

Summer 2020

## **Introduction to Synthetic Biology**

### **Instructors:**

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### **Course overview:**

This course introduces the basics of synthetic biology, genetics, research, and the scientific method. Synthetic biology is a field of science which redesigns and engineers organisms to give them new abilities that could benefit society. For example, scientists have designed microorganisms that can clean pollutants from water, or yogurt that can clean teeth. There are a total of 9 modules, with each lasting 10-15 minutes. The modules include a mix of short lessons, short activities, and at-home experiments to help students to further understand the material and the concepts.

### **Learning objectives:**

By the end of this course, students will be able to gain a basic understanding of synthetic biology, bioethics, current synthetic biology application and scientific research. Students will be able to write a scientific lab report based on an experiment and evaluate their performances and understanding of the course through the written assignments and activities.

### **Modules, reading and homework:**

Learning in this course includes short readings, lectures, and assignments (answering questions on google form, performing one at home experiment, etc). Please read the articles assigned in each module before watching the module and submit the google form or any assignments after completing each module. The questions and activities in each module are designed to maximize your engagement of the course and understanding of the concept. The powerpoint lecture slide is uploaded as well as any additional material on the blackboard under the corresponding module.

### **Grading:**

Although this course is not graded, we encourage you to complete the module and submit the Google form and all the necessary materials. Students who successfully complete all modules will receive a letter certifying your accomplishments from University of Rochester iGEM advisor Dr. Anne S. Meyer, a course certificate, and will be asked to be featured on the University of Rochester iGEM Wiki page (the iGEM competition page that lists and summarizes the UR iGEM project for the judges and general public). Students will have the option to opt out of being featured by name.

**Course outline:**

| Module # | Topic   | Overview of the course   | Link to the reading material   | Link to the google form        |
|----------|---|--|--|--------------------------------|
| 1        | Basic biology                                   | Introduce the structure of the course and the basics of genetics (Gene, DNA, chromosomes, the central dogma).  | <a href="#">What is the "Central Dogma"?</a><br><a href="#">Overview of Genes, DNA, and Chromosome</a> | <a href="#">Google Form #1</a> |
| 2        | Basic synthetic biology                         | Explain basics of synthetic biology; how is synthetic biology different than other science disciplines; give examples of how synthetic biology is used and who uses it   | <a href="#">Chapter 1: Fundamentals of Synthetic Biology</a>   | <a href="#">Google Form #2</a> |
| 3        | Biobricks                                       | Discuss what BioBricks are; learn about common BioBricks and their functions in gene expression; understand why are BioBricks useful to synthetic biologists; Introduction to Synthetic Biology Open Language for communication. | <a href="#">What are BioBricks?</a>  | <a href="#">Google Form #3</a> |
| 4        | CRISPR system                                   | Introduce CRISPR/Cas9: its history, mechanism, and different delivery systems  | <a href="#">Questions and answers about CRISPR</a>   | <a href="#">Google Form #4</a> |
| 5        | Biosensors and bioreporters                     | Introduce the function of biosensors and reporters; provide real life examples   | <a href="#">Biosensors and their applications --- A review</a>   | <a href="#">Google Form #5</a> |
| 6        | Synthetic biology application in the real world | Conditions for success of large scale/commercial synbio use; examples of commercial synbio products  | N/A  | <a href="#">Google Form #6</a> |
| 7        | Ethical issues around synthetic biology         | Define the Dual-Use Dilemma and understand why it is important; learn about ethical themes in synthetic biology; discuss popular ethical topics  | <a href="#">From Corgis to Corn: A Brief Look at the Long History of GMO Technology</a>                | <a href="#">Google Form #7</a> |

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|---|--------------------------------------|--|---|---|
| 8 | How to write a lab report            | Introduce the structure and component of a lab report; DNA extraction experiment.  | N/A   | <ul style="list-style-type: none"> <li>- <a href="#">Sample lab report</a></li> <li>- <a href="#">DNA extraction lab report submission</a></li> </ul> |
| 9 | Introducing our iGEM project and SAA | Give an overview of iGEM competition; talk about what our project is & our inspiration; discuss SAA and its purpose; show how we are reflecting endometriosis in art; give examples of other forms of expression | <a href="#">Explore iGEM's website (~10-15 mins)</a><br><br><a href="#">Taiwan 2016</a> | <a href="#">Google Form #9</a>  |