

**Science & Society 70A (UC Davis), Honors Collegium 70A (UCLA),
Biotechnology PLSS530 (Tuskegee University)
Genetic Engineering In Medicine, Agriculture, & Law
Professors Bob Goldberg, John Harada, & C.S. Prakash
Winter 2012**

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

DISCUSSION SECTIONS: TBA

REQUIRED TEXTS: *Introduction to Biotechnology, 2nd Edition* (W. J. Thieman & M. A. Palladino)
The Double Helix (J. D. Watson)
Scientific American & Other Articles (Downloaded from SmartSite)

OFFICE HOURS: Wednesday: 12:00 – 1:00 PM → 2163 Life Science
Phone: 530-752-0673; Email: jjharada@ucdavis.edu

UC DAVIS WEBSITE: <https://smartsite.ucdavis.edu/xsl-portal/>

GOLDBERG HC70A WEBSITE: http://www.mcdb.ucla.edu/Research/Goldberg/HC70A_W12/

VIDEO AND PODCAST OF LECTURE: <http://www.oid.ucla.edu/webcasts/courses/2011-2012/2012winter/hc70a-1/>

UC DAVIS TEACHING FELLOW:

Mallorie Taylor (maltaylor@ucdavis.edu), Office Hours: By appointment ; 2243 LS; phone (530) 752-2537

LECTURES: Lectures are webcasted and audio podcasted. They can be viewed from the UCLA BruinCast site using RealPlayer.

GUEST LECTURES: Guest speakers have been invited to highlight the real-life impacts of genetic engineering on society. **Note: Attendance is required.**

DISCUSSION SECTION: Discussion Section is taught as an Undergraduate Seminar in Socratic style, and focuses on scientific articles that relate to the history of genetic engineering and its current applications. Articles introduce important concepts and teach how to read and think about science. **Focus your reading around four questions:** (1) What is the overall conceptual issue, or question, being addressed by the article? (2) What are the technologies and approaches 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 the new technology? **Note: Attendance is required. You must read the articles and text background material before discussion section and come prepared to participate in a thoughtful and interactive manner. A Discussion participation grade of up to 50,000 points will be assigned at the end of the quarter.**

QUIZZES: A Take-Home Quiz will be handed out after class each Thursday, and will also be posted on the class website. The take-home quiz focuses on the articles and concepts covered in each Discussion. 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 at the beginning of the next Discussion Section.**

DOUBLE HELIX REPORT: You will write a short report on *The Double Helix* by J. D. Watson that will count 25,000 points. Guidelines will be handed out in class. **The *Double Helix* Report is due at the beginning of class on Tuesday, January 24 (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 will count 125,000 points. Final Oral Exam questions will be handed out in class during Week 9 and will count 200,000 points. The Exam Schedule is:

Take-Home Exam: Due Tuesday, February 14 at the beginning of class (Week 6)

All-Class Mid-Term Oral Exam: Tuesday, February 14 (Week 6)

All-Class Final Oral Exam: Thursday, March 15 (Week 10)

GRADING: You will be able to earn **ONE MILLION regular points** and a number of **BONUS POINTS** during the quarter. **Your grade for this quarter 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	25,000	2.5
Discussion Quizzes	200,000	20
Discussion Participation	50,000	5
Take-Home Exam	400,000	40
Mid-Term Oral Exam	125,000	12.5
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:

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

DATE	TOPIC
1/10	Lecture 1: <i>The Age of DNA: What is Genetic Engineering - Part One</i> Films: <i>Craig Venter & Designing Life</i> (13'); <i>Resurrecting the Extinct</i> (11'); <i>Playing God: Origins of Genetic Engineering</i> (20') Demonstration: Isolating "Your" DNA
1/12	Film: <i>Race for the Double Helix</i>
DISCUSSION 1:	<i>The Manipulation of Genes; Recombinant DNA Debate; Shaping Life in the Lab</i>
1/17	Lecture 2: <i>The Age of DNA: What is Genetic Engineering - Part Two</i> Demonstration: Classical Genetic Engineering: Crop Origins Film: <i>History's Harvest: The Beginnings</i> (13') DOUBLE HELIX REPORT QUESTIONS HANDED OUT
1/19	Films: <i>The Lysenko Affair; History's Harvest: Anti-Science</i> (1')
DISCUSSION 2:	<i>Useful Proteins from Recombinant DNA</i>
1/24	Lecture 3: <i>What Are Genes & How Do They Work: Part One</i> Demonstrations: Gel Electrophoresis & Bacteria "Cloning" BACTERIA "CLONING" GUIDELINES HANDED OUT DOUBLE HELIX REPORT DUE
1/26	Speaker: Professor Channapatna Prakash, PhD: <i>Engineering Crops For the Developing World</i>
DISCUSSION 3:	<i>Transgenic Crops; Sowing a Gene Revolution; Edible Vaccines</i>
1/31	Lecture 4: <i>What Are Genes & How Do They Work: Part Two</i> Film: <i>Kerry Mullis and PCR</i> (22') Demonstration: Making Your Own DNA Fingerprint! BACTERIA "CLONING" REPORT DUE
2/2	Speaker: Harry Klann, Supervising Criminologist, DNA Unit, LAPD: <i>DNA Forensics & The Law</i> TAKE-HOME EXAM QUESTIONS HANDED OUT
DISCUSSION 4:	<i>Chromosome Mapping With DNA Markers; Keeping Your Genes Private; Too Much Information</i>
2/7	Lecture 5 – How Are Genes Cloned & Engineered: The Hemophilia Story
2/9	Speaker: Professor Bob Wayne, Engineering Modern-Day Dogs
DISCUSSION 5:	<i>When Science Takes the Witness Stand; DNA and Justice Denied; Familial DNA Testing; Portrait in DNA; Stop the DNA Dragnet</i>

