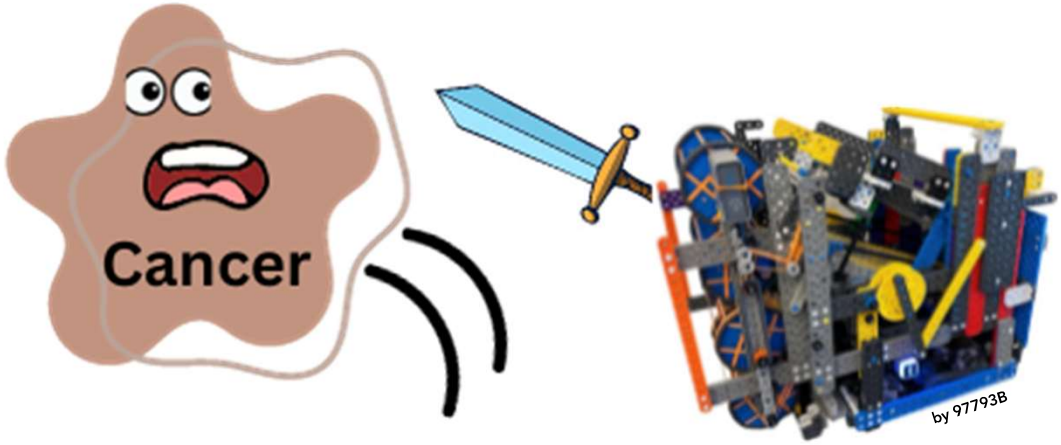
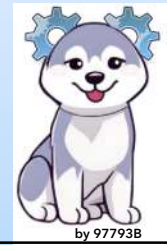


Can the Engineering Design Process help you find a cure for cancer?

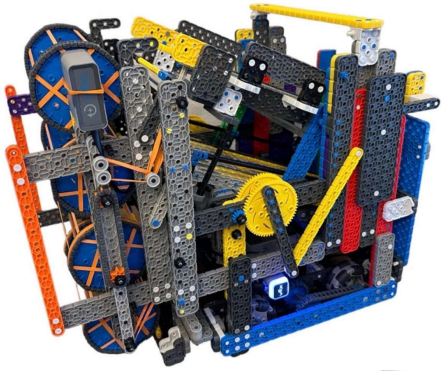
By: Zoya, Chloe, Hans, William, Vesper

97793B (the RoboHuskies)
Irvine, California, USA



Introduction

Can experience with Vex IQ robotics help you discover a cure for cancer? **It definitely can!** At first, you might think discovering new medicine has nothing in common with building a bot with a chassis and lifts. However, scientists that create new medicines actually use something very similar to the Engineering Design Process!



About the Career

Our team interviewed three scientists that work on new cancer medicines at Johnson & Johnson: Karen Ventrella, Haneefa Vaidya, and Pelumi Oluleye. Their job is to make sure new medicines are designed, tested and approved as safely and quickly as possible. They also make sure that the process follows the government's rules.

We chose this career because several of us have family members that fought cancer, so finding new medicines is really important to us. For example, Zoya's grandma had breast cancer, and Chloe's grandma had liver cancer. 😢💔

Karen Ventrella
Sr. Director, J&J Innovative Medicine

Haneefa Vaidya
Director, J&J Innovative Medicine

Pelumi Oluleye
Operations, J&J Innovative Medicine

The design cycle for new cancer medicine is very similar to EDP!

1. Define the problem
What type of cancer do we need better medicine for?

2. Brainstorm
There are many ways to kill or slow down cancer cells. What strategy or path could you use?

3. Research
Learn everything you can by reading scientific articles & speaking to experts (scientists & doctors)

4. Develop Ideas
Design/select possible drugs to try out.

5. Choose Best Idea
Narrow down possible drugs to one to make and test.

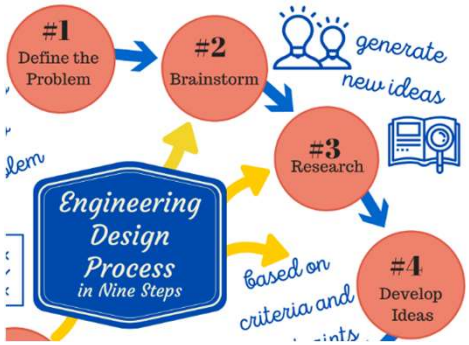
6. Prototype
Make small amount of drug to test in the lab (using cells in dishes) and then in humans.

7. Test/Evaluate
Evaluate safety (side effects) and effectiveness (does it kill cancer cells).

8. Improve
Change how much drug is given (dose), how often (frequency), or formula/recipe of the drug.

9. Communicate Results
Share results online & in medical magazines and meetings.

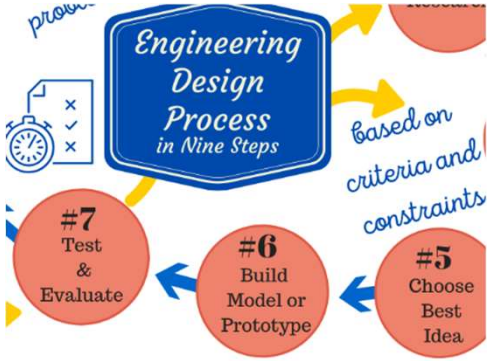
Steps 1-4: Define the problem, Brainstorm, Research, Develop ideas



Before we designed our robot, we studied the game manual to understand the rules and objectives, and we watched videos to brainstorm ideas. This helped us figure out how to build the robot to score the most points.

