

GENETIC ENGINEERING IN MEDICINE, AGRICULTURE, & LAW
Spring 2015

Professors John Harada, Bob Goldberg, & C.S. Prakash

**Science & Society 70A (UC Davis),
Honors Collegium 70A (UCLA),
Genetics and Society PLSS 0599 (Tuskegee University)**

LECTURES & GUEST LECTURES: Tuesday & Thursday 3:30-6:00 → Olson 250

DISCUSSION SECTIONS: Wednesdays, 6:10-8:00 PM → SLB 2064 (except 4/1 which is in LS 1020); sign up for 2 units of BIS 98, CRN 25274

REQUIRED TEXTS: *Introduction to Biotechnology* (W. J. Thieman & M. A. Palladino)
The Double Helix (J. D. Watson)
Scientific American & Other Articles (available on SmartSite)

OFFICE HOURS: Friday: 10:00 – 11:00 AM → LS 2163
Phone: 530-756-7042; Email: jjharada@ucdavis.edu

SAS 70A WEBSITE: <https://smartsite.ucdavis.edu/portal>

UCLA WEBSITE: http://www.mcdb.ucla.edu/Research/Goldberg/HC70A_Sp15/

VIDEOCAST OF LECTURES: <http://www2.oid.ucla.edu/webcasts/courses/2014-2015/2015spring/hmrs70a-1>

TEACHING FELLOW

Alexander Olson (agolson@ucdavis.edu) Office Hrs: By Appointment

LECTURES: SAS 70A lectures are very interactive, and in-class scientific “experiments” highlight major genetic engineering concepts. Lectures are webcasted to help you review concepts at your own pace.
Note: Attendance in lecture is required.

GUEST LECTURES: Guest speakers have been invited to highlight the real-life societal impacts of DNA and genetic engineering. ***Note: Attendance in guest lectures is required.***

DISCUSSION SECTION: Discussion Section is taught as an Undergraduate Seminar in Socratic style, and focuses on articles that relate to the history, applications, and societal impacts of genetic engineering. You must read the articles and text background material before discussion section and come prepared to participate in a thoughtful and interactive manner. Focus your reading around four questions: (1) What is the overall conceptual issue, or question, being addressed? (2) What are the technologies being discussed? (3) What is the significance of the technology, and how does it apply to real-life situations? (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. *Note: Attendance in discussion section is required.***

QUIZZES: A **Take-Home Quiz** will be handed out each week, and will also be posted on the class website. The take-home quiz focuses on the reading material and concepts covered in both discussion and lecture for that week. Quizzes will count 25,000 points each. **Note: You may work together in groups in order to solve the quiz problems. However, each of you must learn how to solve the quiz problem, hand in your own quiz, and be prepared to answer quiz questions in Discussion or Lecture. Quizzes are due by 3 PM the following Tuesday in class.**

DOUBLE HELIX REPORT: You will write a short report on *The Annotated & Illustrated Double Helix* by J. D. Watson that will count 50,000 points. Guidelines will be handed out in class. **The *Double Helix* Report is due at the beginning of class on Tuesday, April 14 Week 3)**

EXAMS: Exams include a **Take-Home Exam** and **Two All-Class Oral Exams**. Take-Home Exam questions will be handed out in class during Week 4 and will count 400,000 points. The mid-term oral exam will cover questions on the Take-Home Exam and Quizzes, and will count 100,000 points. Final Oral Exam questions will be handed out in class during Week 9 and will count 150,000 points. The Exam Schedule is:

Take-Home Exam: Due Tuesday, May 5 at the beginning of class (Week 6)

All-Class Mid-Term Oral Exam: Tuesday, May 5 (Week 6)

All-Class Final Oral Exam: Tuesday, June 2 (Week 10)

GRADING: You will be able to earn **ONE MILLION regular points** and a number of **BONUS POINTS** during the quarter (e.g., lab report). **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:

	Total Points	% Grade
<i>Double Helix</i> Report	50,000	5
Discussion Quizzes (8)	200,000	20
Discussion Participation	100,000	10
Take-Home Exam	400,000	40
Mid-Term Oral Exam	100,000	10
Final Oral Exam	150,000	15
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:

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

TRIP TO UCLA: Our class is scheduled to travel to UCLA from May 5 - 7. At UCLA on Tuesday, May 5, you will be placed into groups along with the students from UCLA to take the oral exam. On Wednesday, you will attend a discussion section at UCLA, and on Thursday, you will attend a lecture by Professor Goldberg. All of your travel and hotel costs will be covered by the class. In addition, each of you will be assigned hosts from the UCLA class. We strongly encourage everyone to participate in the trip. Alternative travel schedules are possible if you have unavoidable conflicts.

CLASS DINNER: A class dinner will be scheduled later in the quarter.

<u>DATE</u>	<u>LECTURE & DISCUSSION SCHEDULE (WEEKS 1-5)</u>
3/31	Lecture 1: <i>The Age of DNA: What is Genetic Engineering - Part One</i> Short Films: <i>Designing Life; Resurrecting the Extinct</i> Demonstration: Isolating "Your" DNA
4/2	Films: <i>Gene Engineers; Playing God</i>
DISCUSSION 1:	Scientific Origins of Genetic Engineering & Biotechnology-1: <i>DNA Cloning: A Personal View After 40 Years; Manipulation of Genes; The Recombinant DNA Debate</i>