DATE	TOPIC
2/14	UC Davis Students Visit UCLA TAKE HOME EXAM DUE ALL-CLASS MIDTERM ORAL EXAM UCLA & UC Davis Class Reception
2/15	Dinner - UC Davis Students
2/16	Lecture 6: <i>The Age of Genomics</i>
DISCUSSION 6:	<i>Transgenic Livestock As Drug Factories; Cloning For Medicine; The Land of Milk & Honey</i>
2/21	Lecture 7: <i>Identifying Individuals Past & Present Using DNA</i> Film: <i>Knowledge or Certainty</i> (12')
2/23	Speaker: Pei Yun Lee, PhD: <i>Stem Cells: Promise, Reality, and Conflict</i>
DISCUSSION 7:	<i>The Future of Stem Cells; Your Inner Healers; Diseases in a Dish; Pandora's Baby</i>
2/28	Tuskegee Students Visit UCLA Lecture 8 – Professor John Harada: <i>Human Genetic Engineering & 21st Century Gene Therapy</i>
2/29	Dinner – Tuskegee Students
3/1	Speaker: Michele Evans, MD: <i>In Vitro Fertilization & Genetic Testing</i>
DISCUSSION 8:	<i>Gene Therapy; Overcoming Obstacles to Gene Therapy; What Cloning Means for Gene Therapy; DNA Drugs Come of Age</i>
3/6	Lecture 9: <i>Science & the Constitution: Regulating Science & GMOs</i> Films: <i>Inherit the Wind</i> (6') <i>Judgment Day</i> (3')
3/8	Film: <i>Extraordinary Measures</i>
DISCUSSION 9:	<i>Traces of a Distant Past; How We Are Evolving; Three Diseases to Blame On Our Ancient Ancestors</i>
3/13	Lecture 10: <i>Science & the Constitution: Who Owns Your Genes?</i>
Discussion 10:	<i>The Genetic Basis of Cancer; Mapping the Cancer Genome</i>
3/15	FINAL ALL-CLASS ORAL EXAM End of Class Reception

TEXT READING ASSIGNMENTS FOR LECTURES AND DISCUSSIONS: 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, 2ND EDITION

LECTURE 1	Chapter 1
DISCUSSION 1	Chapters 2 & 3
LECTURE 2	Chapter 2
DISCUSSION 2	Chapters 2, 3, & 5
LECTURE 3	Chapter 2
DISCUSSION 3	Chapters 6, 12, & 13
LECTURE 4	Chapter 3
DISCUSSION 4	Chapters 8 & 11
LECTURE 5	Chapters 3, 8, & 11
DISCUSSION 5	Chapter 8
LECTURE 6	Chapter 8
DISCUSSION 6	Chapters 7, 12, & 13
LECTURE 7	Chapters 5, 6, & 7
DISCUSSION 7	Chapters 11 & 13
LECTURE 8	Chapter 11
DISCUSSION 8	Chapter 11
LECTURE 9	Chapter 12
DISCUSSION 9	Chapter 5
LECTURES 10 & 11	Chapters 12 & 13
DISCUSSION TEN	Chapter 11

DISCUSSION SECTION BIBLIOGRAPHY: Note: These articles are required reading for Discussion Section. They can be downloaded from the HC70A class websites (Goldberg or CCLE) and opened using Acrobat Reader 6.0 or later.

DISCUSSION ONE - The History and Science of Genetic Engineering

1. Stanley N. Cohen, *The Manipulation of Genes*. Scientific American, July, 1975, **233 (1)**, 24-33.
2. Clifford Grobstein, *The Recombinant DNA Debate*. Scientific American, July, 1977, **237 (1)** 22-33.
3. Frederic Golden, *Shaping Life in the Lab*, Time Magazine, March 9, 1981, pgs. 1-13.

