

Honors Collegium 70A
Genetic Engineering In Medicine, Agriculture, & Law
Dr. Bob Goldberg
Winter 2008

LECTURES & FILM-SPEAKER DISCUSSIONS: Tuesday & Thursday 3:30-6:00 → La Kretz 120

DISCUSSION SECTIONS: Wednesday: 2-4 & 4-6 → La Kretz 101; 6-8 → LS 2320

REQUIRED TEXTS: *Introduction to Biotechnology* (W. J. Thieman & M. A. Palladino)
The Double Helix (J. D. Watson)
Scientific American & Other Articles (downloaded from the Blackboard HC70A website or the Goldberg HC70A website using Acrobat Reader 6.0 or later)

OFFICE HOURS: Wednesday: Noon-2:00PM → Life Sciences 2832
Phone: 310-825-9093; Email: bobg@ucla.edu

GOLDBERG HC70A WEBSITE: http://www.mcdb.ucla.edu/Research/Goldberg/HC70A_W08/

HC70A BLACKBOARD WEBSITE: <http://www.lsic.ucla.edu/classes/winter08/>

BRUINCAST: <http://www.oid.ucla.edu/webcasts/courses/2007-2008/2008winter/hc70a-1/>

ADMINISTRATIVE ASSISTANT: Ingrid Nelson (inelson@mcdb.ucla.edu), LS 2835 (310-825-3270)

TEACHING ASSISTANTS: Brandon Le (ble@ucla.edu)
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LECTURES: Lectures will be video streamed and audio podcasted. They can be accessed from the UCLA BruinCast site. You will need Real Player to view lectures from the UCLA BruinCast website.

FILM-SPEAKER DISCUSSIONS: Guest speakers and films will be used to highlight the impact of genetic engineering on society and will be scheduled throughout the quarter. **Attendance is required.** **Note:** If you miss more than two film-speaker discussion sessions your final grade may be lowered by one letter.

DISCUSSION SECTION: Discussion Section will be taught as an Undergraduate Seminar and will focus on scientific articles and plays/debates that simulate "real-life" genetic engineering situations. The articles/plays/debates will introduce important concepts and will 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 as a consequence of the new technology?

QUIZZES: On Wednesday of each week, a **Take-Home Quiz** will be handed out as well as posted on the class website. The take-home quiz focuses on the articles read for that week's Discussion. **Quizzes are due by 6 PM on Friday of that week in LS 2832.** Quizzes will count 25,000 points each. 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 by your Teaching Assistant, in addition to points earned on the quizzes,

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CLASS DINNERS: I will take groups of students to dinner each week throughout the quarter. These dinners will also include the guest speakers and will be a unique experience!! Check the dinner group list that will be handed out in class for the week and day that you are scheduled to attend dinner.

DOUBLE HELIX ESSAY: You will write a brief essay on *The Double Helix* by J. D. Watson. The essay will count 50,000 points. Guidelines will be handed out in class.

The *Double Helix* Essay is due at the beginning of class on Tuesday, January 21 (Week 3)

CLASS PROJECT: The **entire class as a group** will write, produce, and perform in a videotaped "movie" concerning one aspect of Genetic Engineering discussed this quarter. The purpose of this project is to encourage class interaction, create a useful learning device, and **have some fun**. Movie guidelines will be discussed in class. Previous HC70A class projects can be viewed at: http://www.mcdb.ucla.edu/Research/Goldberg/hc70a_index.html under "Video of Lectures" for each class.

The class project will be shown to the entire class on **Thursday, March 13 (Week 10)** and will count 50,000 points.

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 75,000 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 Thursday, February 14 at the beginning of class (Week 6)

All-Class Mid-Term Oral Exam: Thursday, February 14, La Kretz 120 (Week 6)

All-Class Final Oral Exam: Thursday, March 13, 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
Essay	50,000	5
Movie Project	50,000	5
Discussion Quizzes	225,000	22.5
Discussion Participation	50,000	5
Take-Home Exam	400,000	40
Mid-Term Oral Exam	75,000	7.5
Final Oral Exam	150,000	15
TOTAL	1,000,000	100

I DO NOT GRADE BY A CURVE in order to encourage maximum student participation and interaction. I will use the following guidelines 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:

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

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LECTURE & DISCUSSION SCHEDULE:

DATE	TOPIC
1/8	Lecture 1: <i>The Age of DNA: What is Genetic Engineering?</i> Demonstrations: Isolating DNA & Classical Genetic Engineering
1/10	Film: <i>Race for the Double Helix</i> Dinner 1
DISCUSSION 1:	<i>Recombinant DNA Debate</i> <i>The Manipulation of Genes</i>

