ChE/BE 163: Introduction to Biomolecular Engineering
Fall 2020

Instructors
Frances H. Arnold
frances@cheme.caltech.edu

Niles A. Pierce
niles@caltech.edu

Lectures
Live via Zoom including questions and discussion (cameras on for everyone)

TAs
Directed evolution:
Bruce Wittman
bwittman@caltech.edu
Office hours: Zoom. TBD based on class poll and by appointment

Rational design:
Kaleigh Durst
kjjohnso@caltech.edu
Office hours: Zoom. TBD based on class poll and by appointment

Web site
http://chebe163.caltech.edu/2020/
Please visit the website for complete course policies and schedule.

Grading
80% problem sets and reading memos/quizzes/discussion
20% News & Views final project
Lecture attendance and required readings are mandatory. In-class quizzes may be given.

Topics
The course introduces rational design and evolutionary methods for engineering functional protein and nucleic acid systems. Rational design topics include molecular modeling, positive and negative design paradigms, simulation and optimization of equilibrium and kinetic properties, design of catalysts, sensors, motors, and circuits. Evolutionary design topics include evolutionary mechanisms and tradeoffs, fitness landscapes, directed evolution of proteins, and metabolic pathways. Some assignments require programming.

Honor Code
Unless otherwise noted on a particular problem set, you may discuss assignments with other students. The work, however, should be substantially your own. It is a violation of the Honor Code to copy solutions from classmates or to use course materials from previous years.

Problem Set Schedule (updates on the course web site)
PS1: Thurs Oct 8 – Thurs Oct 22 (rational design)
PS2: Thurs Oct 22 – Thurs Nov 5 (rational design)
PS3: Thurs Nov 5 – Thurs Nov 19 (directed evolution)
PS4: Thurs Nov 19 – Thurs Dec 3 (directed evolution)
News & Views: Tues Sept 29 – Fri Dec 11

All problem sets are submitted as Jupyter notebooks, and the News & Views article is submitted as a PDF. All are emailed to caltech.chebe163@gmail.com

Due Dates
All problem sets must be submitted by 1 pm on the stated dates (i.e., before class starts) and the News & Views must be submitted by 5pm on Dec 11. Each student is allocated 6 "grace days" which can be allocated to any assignments with no deduction (e.g., turn in PS1 2 days late, and PS3 4 days late with no deduction). Note: 1 grace day corresponds to any number of hours up to 24 (e.g., turning a set in 4 hours late counts as 1 grace day). After the 6 grace days have been used up for the term, late assignments will not be accepted. Late work submitted with a note from a Dean (e.g., for medical reasons) does not count against your 6 grace days. Please note that no assignment can be turned in after Friday, Dec 11 due to the term ending.

News & Views
An article in the News & Views section of *Nature* typically describes a current research paper to a non-expert audience. The articles are between 1.5 and 2 pages in length, typically have a single figure, and usually have about eight references. They provide a basic contextual background for the highlighted paper, describe its major findings, and pose open questions in the field. Check out *Nature*'s website for examples of recent News & Views articles.

Your final project is to select a current research paper (no more than three years old) and write a News & Views piece. The paper can be in any journal, but the News & Views should be written in the style of *Nature*. It should be no more than two single-spaced pages in length (11 pt font, 1 inch margins), including a figure that you create (i.e., not taken from the original paper, but designed to tell the story for your piece) and 5 to 10 references.