

# 20.305x Principles of Synthetic Biology

## Course Syllabus

### Instructors

Ron Weiss, Ph.D.

Professor of Biological Engineering and Electrical Engineering and Computer Science  
Director of the Synthetic Biology Center at MIT

Adam Arkin, Ph.D.

Dean A. Richard Newton Memorial Professor of Bioengineering  
Director of the Synthetic Biology Institute at UC Berkeley

### Instructional Assistant:

Sepideh Dolatshahi, Ph.D.

Postdoctoral Associate, Department of Biological Engineering, MIT

### Teaching Assistants:

Guillaume Kugener, MIT

Sebastian Palacios, MIT

### Course Website

[https://courses.edx.org/courses/course-v1:MITx+20.305x\\_2+1T2017/info](https://courses.edx.org/courses/course-v1:MITx+20.305x_2+1T2017/info)

### Learning Outcomes

Students will learn to:

- Use modern DNA assembly techniques to build biological circuits
- Design biological circuits with many levels of control:
  - Pre/post transcriptional regulation
  - RNA-based regulation
  - Protein-protein interactions
- Implement design principles taught in the course
  - Circuit logic and minimization
  - Hazard analysis
  - Input-output matching
- Write ordinary differential equation models to describe biological circuits
- Simulate biological circuit behavior using MATLAB

### Prerequisites

Anyone student with high school biology will have the minimum prerequisites to get through the class, but we *highly recommend taking college-level molecular and cell biology prior to this course*. See PSO for links to suggested courses. Prior knowledge of differential equations and MATLAB is recommended but not required.

## Textbook

A textbook is not required. The course provides the necessary notes to learn the material.

## Discussion Forum

We encourage students to actively participate in the discussion forum offered on the course. Students should ask questions about concepts from the lectures, practice problems, and problem sets. However, students should not directly discuss answers to problem sets or exams. The course staff moderates the discussion forum, but we encourage students to answer other students' questions.

## Grading

There will be five graded problem sets, a midterm exam and a final exam in this course. There will also be a final project in the second half of the semester. You can check the status of your grade throughout the course in the [progress tab](#). The weighting of components is given below, with the abbreviations used on the progress tab for reference:

<b>Problem Sets</b>		<b>25%</b>	
PS0	<b>(ungraded)</b>	<b>0%</b>	
PS1-5	<b>(PS)</b>	<b>5%</b>	(each)
<b>Exams</b>		<b>60%</b>	
Midterm	<b>(ME)</b>	<b>25%</b>	
Final	<b>(FE)</b>	<b>35%</b>	
<b>Term Project</b>		<b>15%</b>	
Progressive Assignments	<b>(TPP)</b>	<b>2.5%</b>	(each)
Final write-up/presentation	<b>(TPF)</b>	<b>10%</b>	

The term project components will be graded by peer-review. You will receive participation points for doing the peer-grading.

## Certification

Students who demonstrate mastery of the course with a passing grade may earn a certificate of completion. EdX will issue the certificate under the name of MITx and the certificates will not include a final grade. Students can audit the course or pursue a certificate. The cut-off date for certificates will coincide with the midterm exam.

## MATLAB

As participant in this class you will be provided a MATLAB Online license to run MATLAB through an online interface on your computer.

MATLAB Online is the online version of the MATLAB desktop program and retains most of the features of the original program in a web-based interface. No download or installation is required, and the program can be accessed from any computer running a common web browser. **Note: All of the following information and steps are completely optional. You can successfully complete all of the MATLAB activities in the course within the embedded boxes. MATLAB Online gives you a way to explore the program more for free during the run of this course.** To gain access to MATLAB Online, **wait until the start date of the course on February 14, 2017**, then follow these steps:

0. If you do not already have one, create a MathWorks account at: <https://www.mathworks.com/mwaccount/register>
1. Click on the Principles of Synthetic Biology license link: <link: will be provided on Feb 14> then provide your MathWorks account log-in information when requested.
2. Click on the blue 'Access MATLAB Online' button when it appears. If you are not automatically redirected, go to <https://matlab.mathworks.com/>, log-in with your MathWorks account information, and begin using MATLAB Online!

## Course Developers

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