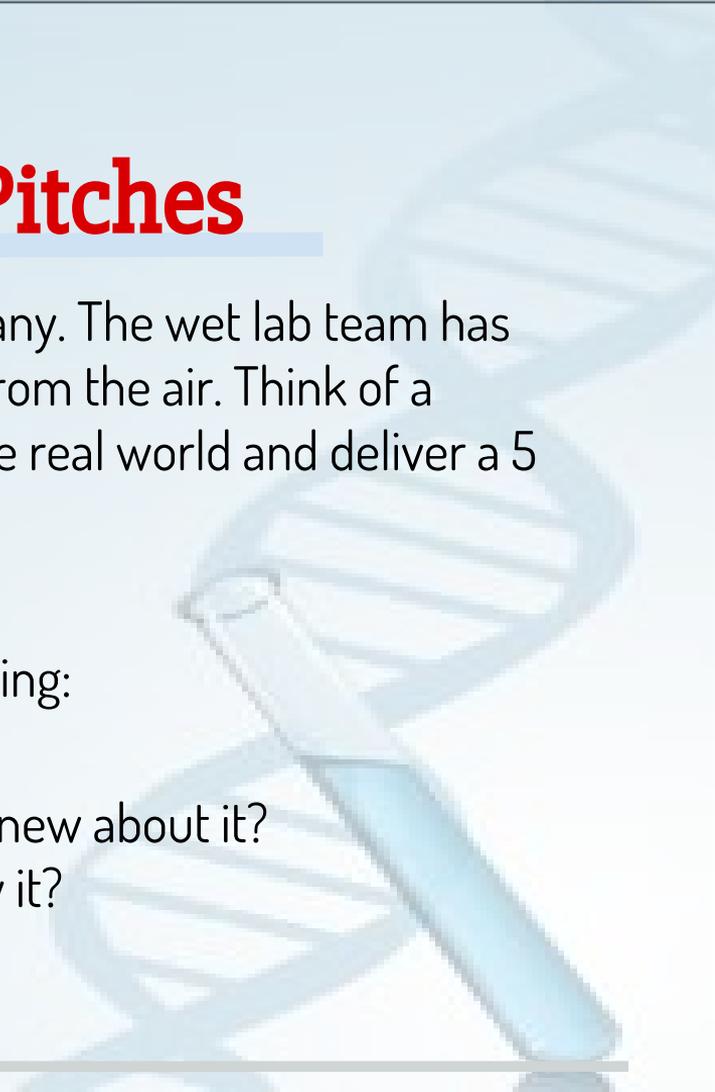
The Task:

Brainstorming & Delivering Pitches

Prompt: You are a group of entrepreneurs at a company. The wet lab team has engineered bacteria that can remove carbon dioxide from the air. Think of a business idea that will implement these bacteria in the real world and deliver a 5 minute pitch.

Your pitch should answer all, if not more, of the following:

- What does your device do?
- How is it different from existing devices? What is new about it?
- How do you plan on convincing consumers to buy it?
- Come up with a catchy name!
- Design a visual for your product!



Thank you for coming!

- Special thanks to
 - Cornell University
 - College of Engineering
 - Dr. Shivaun Archer

