BISP 194 SPRING 2016
GENOME EDITING: PAST, PRESENT, AND FUTURE

GENERAL COURSE INFORMATION

Instructor: Professor Deborah Yelon

Class Meetings: Mondays 4:00-5:30 pm, York 3010

Course Description: In this course, we will learn about genome editing technologies and their applications. We will discuss how genome editing techniques were developed, the ways in which genome editing is currently being used, and the possible ramifications of future advances in this dynamic area.

Prerequisites: Our course focuses on reading, interpreting, and discussing primary research articles regarding techniques in genome editing and their applications. To understand the articles covered in our course, you will rely on your knowledge of the material covered in BICD 100, which is a prerequisite for our course. You may also find it helpful to draw on your knowledge of material covered in BIMM 100, even though it is not a formal prerequisite. Thus, success in our course will require a strong foundation in Genetics and will be further supported by a strong foundation in Molecular Biology. If your performance in BICD 100 and/or BIMM 100 was not strong, you are likely to have difficulty with this course.

Course Website: Information and materials for this course will be posted on our course website (http://tritoned.ucsd.edu). No materials will be handed out in class. All students who are enrolled in the course should be able to use their UCSD student email account login and password to access the website.

Reading Material: This will be an interactive, discussion-based course. Each week, our discussion will focus on one research article as a representation of a topic related to the development and usage of techniques in genome editing (our "primary topic" for the week). Each week, we will also spend a short period at the end of class discussing a topic regarding the societal ramifications of genome editing (our "secondary topic" for the week), using a commentary or editorial article to catalyze our discussion. See our "Weekly Topics" document for the list of each week's primary and secondary topics. The articles chosen for each week are listed in our "Weekly Reading" document, and PDFs of these articles will be posted on our course website. You should read each week's articles before class so that you will be prepared to participate in discussion. See our "Reading Guidelines" document for guidance on how to approach these articles.

Oral Presentations: Each week (except for week 1), a group of students will work together to prepare an oral presentation based on the week's primary and secondary articles. These students will lead the rest of the class in a discussion of the material. Each student will participate in one oral presentation; each week, 5 students will work

together. See our "Oral Presentation Guidelines" document for more information on how to prepare your presentation and on the criteria for grading presentations.

Participation in Discussion: Students in our course are expected to actively participate in our in-class discussions. You can ask questions, answer questions posed by the presenters, or add your opinion to the discussion. At a minimum, you should be present and attentive during class. You can receive the maximum number of points for discussion participation if you are adequately engaged in 8 of our class sessions.

Written Assignments: Each week, you will have the opportunity to complete a written critique of one of the two articles discussed in class. You only need to complete 4 written assignments, and you can choose which of the 8 available opportunities to pursue. Each week's assignment should be uploaded to our course website by 11:59 pm on the appropriate Sunday. For example, your critique of an article discussed at our week 2 session on April 4 would be due by 11:59 pm on April 10. See our "Written Critique Guidelines" document for more information on how to prepare your critiques and on the criteria for grading these assignments. Also, our "Weekly Topics" document features a list of assignment deadlines.

Introductory Assignment: All students must also complete a simple introductory assignment which is due by 11:59 pm on Sunday, April 3. For this assignment, please write a paragraph explaining your motivation for taking this course. Why did you choose to enroll in this course, and what do you hope to get out of this experience? This simple assignment serves two purposes: (1) it allows me to become more familiar with your background and interests, and (2) it allows us to test out the system for online submission of assignments.

Discussion Board: The course website features a discussion board where you can post questions, receive answers, read other students' questions and answers, and even answer other students' questions. The discussion board is an excellent source for answers to your questions about this course.

Contact Information: If you have questions that have not been answered by the discussion board, you can contact Professor Yelon by email (dyelon@ucsd.edu). Please make sure that the subject line of your email includes "BISP 194".

Office Hours: Professor Yelon's office hours will be held in her office, NSB 6113. They will usually be held on Thursdays, from 4-5 pm, but there are some exceptions to this schedule. Please see the "Office Hours Schedule" document for the complete list of office hours scheduled for Spring 2016.