To research ideas for new cancer medicines, scientists first decide what type of cancer to focus on, and then they research what makes that type of cancer grow. They also look for “targets” or markings that make the cancer cells unique, so the medicine won’t hurt healthy cells.

Steps 5-7
Choose best idea,
Build model,
Test/evaluate



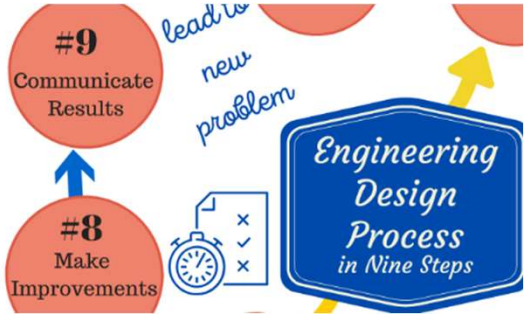
To choose the best ideas for our robot, our team puts them into a table in our notebook, and we rate them. After building the bot, we test in stages: first the chassis, then our lift, and then the object manipulators.

We test and evaluate on a playing field and document everything in our notebook. We make sure the robot follows the competition rules, like size constraints and number of motors.

Scientists also test new medicines in stages: first in a lab using cells, then in animals, then in a small group of healthy humans, and finally in larger groups of cancer patients. The scientists follow rules set by the FDA and by a review board at each hospital that helps to test the new medicine.

When a new medicine is being tested, there is a lot of data collected such as lab tests, x-rays, and side effects. The data is collected in online forms. Before any new medicine is approved by the FDA, they check the data to make sure it is safe and effective.

Steps 8-9 Make improvements, Communicate results



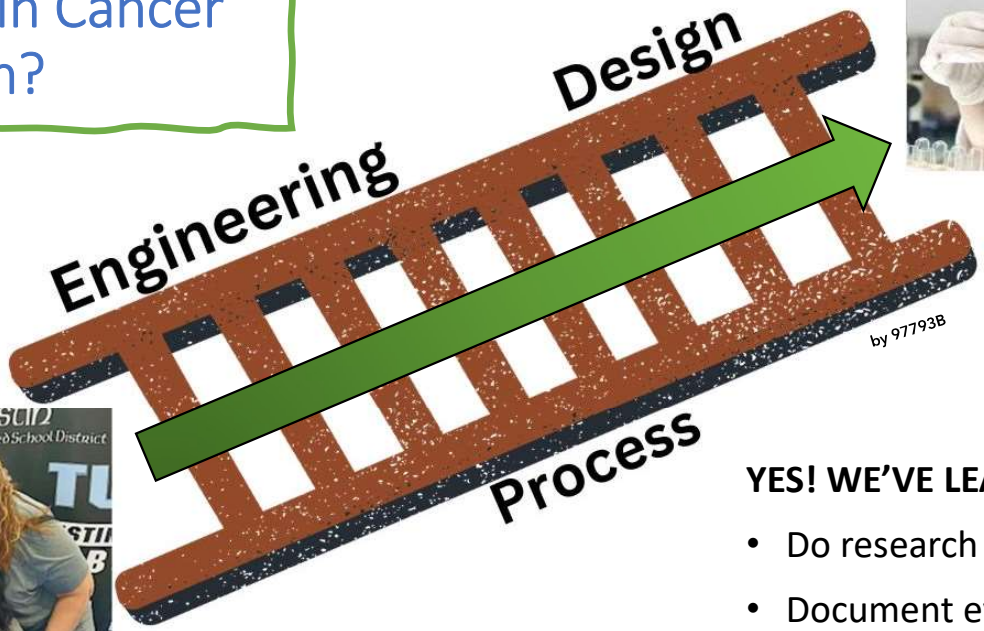
When our team makes improvements to the robot, we can change things like the gear ratio, the type of lift, etc. Our results are recorded in our notebook, and everyone can see our competition scores. Some teams share videos on YouTube.

We have 5 team members, and we complete the design cycle over one school year.

To improve a medicine, scientists can change how much is given (dose), how often it is given (frequency), or even the recipe (formulation). Results are posted online and shared with doctors through medical magazines and medical meetings.

Hundreds of people work on each new medicine, and the full cycle from lab through FDA approval can take **10 years**! Sometimes a new medicine doesn't work, but the scientists learn from every failure and use the lessons to create better versions.

Has Vex IQ & EDP Prepared Us for a Career in Cancer Research?



Team **97793B (RoboHuskies)**

YES! WE'VE LEARNED:

- Do research before you start designing.
- Document everything. Follow the rules.
- How to work in teams
- It can take a lot of adjustments and patience to get it right. The first version is rarely successful.
- Share your results to help others!