1/15	Lecture 2: <i>What Are Genes & How Do They Work: Part One</i> Dinner 2
1/17	Lecture 3: <i>What Are Genes & How Do They Work: Part Two</i> Film: Kerry Mullis and PCR
DISCUSSION 2:	<i>Useful Proteins from Recombinant DNA</i> <i>Discovering Genes for New Medicines</i> <i>The Bioinformatics Gold</i>

1/22	Lecture 4: <i>How Are Genes Cloned & Engineered: The Factor VIII Story</i> Demonstrations: Gel Electrophoresis & Bacteria Gene "Cloning" DOUBLE HELIX "ESSAY" DUE
1/24	Film: <i>History's Harvest</i> Speaker: Dr. Alan McHughen: <i>GMOs: What's All The Fuss About?</i> All-Class Reception & Dinner 3
DISCUSSION 3:	<i>Transgenic Crops</i> <i>Sowing A Gene Revolution</i> <i>Seeds of Concern</i> Debate: <i>To Genetically Engineer Plants or Not?</i>

1/29	Lecture 5: <i>The Age of Genomics: Your Personal Genome</i> Demonstration: Making Your Own DNA Fingerprint!
1/31	Speaker: Dr. Richard Hamilton: <i>How To Make a Biotech Company</i> All-Class Reception & Dinner 4 TAKE-HOME EXAM QUESTIONS HANDED OUT
DISCUSSION 4:	<i>Chromosome Mapping With DNA Markers</i> <i>Grading the Gene Tests</i>

2/5	Lecture 6: <i>Identifying Human Origins: Past and Present</i>
2/7	Speaker: Officer Harry Klann: <i>DNA Forensics & the Law</i> All Class Reception & Dinner 5
DISCUSSION 5:	Play: <i>Trial of the Century</i> <i>When Science Takes the Witness Stand</i> <i>The DNA Detectives</i> <i>CSI Reality</i>

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LECTURE SCHEDULE CONTINUED:

DATE	TOPIC
2/12	Lecture 7: <i>Twenty-First Century Genetic Engineering Applications</i>
2/14	TAKE HOME EXAM DUE ALL-CLASS MIDTERM ORAL EXAM Dinner 6
DISCUSSION 6:	<i>Transgenic Livestock As Drug Factories</i> <i>Cloning For Medicine</i> <i>The Land of Milk & Honey</i> Debate: <i>To Genetically Engineer Animals or Not?</i>
2/19	Lecture 8: <i>Science & the Constitution: Regulating Science & GMOs?</i>
2/21	Speaker to be Announced All Class Reception & Dinner 7
DISCUSSION 7:	<i>Embryonic Stem Cells for Medicine</i> <i>The Future of Stem Cells</i> <i>The First Human Cloned Embryo</i> <i>Pandora's Baby</i>
2/26	Lecture 9: <i>Science & the Constitution: Who Owns Our Genes?</i>
2/28	Speaker to be Announced All-Class Reception & Dinner 8
DISCUSSION 8:	<i>The Genetic Basis of Cancer</i> <i>The Magic of Microarrays</i> <i>Mapping the Cancer Genome</i>
3/4	Lecture 10: <i>Genetics, Cloning, & the Law: 21st Century Issues</i>
3/6	Speaker: Dr. Greg Stock: <i>Ethical Issues in Human Genetics and Cloning</i> All-Class Reception & Dinner 9
DISCUSSION 9:	<i>Chemical & Biological Weapons</i> <i>Attacking Anthrax</i> <i>Technology Against Terror</i>
3/11	Lecture 11: <i>Genetic Engineering: Past, Present, & Future</i> Film: Knowledge or Certainty
Discussion 10:	<i>Gene Therapy</i> <i>Overcoming Obstacles to Gene Therapy</i> <i>What Cloning Means for Gene Therapy</i>
3/13	FINAL ALL-CLASS ORAL EXAM & CLASS PROJECT DUE

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TEXT READING ASSIGNMENTS FOR LECTURES AND DISCUSSIONS:

INTRODUCTION TO BIOTECHNOLOGY

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

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

LECTURE 7	Chapters 5, 6, 7, 9, & 10
DISCUSSION 7	Chapters 11 & 13

LECTURE 8	Chapter 12
DISCUSSION 8	Chapter 11

LECTURE 9	Chapter 12
DISCUSSION 9	Chapter 5

LECTURES 10 & 11	None
DISCUSSION TEN	Chapter 11

DISCUSSION SECTION BIBLIOGRAPHY: These articles are required reading for Discussion Section. They can be downloaded from the HC70A class websites (Goldberg or Blackboard) and opened using Acrobat Reader 6.0 Or later. Recent Scientific American articles can also be downloaded directly from Scientific American using the UCLA Library E-journals site (<http://www2.library.ucla.edu/search/ejournals.cfm>).

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.

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DISCUSSION SECTION BIBLIOGRAPHY CONTINUED:

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.
3. Ken Howard, *The Bioinformatics Gold*. Scientific American, July, 2000, **282 (1)**, 58-63.