Grading: Your grade will be based on your performance with three course components: (1) your oral presentation, (2) your written assignments, and (3) your participation in class discussions. Your final grade will be determined by what percentage of the total available points (300 points) you earn. Points are available as follows:

100 points for oral presentation
100 points for written assignments (25 points for each of 4 assignments)
80 points for discussion participation (attained by participating in 8 classes)
20 points for introductory assignment
300 points total

These guidelines will be used to assign grades:
≥255 points (85%) A (A-, A or A+)
≥225 points (75%) B (B-, B or B+)
≥180 points (60%) C (C-, C or C+)
≥150 points (50%) D

Academic Integrity: Academic dishonesty will not be tolerated in this course. According to UCSD policy, academic dishonesty includes:

- completing assignments for another student
- allowing another student to complete an assignment for you
- copying another student's work on an assignment
- allowing another student to copy your work on an assignment
- incorporating plagiarized material into an assignment

Any issues with academic dishonesty will be reported to the UCSD Academic Integrity Coordinator and the Dean of the student's college. Confirmed cases of academic dishonesty will result in the student receiving an F as their final grade and other disciplinary actions determined appropriate by the Academic Integrity Coordinator.

Week	Day	Date	Primary Topic	Secondary Topic	Assignment
1	Monday	March 28	Introduction to our course		Introductory paragraph due April 3, 11:59 pm
2	Monday	April 4	Gene targeting via homologous recombination in ES cells	Regulation of DIY genome editing	Week 2 critique due April 10, 11:59 pm
3	Monday	April 11	Targeted mutagenesis using engineered nucleases	Regulation of genetically engineered products	Week 3 critique due April 17, 11:59 pm
4	Monday	April 18	CRISPR/Cas9: a programmable RNA-guided endonuclease system	Patents for gene editing technologies	Week 4 critique due April 24, 11:59 pm
5	Monday	April 25	Genome editing using CRISPR/Cas systems	“Frivolous” uses of genome editing	Week 5 critique due May 1, 11:59 pm
6	Monday	May 2	Therapeutic applications of genome editing	Challenges for therapeutic applications	Week 6 critique due May 8, 11:59 pm
7	Monday	May 9	Gene drive approaches for controlling pathogens	Potential risks of gene drive systems	Week 7 critique due May 15, 11:59 pm
8	Monday	May 16	Genome-wide screening with CRISPR/Cas systems	Editing the human germline	Week 8 critique due May 22, 11:59 pm
9	Monday	May 23	Elucidating the functions of the noncoding genome with CRISPR/Cas	Value of basic research	Week 9 critique due May 29, 11:59 pm
10	Monday	May 30	**MEMORIAL DAY: NO CLASS**		

Reading for Week	Day	Date	Primary Reading	Secondary Reading
2	Monday	April 4	Thomas and Capecchi, 1987. Site-directed mutagenesis by gene targeting in mouse embryo-derived stem cells. *Cell* **51**:503-512.	Kuiken, T., 2016. Learn from DIY biologists. *Nature* **531**:167-168.
3	Monday	April 11	Bibikova et al., 2002. Targeted chromosomal cleavage and mutagenesis in *Drosophila* using zinc-finger nucleases. *Genetics* **161**:1169-1175.	Kuzma, J., 2016. Reboot the debate on genetic engineering. *Nature* **531**:165-167.
4	Monday	April 18	Jinek et al., 2012. A programmable dual-RNA-guided DNA endonuclease in adaptive bacterial immunity. *Science* **337**:816-821.	Rood, J., 2015 Who owns CRISPR? *The Scientist* (the-scientist.com)
5	Monday	April 25	Cong et al., 2013. Multiplex genome engineering using CRISPR/Cas systems. *Science* **339**:819-823.	Sherkow and Greely, 2013. What if extinction is not forever? *Science* **340**:32-33.
6	Monday	May 2	Tabebordbar et al., 2016. In vivo gene editing in dystrophic mouse muscle and muscle stem cells. *Science* **351**:407-411.	Gewin, V., 2015. Expanding possibilities. *Nature* **528**:S10-S11.
7	Monday	May 9	Gantz et al., 2015. Highly efficient Cas9-mediated gene drive for population modification of the malaria vector mosquito *Anopheles stephensi*. *PNAS* **112**:E6736-43.	Wade, N. 2015. Gene drives offer new hope against diseases and crop pests. *The New York Times* (http://nyti.ms/22lsHHT)
8	Monday	May 16	Wang et al., 2015. Identification and characterization of essential genes in the human genome. *Science* **350**:1096-1101.	Hayden, E.C., 2016. Tomorrow's children. *Nature* **530**:402-405.
9	Monday	May 23	Korkmaz et al., 2016. Functional genetic screens for enhancer elements in the human genome using CRISPR-Cas9. *Nature Biotechnology* **34**:192-198.	Fang and Casadevall, 2010. Lost in translation — basic science in the era of translational research. *Infection and Immunity* **78**:563-566.