

BME 494: Introduction to Synthetic Biology
3 credits

Instructors:

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Office hours:

Dr. Haynes: Tues 10 am – 12 pm; Thurs 10 am – 12 pm

Dr. Wang: By appointment

Undergraduate Teaching Assistants:

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Office hours: By appointment

Lecture: Engineering Center G-141 (E-Space), T/Th 3 – 4:15 pm

Overview: Introduction to Synthetic Biology will introduce the field of synthetic biology to students of any background. This includes literature review, wetlab demonstrations in microbiology techniques, and potential preparation for the International Genetically Engineered Machine (iGEM) competition. Students will gain an understanding of the field, begin developing their own applications to solve world problems, and improve their abilities to effectively present scientific ideas.

Class structure: The class will be divided into three units.

Unit 1: Engineering devices using biological parts (1/5-2/2)

Learning Objectives: Students should leave this unit with a thorough understanding of the field of synthetic biology, beginning with a scientific understanding of the organisms involved. Students will leave with a basic understanding of the iGEM competition (organization, requirements, judging) and projects from previous competitions. Students will also be introduced to important topics and scientific precedents in synthetic biology outside of the iGEM competition.

Unit 2: How to engineer life: techniques and protocols (2/7-3/15)

Learning Objectives: Students should leave this unit equipped with a theoretical understanding of the typical lab techniques used in synthetic biology projects. Students will understand how laboratories carry out their work: from basic design and DNA construct assembly to data collection. Emphasis will be on good lab/experimental controls and the collection of statistically valid measurements. Students will also understand how commonly used lab devices function and explore the recent efforts to simplify and lower in cost.

Unit 3: Information Sharing and Human Practices (3/27-4/24)

Learning Objectives: Students should leave this unit with a further understanding of the human element of synthetic biology. The bioterror risks will be discussed and assessed, including past events and the possible risks given present technology. Additionally, students will get a sense of synthetic biology's place in the emerging global information age, including possible practitioners outside of academia and the various challenges these parties face.

GRADING

Projects (3 total, 20% each)

For each unit, there will be a team project consisting of a 10-minute presentation and written report. Students will be evaluated by the instructors, teaching assistants, and classmates. Further grading details can be found in the respective project rubrics.

Quizzes (20%)

Short quizzes will be given at the beginning of every class following content-filled (non-student presentation) class days on both subject matter covering in the class as well as assigned readings, which will be provided. Depending on the total number of quizzes, one or more may be dropped at the end of the semester.

Participation (20%)

Students will be graded on their attendance, participation in lecture discussions, and peer presentation evaluations. In addition, the first assignment (Personal Introduction) is 5% of this score.

Grading Scale:

A+	97 – 100
A	93 – 97
A-	90 – 93
B+	87 – 90
B	83 – 87
B-	80 – 83
C+	77 – 80
C	73 – 77
C-	70 – 73
D	60 – 70
E	Below 60

SCHEDULE

Unit	Dates	Tuesday	Thursday
1	1/5	X	Introduction and Syllabus
1	1/10,12	Student Background Presentations	Engineering Concepts as Living Systems
1	1/17,19	Synthetic Biology Today	iGEM and Biobricks
1	1/24,26	Future Applications	Example Presentations Project Day
1	1/31,2/2	Presentation #1	Presentation #1
2	2/7,9	Choosing a Scientific Problem	Synthetic Biology Design
2	2/14,16	Assembly Methods	Assembly Methods (Continued)
2	2/21,23	Analysis - How do we measure function?	Analysis (Continued)
2	2/28,3/1	Mathematical Modeling	Modeling (Continued)
2	3/6,8	Project Day	BioHacking
2	3/13,15	Presentation #2	Presentation #2
X	3/20,22	Spring Break	Spring Break
3	3/27,29	DIY Bio	BioArt
3	4/3,5	Open Source Science	Bioethics/Bioterrorism
3	4/10,12	Outreach with Synthetic Biology	Flex Day
3	4/17,19	Project Day	Presentation #3
3	4/24,26	Presentation #3	Final: 12:10-2:00