4/7	Lecture 2: <i>The Age of DNA: What is Genetic Engineering - Part Two</i> Demonstration: Classical Genetic Engineering: Crop Origins Short Film: <i>History's Harvest: The Beginnings</i> DOUBLE HELIX REPORT QUESTIONS HANDED OUT
4/9	Film: <i>Race for the Double Helix</i>
DISCUSSION 2:	Scientific Origins of Genetic Engineering & Biotechnology-2: <i>Useful Proteins from Recombinant DNA</i>

4/14	Lecture 3: <i>What Are Genes & How Do They Work: Part One</i> Demonstration: Bacteria "Cloning" BACTERIA "CLONING" GUIDELINES HANDED OUT DOUBLE HELIX REPORT DUE
4/16	Speakers: Channapatna Prakash, PhD: <i>Engineering Crops For the Developing World</i> ; Alan McHughen, PhD: <i>GMOs – What's All the Fuss About?</i> All-Class Reception
DISCUSSION 3:	Crop Genetic Engineering: <i>Transgenic Crops; Are Genetically Engineered Foods Evil? Oxford Farming Lecture</i>

4/21	<i>Tuskegee University Students Visit UCLA</i> Lecture 4: <i>What Are Genes & How Do They Work: Part Two</i> Short Film: <i>Kary Mullis and PCR</i> Demonstration: Making Your Own DNA Fingerprint! BACTERIA "CLONING" REPORT DUE
4/23	Movie: <i>Conviction</i> TAKE-HOME EXAM QUESTIONS HANDED OUT Tuskegee & UCLA All-Class Reception
DISCUSSION 4:	How to Mark Your Genes: <i>Chromosome Mapping With DNA Markers; Keeping Your Genes Private; The DNA Dilemma; Fetal DNA Sequence; DNA Sequencer Raises Doctor's Hopes For Personalized Medicine</i>

4/28	Lecture 5 – How Are Genes Cloned & Engineered: The Hemophilia Story Demonstration: DNA Gel Electrophoresis
4/30	Speaker: Harry Klann , Supervising Criminologist, LAPD DNA Unit: <i>DNA Forensics & The Law</i> All-Class Reception
DISCUSSION 5:	DNA & The Law: <i>When Science Takes the Witness Stand; DNA Goes to Court; DNA Analysis Exposes Flaws in an Inexact Forensic Science</i>

<i>DATE</i>	<i>LECTURE & DISCUSSION SCHEDULE (WEEKS 6-10)</i>
5/5	UC Davis Students Visit UCLA TAKE HOME EXAM DUE ALL-CLASS MIDTERM ORAL EXAM UC Davis & UCLA All-Class Reception
5/7	Lecture 6: <i>21st Century Genetic Engineering Applications</i>
DISCUSSION 6:	Animal Genetic Engineering: <i>Transgenic Livestock As Drug Factories; The Land of Milk & Honey; FDA Approval of Atryn; Cloning For Medicine; FDA Approval of Genetically Engineered Salmon; Politics Holds Back Animal Engineers</i>

5/12	Lecture 7: <i>Age of Genomics-Identifying Individuals Past & Present Using DNA</i> Short Film: <i>Knowledge or Certainty</i>
5/14	Speaker: Pei Yun Lee, PhD: <i>Stem Cells: Promise, Reality, and Conflict</i> All-Class Reception
DISCUSSION 7:	Stem Cells & Genetic Engineering: <i>The Future of Stem Cells; Your Inner Healers; Diseases in a Dish; Pandora's Baby</i>

5/19	Lecture 8 – Professor John Harada: <i>Human Genetic Engineering</i> All-Class Reception
5/21	Speaker: Michele Evans, MD: <i>In Vitro Fertilization & Genetic Testing</i> All-Class Reception
DISCUSSION 8:	Human Genetic Engineering: <i>Gene Therapy; Gene Therapy's Second Act; Is the Gene Editing Revolution Finally Here?; DNA Editing of Human Embryos Alarms Scientists</i>

5/26	Lecture 9: <i>Science & the Constitution: Regulating Science & GMOs</i> Short Films: <i>Inherit the Wind; Judgment Day</i>
5/28	Lecture 10: <i>Science & the Constitution: Who Owns Your Genes?</i>
DISCUSSION 9:	Patenting Genes: <i>Patenting Life; Owning the Stuff of Life; Supreme Court</i>

FINAL ALL-CLASS ORAL EXAM
End of Class Reception

LECTURE & DISCUSSION SECTION TEXT READING:

Note: These chapters review all information related to the topics covered in each lecture and discussion PLUS additional topics. *Concentrate on chapter sections related to lectures and discussion articles.*

Introduction to Biotechnology, 3rd Edition (2013)

Lecture 1	Chapters 1 & 3 (pgs. 58-69)
Discussion 1	Chapter 3 (pgs. 58-69)
Lecture 2	Chapters 1 & 3 (pgs. 58-69)
Discussion 2	Chapters 2 & 3 (pgs. 69-99)
Lecture 3	Chapter 2
Discussion 3	Chapters 6, 12, & 13
Lecture 4	Chapter 2
Discussion 4	Chapters 8 & Chapter 11 (pgs. 263-272; pg. 278)
Lecture 5	Chapters 3 & 11 (pgs. 263-272; pg. 278)
Discussion 5	Chapter 8
Lecture 6	Chapters 5 & 7
Discussion 6	Chapters 7, 12, & 13
Lecture 7	Chapters 1 (pgs. 15-16), 3 (pgs. 88-99), 11 (pgs. 270-271)
Discussion 7	Chapters 11 (pgs. 292-305) & 13
Lecture 8	Chapter 11 (pgs. 280-287)
Discussion 8	Chapter 11 (pgs. 280-287)
Lecture 9	Chapter 12
Discussion 9	Chapters 12 & 13
Lecture 10	Chapter 12