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. Kathryn Brown, *Seeds of Concern*, Scientific American, April, 2001, **284 (4)**, 52-57.

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. John Rennie, *Grading the Gene Tests*. Scientific American, June, 1994, **270 (6)**, 89-97.

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. Jerry Adler and John McCormick, *The DNA Detectives*. Newsweek, **November 16, 1998**, pgs. 64-71.
3. Max H. Houck, *CSI Reality*. Scientific American, July, 2006, **295 (1)**, 85-89

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. Roger A. Pedersen, *Embryonic Stem Cells For Medicine*. Scientific American, April, 1999, **280 (4)**, 68-73.
2. Clive Cookson et al., *The Future of Stem Cells*. Scientific American Special Report, July, 2005, **A6-A21**.
3. Jose B. Cibelli, Robert P. Lanza, Michael West, and Carol Ezzell, *The First Human Cloned Embryo*. Scientific American, January, 2002, **286 (1)**, 44-51.
4. Robin Marantz Henig, *Pandora's Baby*, Scientific American, June, 2003, **266 (6)**, 63-68.

DISCUSSION EIGHT – 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. Stephen H. Friend and Roland B. Stoughton, *The Magic of Microarrays*. Scientific American, February, 2002, **286 (2)**, 44-53.
3. Francis S. Collins and Anna D. Barker, *Mapping the Cancer Genome*, Scientific American, March, 2007, **296 (3)**, 50-57.

DISCUSSION NINE – Counteracting Bioweapons

1. Mathew Meselson, *Chemical and Biological Weapons*, Scientific American, May, 1970, **222 (5)**, 15-25.
2. John T. Young and R. John Collier, *Attacking Anthrax*. Scientific American, March, 2002, **286 (3)**, 48-59.
3. Rocco Casagrande, *Technology Against Terror*, Scientific American, October, 2002, **287 (3)**, 83-87.

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DISCUSSION SECTION BIBLIOGRAPHY CONTINUED:

DISCUSSION TEN – 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.

REFERENCE MATERIAL: These books are on reserve in the Powell Library (<http://www2.library.ucla.edu/service/student.cfm>), and complement and expand on the topics covered in both the lectures and discussions. They represent an excellent collection of reference books on molecular biology, genetics, biotechnology, human cloning, molecular biology history, genetic engineering, and legal/constitutional issues as it applies to breakthroughs in genetic/cloning technologies. *These books may be helpful for your essay, exams, class project, and expanded "horizons" – particularly where your text does not cover the lecture/discussion topic.*

A Practical Companion To The Constitution – J.K. Lieberman

Actual Innocence: When Justice Goes Wrong And How To Make It Right – Scheck et al.

An Introduction To Genetic Analysis – Eighth Edition -- Griffiths et al.

Applied Molecular Genetics -- R.L. Miesfeld

Ascent Of Man -- Bronowski

Biochemistry -- Fourth Edition -- L. Stryer

Biology -- Sixth Edition -- Raven & Johnson

Biotechnology - An Introduction -- Barnum

Cloning And The Constitution – I. H. Carmen

Dealing With Genes -- Berg & Singer

DNA Science -- Miklos & Freyer

DNA Technology -- Second Edition -- I.E. Alcamo

Eighth Day Of Creation -- Second Edition -- Judson

Gene Cloning – Third Edition -- T.A. Brown

Genetics -- From Genes To Genomes - L. Hartwell et al.

Genetics, Society, & Clinical Practice -- Harper & Clarke

Genetic Privacy – Graeme Laurie

Genomes -- T.A. Brown

Human Genetics – The Molecular Revolution -- E. Mcconkey

Human Genetics – Third Edition -- Vogel & Motulsky

Human Molecular Genetics -- Third Edition -- Strachan & Read

Introduction to Biotechnology -- Thiemann & Palladino (**Class Text**)

Life: The Science Of Biology – Sixth Edition -- Purves et al.

Molecular Biology Of The Cell -- Third Edition -- Alberts et al.

Molecular Biology of the Gene -- Fifth Edition -- Watson et al.

Molecular Biotechnology -- Second Edition -- Glick & Pasternak

Molecular Cell Biology – Fourth Edition -- Lodish et al.

Pocket Guide to Biotechnology, R. Schmid (**Excellent Reference Book**)

Plants, Genes, & Crop Biotechnology – Second Edition -- Chrispeels & Sadava

Principles Of Gene Manipulation -- Sixth Edition – Primrose et al. (**Excellent Reference Book**)

Recombinant DNA -- Second Edition -- Watson et al. (**Excellent Reference Book**)

Rosalind Franklin – The Dark Lady Of DNA – B. Maddox

The Double Helix – Watson (**Class Text**)

Understanding DNA & Gene Cloning -- Second Edition -- K. Drlica