CH 391L Synthetic Biology
Spring 2014
Unique # 53230

Monday 2–5 PM
MBB 2.456
Professor: Barrick

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Topics: This course covers current developments in the design and construction of biological systems. Emphasis is on techniques for DNA sequence editing and assembly, methods for discovering and engineering new biological parts, and key examples of how this technology is being applied to problems of scientific and societal importance.

Prerequisite: Fundamentals of Biochemistry (Bio 337, CH 339K, or BCH 339F) with a grade of at least a B or equivalent strongly suggested. Undergraduates must have the instructor's permission to register for this course.

Course web page: The course web site on the SynBioCyc Wiki will be used for course announcements and to complete assignments: http://synbiocyc.org.

Grading: There will be 1000 total points for this course. Final grades will be assigned based on how many points you accumulate. The course will not use +/– grading.

Topic presentations		Points	Grade
• Written reports (Wiki)	30	≥90	A
• Oral presentations	20	≥80	B
Participation/exercises	25	≥70	C
Final group project	25	≥60	D
Total	100	<60	F

Written reports and oral presentations will be graded according to rubrics provided on the course website. Participation will be graded through a combination of contributions to in-class discussions, documentation of feedback on other people's written topics on the Wiki, and tutorial exercises. To receive full credit, you should expect to provide substantive written feedback on at least 50% of the topics discussed in the course.

Course Structure

Each class will have two halves with a 10-15 minute break between them. The second half will introduce new topics. The first half will wrap up discussion on topics from the previous week.

New Topics: In the *second* half of each class, several participants will each have 20 minutes to individually present new topics. To prepare for these ***oral presentations***, you are required to complete a "***written report"*** in the form of creating or updating a Wiki page on OpenWetWare (under /CH391/S14).

***RUBRICS WILL BE AVAILABLE ONLINE and discussed in class for both the oral presentation and the written report.

The written Wiki report must be finished by the time of your presentation.

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Topic Choice: Topic and paper choices should be discussed with the instructor *and* announced to the class at least 1 week prior to the scheduled presentation. A topic list for the course is attached, but there is significant leeway to tailor the topics toward your interests.

Audience expectations: Other members of the class will be expected to *provide feedback* by asking questions during your presentation and/or editing the Talk pages for your written Wiki report within a few days after your presentation (by 9:00 AM on Friday morning of the week of the presentation). These comments should be constructive. It is *expected* that your classmates will ask you interesting questions or bring up issues that you can't immediately answer, and that we will all learn from the feedback and revision cycle!

All students are encouraged to bring a laptop, iPad, etc. to view Wiki pages and scientific papers *during* in-class presentations.

Topic Updates / Paper Discussions: In the *first* half of the next class period, students who presented new topics during the previous class will present responses to the comments and questions raised during their last presentation and on their wiki page. You may need to add additional citations to expand on the background. To keep a record of your changes, you should keep track of your point-by-point responses and the Wiki edits that you made to your written report on your Wiki topic's Talk page as if you were responding to reviewers of a scientific paper.

***A tutorial covering this will be presented in class.

After you present these updates, the **entire class** will discuss the **key research paper** relevant to your topic. Everyone in class is expected to be familiar with the details of this paper. The instructor may ask ***any person*** to either give their assessment of the research paper or to answer questions about the motivation, methods, experiments, results, implications, etc. when discussing this research paper.

One goal of the topic component of the class is to create a reference work that everyone can come back to after completing the class to remember key details.

Final Projects:

Groups of 3-4 participants will create a proposal for a synthetic biology project. A written document (10-15 double-spaced pages) should describe the motivation for the work and how it would be accomplished (be very specific and use figures). This project will be turned in offline (not on the Wiki), since it might be a research idea that you want to actually work on without immediately sharing it with the world.

***A RUBRIC WILL BE AVAILABLE ONLINE and discussed in class.

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For example project ideas, look at various past iGEM team websites linked from http://igem.org/Team_Wikis?year=2013.

You will self-organize into groups and submit project topics by March 17th, project outlines by April 7th, and Final drafts on April 21st. DO NOT WAIT UNTIL THE LAST SECOND TO DO YOUR BACKGROUND RESEARCH.

