GENETIC ENGINEERING IN MEDICINE, AGRICULTURE, & LAW
Professors Bob Goldberg (UCLA) and John Harada (UC Davis)
Winter 2023

LECTURES: Tuesday & Thursday 3:30-6:00 pm – ***see Bruin Learn for zoom link***

REQUIRED TEXT: *Introduction to Biotechnology* (W. J. Thieman & M. A. Palladino, 4th Edition, 2019).
The HC70A text can be purchased from the bookstore, or as an eBook from either Amazon or VitalSource.
The eBook is less expensive than the hardcopy text.

OFFICE HOURS: Monday: 4:00 – 5:30 pm – ***see Bruin Learn for zoom link***
Email: bobg@g.ucla.edu

GOLDBERG HC70A WEBSITE: *http://www.mcdb.ucla.edu/Research/Goldberg/HC70A_W23//*

HC70A Bruin Learn WEBSITE: *https://bruinlearn.ucla.edu/courses/76611*

COURSE ADMINISTRATOR: Dr. Lauren Bowman
Email: laurenbowman@g.ucla.edu

DISCUSSION COORDINATOR: Dr. Kelli Henry (kfhenry@g.ucla.edu), Office hours: Wed., 11 am to noon

LEARNING ASSISTANTS: Gwyn Schoenbaum (gschoenbaum@g.ucla.edu), Office hours: Tr., 10:30 to 11:30 am
Olivia Bielskis (oliviabielskis@g.ucla.edu), Office hours: Fri., 2 to 3 pm
Shally Li (jiaxinli852@g.ucla.edu), Office Hours: Tues., 11 am to noon
See Bruin Learn for zoom links.

LECTURES: HC70A lectures are interactive, and ***Online lecture attendance is required.***

GUEST LECTURES: Guest speakers highlight the societal impacts of genetic engineering, and ***Online guest lecture attendance is required.***

DISCUSSION SECTIONS: Discussion Sections are taught as undergraduate seminars in a Socratic style, and focus on articles that relate to the history, applications, and societal impacts of genetic engineering. Focus your reading around four questions: (1) What is the overall **scientific question** being addressed? (2) What are the **technologies** being discussed? (3) What is the **significance** of the technology? (4) What **ethical issues** arise, if any, as a consequence of new technology? A Discussion participation grade of up to 100,000 points will be assigned at the end of the quarter. ***Online discussion section attendance is required. See Bruin Learn for zoom links.***

QUIZZES: Take-Home Quizzes will focus on the concepts covered in discussion and lecture each week. Quizzes count 50,000 points each. **Quizzes will be posted on Thursday after lecture and are due by 6 pm the Monday following Discussion Section on the HC70A Bruin Learn site.**

EXAMS: Exams include **Two Online All-Class Oral Exams**. Midterm Oral Exam questions will be posted the Tuesday of Week 4 and will count 200,000 points. Final Oral Exam questions will be posted Tuesday of Week 8 and will count 200,000 points.

The Exam Schedule is:
Online All-Class Mid-Term Oral Exam: Tuesday, February 14 (Week 6)
Online All-Class Final Oral Exam: Thursday, March 16 (Week 10)

COURSE GRADING: You will be able to earn **ONE MILLION regular points** and a number of **BONUS POINTS** during the quarter. **Your grade will be based on 1,000,000 points**, although you have the potential for earning more than 1,000,000 points. Regular points will be divided as follows:

Assignment	Total Points	% Grade
Lecture Attendance	100,000	10
Quizzes (8)	400,000	40
Discussion Section	100,000	10
Mid-Term Oral Exam	200,000	20
Final Oral Exam	200,000	20
TOTAL	**1,000,000**	**100**

The following guidelines will be used to assign grades: A (>90%), **B** (80-89%), **C** (70-79%), **D** (60-69%), **F** (<60%). Your grade will be assigned using the following formula:

$$\%\ \textbf{Total Points} = \frac{\textbf{[(Regular points + Bonus points)]}}{\textbf{[(1,000,000)]}} \times \textbf{[100]}$$

DISCUSSION GRADING CRITERIA: Each Discussion is worth 10,000 points. Points will be assigned as follows:

Grading Criteria	Total Points
Attend Discussion	2,000
Participate in Discussion *(i.e., answer & ask questions)*	6,000
Demonstrate You Read and Understand Articles *(i.e., knowing the main concepts addressed in each figure and article as a whole)*	2,000
TOTAL	**10,000**

