

Science & Society 70A (UC Davis) and Honors Collegium 70A (UCLA)
Genetic Engineering In Medicine, Agriculture, & Law
Professors Bob Goldberg & John Harada
Winter 2011

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

DISCUSSION SECTIONS: Wednesdays → 8:00-10:00 PM, 2064 Science Laboratory Building

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 the Smartsite
or the Goldberg HC70A website using Adobe Reader 6.0 or later)

OFFICE HOURS: by appointment → 2163 Life Science
Phone: 530-752-0673; Email: jjharada@ucdavis.edu

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

GOLDBERG HC70A WEBSITE: http://www.mcdb.ucla.edu/Research/Goldberg/HC70A_W11/

BRUINCAST: <http://www.oid.ucla.edu/webcasts/courses/2010-2011/2011winter/hc70a-1/>

TEACHING ASSISTANT:

Ryan Kirkbride <rkirkbride@ucdavis.edu> Office Hours: by appointment

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

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

DISCUSSION SECTION: Discussion Section will be taught as an Undergraduate Seminar (PLB 98, CRN 37152) in the Socratic style and will focus on scientific articles and debates that relate to the history of genetic engineering and its current applications. Articles will introduce important concepts and teach you how to read and think about science. **Focus your reading around four questions:** (1) What is the question being addressed by the article? (2) What are the technologies/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: You must read the articles and text background material before discussion section and come prepared to participate in a thoughtful and interactive manner.**

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/topics/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 and hand in your own quiz.** A Discussion participation grade of *up to* 50,000 points will be assigned at the end of the quarter.

Quizzes are due at the beginning of the next Discussion Section.

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

TRIP TO UCLA: Our class is scheduled to travel to UCLA from February 8 - 10. On Tuesday, Feb. 8, 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.

DOUBLE HELIX REPORT: You will write a short report on *The 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, January 18 (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 175,000 points. The Exam Schedule is:

Take-Home Exam: Due Tuesday, February 8 at the beginning of class (Week 6)

All-Class Mid-Term Oral Exam: Tuesday, February 8, La Kretz 120 (Week 6)

All-Class Final Oral Exam: Thursday, March 10 La Kretz 120 (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	50,000	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	175,000	17.5
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:

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

DATE	TOPIC
1/4	Lecture 1: <i>The Age of DNA: What is Genetic Engineering?</i> Film: Craig Venter & Synthetic Organisms Demonstrations: Isolating DNA & Classical Genetic Engineering
1/6	Film: <i>Race for the Double Helix</i>
DISCUSSION 1:	<i>The Manipulation of Genes</i> <i>Potential Biohazards of Recombinant DNA Molecules</i> <i>Recombinant DNA Debate</i>
1/11	Lecture 2: <i>What Are Genes & How Do They Work: Part One</i> Demonstrations: Gel Electrophoresis & Bacteria "Cloning" DOUBLE HELIX REPORT QUESTIONS HANDED OUT BACTERIA "CLONING" GUIDELINES HANDED OUT
1/13	Speaker: Dr. Robert Wayne, PhD: <i>Hunting For Canine Ancestors & Engineering Modern-Day Dogs</i> All-Class Reception
DISCUSSION 2:	<i>Useful Proteins from Recombinant DNA</i> <i>Discovering Genes for New Medicines</i>
1/18	Lecture 3: <i>What Are Genes & How Do They Work: Part Two</i> Film: Kerry Mullis and PCR DOUBLE HELIX REPORT DUE Dinner 1
1/20	Speaker: Richard Hamilton, PhD: <i>Engineering Plants For Biofuels</i> All-Class Reception
DISCUSSION 3:	<i>Transgenic Crops</i> <i>Sowing a Gene Revolution</i> <i>Grassoline at the Pump</i>
1/25	Lecture 4: <i>How Are Genes Cloned & Engineered: The Factor VIII Story</i> Demonstration: Making Your Own DNA Fingerprint!
1/27	Speaker: Channapatna Prakash, PhD: <i>Engineering Crops For the Developing World</i> TAKE-HOME EXAM QUESTIONS HANDED OUT All-Class Reception & Dinner 2
DISCUSSION 4:	<i>Chromosome Mapping With DNA Markers</i> <i>Keeping Your Genes Private</i>

