

## **BIMM 194: Advanced Topics in Modern Biology PROTEIN ENGINEERING**

**Instructor:** Dr. Jayant B. Ghiara

**Office:** York Hall, 3080A

**E-mail for emergencies only\*:** [jbghiara@ucsd.edu](mailto:jbghiara@ucsd.edu) (Please write **BIMM 194** in the Subject line for all email correspondence) \* *see notes in the section on Class Website (TED) below.*

**Ask questions in class or post them on TED! I will give you plenty of opportunity.**

### **COURSE SYLLABUS**

#### **Course Objectives:**

Protein engineering has come a long way since the development of molecular biological techniques for site directed mutagenesis in the 1980s. Protein structure-based design of libraries and selection there-from, allows for rapid generation of proteins with altered/novel functions. Nature does a great job with antibodies but we shall go beyond, to discuss engineering of antibodies and transcription factors for applications in medicine and biotechnology

The 194 course series was created to provide students with upper-division standing, an opportunity to learn in a small enrollment, intellectually challenging seminar-style course environment. The goal of 194 courses is to provide students with an opportunity to extend what they have learned in upper division courses by analyzing existing knowledge and contemporary thinking in a particular biological sciences field. Specifically, students will be expected to read, present and discuss reviews and selected papers from primary literature.

**Text:** There is no single suitable textbook for this course. The publisher has made it possible to purchase specific chapters from the three texts we will draw from for basic understanding of course material (also see the file ebook-handout.pdf). In addition review and research papers will be assigned for reading, class presentations and discussion.

You are expected to read the chapters marked with a \* (as in \*Chapter 1).

Other chapters/papers listed are optional, for those interested in delving deeper into the material.

**Introduction to Protein Structure, 2e, Carl Branden and John Tooze, Garland Science (1999)**  
(\$5/chapter on <http://store.vitalsource.com>)

\*Chapter 1: The Building Blocks (3-34)

Chapter 9: DNA Recognition by Eukaryotic Transcription Factors (151-173)

\*Chapter 10: Specific Transcription Factors Belong to a Few Families (175-203)

\*Chapter 15: Recognition of Foreign Molecules by the Immune System (299-323)

\*Chapter 17: Prediction, Engineering and Design of Protein Structures (347-372)

**The Immune System, 3e, Peter Parham, Garland Science (2009)**  
(\$9/chapter on <http://store.vitalsource.com> ) or (\$9.99 at [www.inkling.com](http://www.inkling.com) )

\*Chapter 4: Antibody Structure and the Generation of B-cell Diversity

**The Molecules of Life: Physical and Chemical Principles**, John Kuriyan, Boyana Konforti, David Wemmer, Garland Science (2012) (\$9/chapter on <http://store.vitalsource.com> )

Chapter 4: Protein Structure (131-190)

Chapter 12: Molecular Recognition: The Thermodynamics of Binding (531-580)

\*Chapter 13: Specificity of Macromolecular Recognition (581-632)

**Papers/Reviews assigned as readings:** To make it easier for you, I shall upload pdf files for assigned papers/reviews on TED on a weekly basis. Some of the readings may seem difficult at first but remember this is science and do not expect to breeze through it like a novel. You need to read carefully, take your time, and look up difficult words/concepts. You will be surprised as to how much you already know and understand from the knowledge you have gained in multiple biology courses. Time to bring it all together and push yourselves to apply what you have learned!

**Websites:**

1. Text-chapter related websites at: [www.garlandscience.com](http://www.garlandscience.com)

2. Class Website (TED): For class related materials, access TED at <https://ted.ucsd.edu/> using your University username and password. Please check it frequently. It will be divided into sections according to class meetings (Week-1, Week-2 etc.). Use the board to post/answer questions as everyone will benefit from these discussions.

**Classes:** Held Wednesdays, 5:00-6:20 pm, in York 3010. Students will be expected to read, present and discuss reviews and selected papers from primary literature during class meetings.

**TA Discussion Sections:** There will be no TAs or Discussion Sections for this two-unit course.

**Evaluation and grades:** Your performance in the class will be determined by your participation in class discussions, your presentations, and regular written summaries of readings. There will be no final exam during finals week.

Weekly, one-page summary of assigned reading (starting week 2)	160 points
Satisfactory participation and attendance	100 points
Group Presentations	<u>240 points</u>
Total	400 points

**Weekly, one-page summary of assigned reading (starting week 2):** Whether it is a book chapter, review or research paper, or a combination of the two that is assigned, you will be required to submit a one-page summary of your readings, in class. These summaries (8 in total) carry 20 points each. Submitting the summary at some time after class (but before the next class i.e. up to one week late) will result in a 5-point penalty. No summaries submitted more than a week late will receive points but you should do them for your own learning. It is important to read and write your summary before you come to class in order to understand the in-class discussions. This is not a straight lecture class so you will learn only if you participate and if you participate it will be a fun learning experience for you!

**Satisfactory participation and attendance:** Show up to class on time, having read the assigned readings and ready to participate and you can earn 10 points per class meeting. Participation *does not* mean stating you did not understand anything or asking the question, “Please explain what the paper says”. You are advanced students and you need to spend some time reading, re-reading the material and/or researching further and building on what you have learned as a biology student. I want to see you making connections, gaining new insights and excitedly sharing them with others in class. Cool?

**Group Presentations:** Beginning week 5 (so during weeks 6 through 10), groups of students (consisting of 4 or 5 students – no more no less), will present selected papers/reviews to the class. Each group should prepare some questions/a quiz for the students to take at the end of their presentation to assess the success of the presentation in getting key points across. The questions/quizzes are for stimulating further discussion and thought. The presenting group will be judged on how thought provoking these questions are, and I may add to them, as appropriate. I shall explain this further during the first class meeting. The presentations should be about 20 minutes long with another 10 minutes for questions/quiz.

Clarity of presentation: 80 points

Content and insights: 80 points

Mastery of the material as demonstrated by answers to student questions during/following the presentation and the questions/quizzes used: 80 points

### **Grading policies:**

Final grades will be determined at the end of the course, based on your total scores. Letter grades will be assigned as follows:

A range = 90-100	90-92 = A-	93-97 = A	98 and above = A+
B range = 80-89	80-82 = B-	83-87 = B	88 and 89 = B+
C range = 70-79	70-72 = C-	73-77 = C	78 and 79 = C+
D range = 60-69	F = 0-59		

### **Classroom Etiquette:**

You are encouraged to ask questions and actively participate in class discussions but all your comments must be directed to the class. Please turn off your cell phones and do not engage in conversations with other students when the instructor or any other student is addressing the class. Please be considerate towards other students by not walking in and out of the classroom for water/restroom breaks while the class is in session, unless a medical condition warrants it (please situate yourself in a seat close to the door in case of such a medical condition so any disruption is kept to a minimum).

### **How to do well in this course:**

1. Read the assigned readings and complete your written summary before class. Diagrams and figures are not just “pictures”. Carefully study figures and figure legends to make sure you understand what is presented in the paper/review/book chapter.
2. There is no substitute for attending class as this is an advanced seminar style course.
3. Participate in class. Teaching and learning go hand-in-hand and your active participation will ensure optimal learning. I will not know what clarifications you need if you don’t ask!
4. Be respectful of your fellow classmates during their presentations. You are welcome to add to what was presented if you have read/know more.