Expectations for the outline will be presented on March 17th.

FINAL PROJECT PRESENTATION: Similar to usual class topics, your group will have 20 minutes to present your final project on the last day of class. Expect at least 10 minutes of questions and discussion. You will need to provide printed or digital copies [comments enabled] of your report to classmates so that they can return comments to you.

You will collectively be responsible for making revisions in response to ideas and questions raised by your classmates. **You will turn in a copy of your final project report that has been revised in response to this feedback at the end of finals week [May 13th].**

Scholastic Dishonesty: If you are caught in some form of scholastic dishonesty, (for examples, see: http://deanofstudents.utexas.edu/sjs/scholdis_whatis.php) you will receive an F in the course, and you will be reported to Student Judicial Services (Office of the Dean of Students). You will receive no warning before these actions are taken.

Be particularly careful when editing OWW Wiki pages. Do not include copyrighted material (such as figures from papers) that are not in the public domain, unless subject to fair use. Be very careful to not plagiarize, which includes paraphrases your sources.

Other: The University of Austin provides appropriate academic accommodations for qualified students with disabilities upon request. For more information, contact the Office of the Dean of Students at 471-6259, 471-6441 TTY.

It is the policy of The University of Texas at Austin that the student must notify each instructor at least fourteen days prior to the classes scheduled on dates he or she will be absent to observe a religious holy day. For religious holidays that fall within the first two weeks of the semester, the notice should be given on the first day of the semester. The student may not be penalized for these excused absences but the instructor may appropriately respond if the student fails to complete satisfactorily the missed assignment or examination within a reasonable time after the excused absence.

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TOPICS

#	DATE	TOPIC
1	Jan 13	**Introduction:** Synthetic biology: history, ethics, and challenges. Overview of course structure and topics. Wiki editing tutorial, ethics, and standards.
	Jan 20	**Martin Luther King, Jr. Day:** No class.
2	Jan 27	**What is a part?:** iGEM registry (tutorial), BioBricks, Biological parts and introduction to CAD systems for synthetic biology, TinkerCell (intro).
3	Feb 3	**Assembling the parts:** Oligonucleotide, gene, and genome synthesis, Gibson assembly, codon optimization. Genome Compiler (tutorial).
4	Feb 10	**Methods of part creation, prospecting, selection, and optimization:** Fluorescent proteins (e.g., GFP), ancestral sequence reconstruction, directed protein evolution.
5	Feb 17	**Parts – Chassis:** Host organisms, plasmid replication origins, selectable and counter-selectable genetic markers, biocontainment.
6	Feb 24	**Parts – Basics of gene expression:** T7 RNA polymerase, transcriptional promoters and terminators, ribosome binding sites, unnatural amino acids, TinkerCell (tutorial I).
7	Mar 3	**Parts – Reporter genes, gene regulation:** Transcription factors, luciferase, nucleic acid selection, riboswitches, spinach RNA.
	Mar 10	**Spring Break:** No class.
8	Mar 17	**Parts – Environmental sensing and responses:** Light sensing (optogenetics), quorum sensing, locomotion. ***Topics and groups for final projects due***
9	Mar 24	**Systems – Circuits:** Oscillators, counters, memory, edge detection. TinkerCell (tutorial II)
10	Mar 31	**Genome editing techniques:** MAGE, CRISPR, recombinases.
11	Apr 7	**Systems – Whole organisms:** Refactored phage T7 and synthetic yeast, Amber-less *E. coli*, Polio virus, dual-use research, and GMO foods. ***Final project outlines due***
12	Apr 14	**Systems – Metabolic engineering:** Nitrogenase gene cluster refactoring, artemisinin production, bioremediation & caffeinated coli.
13	Apr 21	**Systems – Synthetic ecology, miscellaneous:** microbial consortia, pattern formation, biomaterials ***Final project drafts due***
14	Apr 28	***Final project presentations***
	May 13	***Revised written final projects due***

* At the instructor's discretion, the above schedule and topics may be modified. The class will be notified of any changes during class and on the SynBioCyc web site.