OVERVIEW OF THE ONLINE LEARNING ASPECTS OF HC70A

1. Due to the interactive nature of this course, lectures are synchronous. **A link to the biweekly lecture zoom meeting will be posted under each week on the Bruin Learn HC70A page**. Attendance is mandatory and will contribute to your grade (see the grading breakdown section of syllabus for details).
2. Discussion Sections are also highly interactive, synchronous, and attendance is mandatory. Discussions will discuss readings and concepts covered in class. **A link to your individual weekly discussion zoom meeting will be posted under each week on the Bruin Learn HC70A page. Discussion Section articles will be posted on the HC70A Bruin Learn website.** You will be graded based on your participation (see the grading breakdown section of syllabus for details).
3. Lectures will be recorded and posted on the Bruin Learn. The recordings should be used on the rare occasion that personal circumstances prevent you from attending class, or as a study aid.
4. The midterm exam will be a group oral exam. The final exam will also be a group oral exam. Groups will be assigned prior to the oral exams to allow for group preparation.
5. **Quizzes/assignments will be posted under the week when they are assigned and submitted via the *Bruin Learn* website.**
6. We are working to make this course as interactive, engaging, and educational as possible and we expect that students will approach class with the same energy. Should circumstances that are beyond a student's control interfere with their academic performance, we will try to be flexible in accommodating student's needs.
7. **Bruin Learn will act as a main hub for our class.** We will use the Bruin Learn to host (1) class announcements; (2) links to the syllabus and email list (3) zoom links to the lectures and discussions; (4) recorded videos of lectures; (5) copies of slides that are shown during lecture; (6) discussion section handouts; (7) quizzes; (8) links to upload completed assignments; (9) midterm and final exam questions; and (10) keys to quizzes.
8. **Trouble shooting issues and online learning support:**
   a. Instructions for using zoom are available via a link included here: https://ucla.zoom.us/. Please sign in and set up your zoom account before the first class.
   b. To maintain security, students will not be able to send chat messages to each other during lecture. Please use the 'raise hand' function on zoom if you have a question
   c. If you have trouble with the video during lectures, you can connect to the audio via cell phone. You can find phone numbers and the meeting ID for the lectures by clicking the invitation button in the zoom activity link while watching the video on your computer/tablet/smart phone. If you can't get zoom to

work, call in to the lecture via smart phone and follow along with the lecture slides which will be available on Bruin Learn.

d. If you become disconnected during lecture, try to reconnect to the session with the same zoom link. If you cannot reconnect, send an email message to the Shally Li to explain your situation and connect with zoom support to troubleshoot the issue.

e. If I get disconnected prematurely during lecture, this does not mean class is cancelled. Unless we say otherwise, we will restart the zoom meeting and resume class. If I am unable to reconnect, I will send the class a message through the Bruin Learn announcements or email.

f. To enhance interactions during the online lectures, individuals may be called upon randomly to contribute to discussions in class and/or to answer quiz questions.

DATE	***LECTURE & DISCUSSION SCHEDULE (Weeks 1 to 5)***
1/10	**Lecture 1:** *The Age of DNA: What is Genetic Engineering - Part One* **Experiment**: Isolating DNA
1/12	**Film:** *Race For the Double Helix (2 Hours)*
DISCUSSION 1:	*What Do You Think About Genetic Engineering and GMOs?*
1/17	**Lecture 2:** *The Age of DNA: What is Genetic Engineering - Part Two* **Demonstration:** *Origins of Crop Genetic Engineering*
1/19	**Films:** *The Gene Engineers (1 Hour); Designing Life-Craig Venter (13 Minutes); Genetic Information Age-George Church (13 Minutes)* **Experiments:** *Bacteria Cloning (20 Minutes) & Gel Electrophoresis (20 Minutes)*
DISCUSSION 2:	**Origins of Genetic Engineering-1: Hybrid DNA Molecules & Controversy:** *Manipulation of Genes; The Recombinant DNA Debate* **QUIZ #1**
1/24	**Lecture 3:** *What Are Genes & How Do They Work: Part One*
1/26	**Film:** *Extraordinary Measures (1.75 Hours)*
DISCUSSION 3	**Origins of Biotechnology-From Genes to Drugs:** *Useful Proteins from Recombinant DNA – The Insulin Story; Unlocking the COVID Code* **Demonstration:** DNA Sequencing **QUIZ #2**
1/31	**Lecture 4:** *What Are Genes & How Do They Work: Part Two* **MID-TERM ORAL EXAM QUESTIONS POSTED**
2/2	**Lecture 5 –** *How Are Genes Cloned & Engineered: The Insulin &Hemophilia Stories*
DISCUSSION 4:	**From Genes to Vaccines:** *Ancient DNA & Plagues; Ancient DNA Reveals That Europe is a Melting Pot; Will This Pandemic Ever End; The Last Time a Vaccine Saved America; How the Coronavirus Infects Cells; How Pfizer Makes Its COVID Vaccine; Will This Pandemic Ever End?* **QUIZ#3**
2/7	**Lecture 6 –** *A 21st Century Genetic Engineering Revolution – Part One*
2/9	**Film:** *Food Evolution (1.5 Hours)* **Speaker:** Channapatna Prakash, Ph.D.
DISCUSSION 5:	**Genetic Engineering Crops & Farm Animals:** *Transgenic Crops; Why We Need Golden Rice; Transgenic Livestock As Drug Factories; First Shipments of Genetically Modified Salmon to US Restaurants; Sale of Gene Edited Fish in Japan*