DISCUSSION TWO - Using Genetic Engineering to Make Drugs in Bacteria

1. Walter Gilbert and Lydia Villa-Komaroff, *Useful Proteins From Recombinant Bacteria*. Scientific American, April, 1980, **242 (4)**, 74-94.

DISCUSSION THREE - Using Genetic Engineering to Make Better Crops

1. Charles S. Gasser and Robert T. Fraley, *Transgenic Crops*. Scientific American, June, 1992, **266 (6)**, 62-69.
2. Terri Raney and Prabhu Pingali, *Sowing a Gene Revolution*. Scientific American, September, 2007, **297 (3)**, 104-111.
3. William H. R. Langridge, *Edible Vaccines*. Scientific American, September, 2000, **283 (3)**, 66-71

DISCUSSION FOUR - Using DNA to Identify Human Disease Genes

1. Ray White and Jean-Marc Lalouel, *Chromosome Mapping with DNA Markers*. Scientific American, February, 1988, **258 (2)**, 40-48.
2. Mark A. Rothstein, *Keeping Your Genes Private*, Scientific American , September, 2008, **299 (3)**, 64-69.
3. Melinda Wenner Moyer, *Too Much Information*, Scientific American, April, 2011, **304 (4)**, 27.

DISCUSSION FIVE - DNA Testing in the Courtroom

1. Peter J. Neufeld and Neville Colman, *When Science Takes the Witness Stand*. Scientific American, May, 1990, **262 (5)**, 46-53.
2. Sheldon Krinsky and Tania Simoncelli, *DNA and Justice Denied*. LA Times, **December 22, 2010**
3. Greg Miller, *Familial DNA Testing*. Science **329**, 262 (2010)
4. Christine Soares, *Portrait in DNA*, Scientific American, May, 2010, **302 (4)**, 14-15.
5. Editors, *Stop the DNA Dragnet*, Scientific American, December, 2011, **305 (6)**, 14.

DISCUSSION SIX - Using Genetic Engineering to Make Drugs in Farm Animals

1. William H. Velander, Henryk Lubon, and William N. Drohan, *Transgenic Livestock as Drug Factories*. Scientific American, January 1997, **276 (1)**, 70-74.
2. Ian Wilmut, *Cloning For Medicine*. Scientific American, December 1998, **279 (6)**, 58-63.
3. Gary Stix, *The Land of Milk & Honey*, Scientific American, November 2005, **293 (5)**, 102-104.

DISCUSSION SEVEN - Stem Cells: Studying and Curing Human Diseases

1. Clive Cookson et al., *The Future of Stem Cells*. Scientific American Special Report, July, 2005, **A6-A21**.
2. Konrad Hochedlinger, *Your Inner Healers*. Scientific American, May, 2010, **302 (4)**, 47-53.
3. Stephen S. Hall, *Diseases in a Dish*, Scientific American, March, 2011, **304 (3)**, 41-45.
4. Robin Marantz Henig, *Pandora's Baby*, Scientific American, June, 2003, **266 (6)**, 63-68.

DISCUSSION EIGHT - Gene Therapy: Fixing Human Genetic Defects

1. Inder M. Verma, *Gene Therapy*. Scientific American, November, 1990, **263 (5)**, 68-84.
2. Theodore Friedman, *Overcoming the Obstacles to Gene Therapy*. Scientific American, June, 1997, **276 (6)**, 96-101.
3. Matthew P. Morrow and David B. Weiner, *DNA Drugs Come of Age*, Scientific American, July, 2010, **303 (1)**, 48-53
4. Steve Mirsky and John Rennie, *What Cloning Means for Gene Therapy?* Scientific American, June, 1997, **276 (6)**, 122-123

DISCUSSION NINE - Using DNA to Trace Ancestry and Human Origins

1. Gary Stix, *Traces of a Distant Past*, Scientific American, July, 2008, **298 (6)**, 56-63
2. Jonathan K. Pritchard, *How We Are Evolving*, Scientific American, October, 2010, **303 (4)**, 41-47.
3. Emily Anthes, *Three Diseases We May Be Able To Blame On Our Ancient Ancestors*, Discover Magazine, December, 2008

DISCUSSION TEN - Understanding and Defeating Cancer

1. Webster K. Cavenee and Raymond L. White, *The Genetic Basis of Cancer*. Scientific American, March 1995, **273 (3)**, 72-79.
2. Francis S. Collins and Anna D. Barker, *Mapping the Cancer Genome*, Scientific American, March, 2007, **296 (3)**, 50-57.
3. Jeff Wheelwright, *Cancer's Wandering Gene*, Discover Magazine, December, 2011, pgs. 64-70.