DATE	TOPIC
2/1	Lecture 5 – Professor John Harada: <i>How to Make Transgenic Organisms: From Mighty Mice to Golden Rice</i> Dinner 3
2/3	Speaker: Harry Klann, Criminologist: <i>DNA Forensics & The Law</i> All Class Reception
DISCUSSION 5:	<i>When Science Takes the Witness Stand</i> <i>The DNA Detectives</i> <i>DNA and Justice Denied</i> <i>Familial DNA Testing</i>
2/8	UC Davis Students Visit UCLA (2/8-2/10) TAKE HOME EXAM DUE ALL-CLASS MIDTERM ORAL EXAM UCLA & UC Davis Class Reception & Dinner 4
2/10	Lecture 6: <i>The Age of Genomics</i>
DISCUSSION 6:	<i>Transgenic Livestock As Drug Factories</i> <i>Cloning For Medicine</i> <i>The Land of Milk & Honey</i>
2/16	Lecture 7: <i>Identifying Individuals Past & Present Using DNA</i>
2/18	Michele Evans, MD: <i>In Vitro Fertilization & Genetic Testing</i> All Class Reception & Dinner 5
DISCUSSION 7:	<i>The Future of Stem Cells</i> <i>The First Human Cloned Embryo</i> <i>Pandora's Baby</i>
2/23	Lecture 8: <i>Human Genetic Engineering & Gene Therapy</i>
2/25	Dr. Pei Yun Lee: <i>Stem Cells: Promise, Reality, and Conflict</i> Dinner 6
DISCUSSION 8:	<i>Gene Therapy</i> <i>Overcoming Obstacles to Gene Therapy</i> <i>What Cloning Means for Gene Therapy</i>
3/2	Lecture 9: <i>Science & the Constitution: Regulating Science & GMOs</i> Dinner 7
3/4	Speaker: Dr. John Novembre: <i>Tracking Human Ancestry</i> All-Class Reception
DISCUSSION 9:	<i>Traces of a Distant Past</i> <i>How We Are Evolving</i>

DATE	TOPIC
3/9	Lecture 10: <i>Science & the Constitution: Who Owns Your Genes?</i> Film: Knowledge or Certainty Dinner 8
Discussion 10:	<i>The Genetic Basis of Cancer</i> <i>Mapping the Cancer Genome</i>
3/10	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 Smartsite and opened using Acrobat Reader 6.0 or later.

DISCUSSION ONE – The Basics 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. Paul Berg et al., *Potential Biohazards of Recombinant DNA Molecules*, Science, July 26, 1974, **185**, 303

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.
2. William A. Haseltine, *Discovering Genes For New Medicine*. Scientific American, March, 1997, **276 (3)**, 92-97.

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. George W. Huber and Brice E. Dale, *Grassoline at the Pump*, Scientific American, July, 2009, **301 (1)**, 52-59.

DISCUSSION FOUR – Identifying and Testing 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.

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)

DISCUSSION SIX – Genetic Engineering Farm Animals to Make Drugs

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 – Embryonic Stem Cells and Cloning for Medicine

1. Clive Cookson et al., *The Future of Stem Cells*. Scientific American Special Report, July, 2005, **A6-A21**.
2. Jose B. Cibelli, Robert P. Lanza, Michael West, and Carol Ezzell, *The First Human Cloned Embryo*. Scientific American, January, 2002, **286 (1)**, 44-51.
3. 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. Steve Mirsky and John Rennie, *What Cloning Means for Gene Therapy?* Scientific American, June, 1997, **276 (6)**, 122-123

DISCUSSION NINE – Tracing 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.

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.