DATE	*LECTURE & DISCUSSION SCHEDULE (Weeks 6 to 10)*
2/14	**ALL-CLASS MIDTERM ORAL EXAM**
2/16	**Lecture 7 –** *A 21st Century Genetic Engineering Revolution – Part Two*
DISCUSSION 6:	**DNA & The Law:** *When Science Takes the Witness Stand; How Your Family Tree Could Catch a Killer; Genetic Databases Could Identify Millions of Americans* **Short Film:** *Your DNA is Already in a Database (27 Minutes)* **QUIZZES #4 & #5**
2/21	**Lecture 8 –** *Age of Genomics: Three Parent Babies, Human Origins, & Race* **Short Film:** *Knowledge or Certainty (15 Minutes)*
2/23	**Speaker: Harry Klann**, Supervising Criminologist, LAPD, Retired *DNA Forensics & The Law* **Experiment:** Making DNA Fingerprints
DISCUSSION 7:	**How to Mark Your Genes:** *Chromosome Mapping With DNA Markers; Genomics For the People; Full Genome Sequencing For Newborns***;** *Newborn Screening 200,000 Babies* **QUIZ #6**
2/28	**Lecture 9 –** *Human Genetic Engineering* **– Dr. John Harada** **Short Film:** *Sickle Cell Gene Therapy (11 Minutes)* **FINAL ORAL EXAM QUESTIONS POSTED**
3/2	**Speaker: Michele Evans, MD:** *In Vitro Fertilization & Embryo Genetic Testing*
DISCUSSION 8:	**Human Gene Therapy – The Beginning:** *Gene Therapy; Gene Therapy's Second Act* **QUIZ #7**
3/7	**Lecture 10:** *Genetic Engineering & The Law: Regulating Science & GMOs*
3/9	**Speaker: Daisy Robinton:** *The Oviva Story*
DISCUSSION 9:	**Human Gene Therapy – 21st Century Applications –** *Unlocking the Mysteries of ALS; Gene Therapies for Brain Diseases; Are We About to Cure Sickle Cell Disease?* **QUIZ #8**
3/14	**Lecture 11:** *Genetic Engineering & The Law: Patents & Who Owns Your Genes?*
3/16	**FINAL ALL-CLASS ORAL EXAM**
DISCUSSION 10:	**The CRISPR Revolution:** *The DNA Revolution; The DNA Synthesis Revolution; Bring Back the Woolly Mammoth; Chinese Scientist's Claim of Gene Edited Babies Creates an Uproar; Chinese Scientist Who Edited Babies Gets Three Years in Prison* *What Do You Think About Genetic Engineering and GMOs <u>Now</u>?*

TEXT READING ASSIGNMENTS:

Note: No textbook is perfect and follows the lecture sequence of every class – including HC70A! Your textbook contains most of the conceptual information covered in HC70A lectures and discussion sections – *but not in the same order*. The textbook index section will connect you to specific concepts covered in lecture and discussion. *For the textbook reading assignments I have extracted the most relevant pages that review and complement topics covered in lectures and discussions.* ***Study the information presented in these assignments as it will help you understand the major concepts presented in HC70A, and help solve problems on the exams and quizzes.***

***Introduction to Biotechnology*, 4th Edition (2019)**

Lecture 1	Chapters 1 & 3 (pgs. 60-70)
Discussion 1	No Text Reading
Lecture 2	Chapters 3 (pgs. 60-70)
Discussion 2	Chapter 2 (pgs. 33-36) & Chapter 3 (pgs. 60-70)
Lecture 3	Chapter 2
Discussion 3	Chapter 2, Chapter 3 (pgs. 70-84), & Chapter 5 (pgs. 130-144)
Lecture 4	Chapter 2
Discussion 4	Chapter 5 (pgs. 145-151)
Lecture 5	Chapter 3 (pgs. 70-84)
Guest Lecture on GMOs	Chapter 6
Discussion 5	Chapters 6, 7, & 12
Lecture 6	Chapter 2 (57-58) & Chapter 3 (pgs. 88-89)
Guest Lecture on Forensics	Chapter 8
Discussion 6	Chapter 8
Lecture 7	Chapter 3 (pgs. 89-104) & Chapter 13 (pgs. 356-358)
Guest Lecture on Stem Cells	Chapter 11 (309-327)
Discussion 7	Chapter 11 (279-290)
Lecture 8	Chapter 11 (pgs. 299-309)
Discussion 8	Chapter 11 (pgs. 299-309)
Lecture 9	Chapter 12
Discussion 9	Chapter 11 (pgs. 299-309) & Chapter 12
Lecture 10	Chapter 12
Discussion 10	Chapter 2 (pgs. 57-58) & Chapter 3 (pgs. 88-89)