

Honors Collegium 70A
Genetic Engineering In Medicine, Agriculture, & Law
Dr. Bob Goldberg
Winter 2006

Sponsored by the HHMI University Professors Program

LECTURES & FILMS: Tuesday & Thursday 3:30-6:00 → La Kretz 120

DISCUSSION SECTIONS: Wednesday: 2-4 & 4-6 → La Kretz 101

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

OFFICE HOURS: Wednesday: 11:00AM-2:00PM → Life Sciences 2832
Phone: 825-9093; Email: bobg@ucla.edu

GOLDBERG HC70A CLASS WEBSITE: http://www.mcdb.ucla.edu/Research/Goldberg/HC70A_W06/

HC70A BLACKBOARD CLASS WEBSITE: <http://www.lsic.ucla.edu/classes/winter06/hmrs70a.html>

WEBCAST/PODCAST WEBSITE: <http://www.oid.ucla.edu/webcasts/courses/2005-2006/2006winter/hc70a/>

ADMINISTRATIVE ASSISTANT: Jessica Luke (jluke@mcdb.ucla.edu), Life Sciences 2835 (825-3270)

TEACHING ASSISTANTS: Gloria Chu (glochu@ucla.edu), Life Sciences 2835 (825-3270)
Mike Gaviño (mgavino@ucla.edu), Life Sciences 2835 (825-3270)

TEACHING ASSISTANT OFFICE HOURS: Mike & Gloria - Friday, 10AM-2:00PM, Life Sciences 2805

LECTURES: Lectures will be webcasted and streamed on both the UCLA Webcast and Goldberg HC70A class websites. You will need Quicktime 7.0, or later, to view lectures from the Goldberg HC70A website, and Real Player to view lectures from the UCLA Webcast website. Lectures will also be podcasted.

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?

On Wednesday of each week, a **take-home quiz** will be handed out as well as posted on the class websites. The take-home quiz focuses on the articles read for that week’s Discussion. **Quizzes are due by midnight 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. In addition to points earned on the quizzes, a Discussion participation grade of *up to* 100,000 points will be assigned at the end of the quarter by your Teaching Assistant.

Honors Collegium 70A Winter 2006

Page Two

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 75,000 points. Guidelines will be handed out in class.

The *Double Helix* Essay is due at the beginning of class on Tuesday, January 31 (Week 4)

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 16 (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 5. The mid-term oral exam will cover questions on the Take-Home Exam. Final Oral Exam questions will be handed out on the last lecture day of class (March 9). The Take-Home Exam will count 350,000 points and the All-Class Oral Exams will count 200,000 points. The Exam Schedule is:

Take-Home Exam: Due Tuesday, February 21 at the beginning of class (Week 7)

All-Class Mid-Term Oral Exam: Tuesday, February 21 (Week 7)

All-Class Final Oral Exam: Thursday, March 16, 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	100,000	10
Take-Home Exam	350,000	35
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:

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

Honors Collegium 70A Winter 2006

Page Three

LECTURE & DISCUSSION SCHEDULE:

<u>DATE</u>	<u>TOPIC</u>
1/10	Lecture 1: <i>The Age of DNA -- What is Genetic Engineering? – Part 1</i> Demonstrations: Isolating Your DNA & Classical Genetic Engineering
1/12	Lecture 2: <i>The Age of DNA -- What is Genetic Engineering? – Part 2</i> Dinner 1
DISCUSSION 1:	<i>The Manipulation of Genes</i> <i>Recombinant DNA Debate</i> Film: <i>Cutting & Splicing of DNA</i>
1/17	Film: <i>Race for the Double Helix</i>
1/19	Lecture 3: <i>What Are Genes?</i>
DISCUSSION 2:	<i>Useful Proteins from Recombinant DNA</i> <i>Discovering Genes for New Medicines</i> <i>The Bioinformatics Gold</i> <i>The Human Genome Business Today</i>
1/24	Lecture 4: <i>How Do Genes Work?</i> Film: Kerry Mullis and PCR Demonstrations: Gel Electrophoresis & Bacteria Gene "Cloning"
1/26	Film: <i>History's Harvest</i> Speaker: Dr. Alan McHughen -- "GMOs: What's All The Fuss About?" Dinner 2
DISCUSSION 3:	<i>Transgenic Livestock As Drug Factories</i> <i>Cloning For Medicine</i> <i>Edible Vaccines</i> <i>Seeds of Concern</i> <i>Green Gene Revolution</i> Debate: <i>To Genetic Engineer or Not?</i>
1/31	Lecture 5: <i>How Are Genes Cloned & Engineered – The Factor VIII Story</i> Demonstration: Making a DNA Fingerprint of Yourself! DOUBLE HELIX "ESSAY" DUE
2/2	Speaker: Dr. Richard Hamilton: "How To Make a Biotech Company" Dinner 3
DISCUSSION 4:	<i>Chromosome Mapping With DNA Markers</i> <i>Grading the Gene Tests</i> <i>Testing Your Future</i> <i>A Laws Fetal Flaw</i>

Honors Collegium 70A Winter 2006

Page Four

LECTURE SCHEDULE CONTINUED:

<u>DATE</u>	<u>TOPIC</u>
2/7	Lecture 6: <i>21st Century Genetic Engineering Applications</i> TAKE-HOME EXAM QUESTIONS HANDED OUT
2/9	Speaker: Officer Harry Klann: <i>Using DNA to Catch Criminals</i> Dinner 4
DISCUSSION 5:	Review Films: <i>Planted DNA Evidence</i> <i>Murder, Rape, and DNA</i>

2/14	Lecture 7: <i>Science & the Constitution: How Is Science Regulated?</i>
2/16	Lecture 8: <i>Science & the Constitution: Who Owns Our Genes?</i> Dinner 5
DISCUSSION 6:	<i>When Science Takes the Witness Stand</i> <i>The DNA Detectives</i> Play: <i>Trial of the Century (@Law School Moot Courtroom)</i>

2/21	Lecture 9: <i>The Human Genome Project: Detecting and Using Your Genes</i> TAKE HOME EXAM DUE ALL-CLASS MIDTERM ORAL EXAM
2/23	Speaker: Dr. Michele Evans: <i>In-vitro Fertilization and Genetic Testing</i> Dinner 6
DISCUSSION 7:	<i>Embryonic Stem Cells for Medicine</i> <i>The Stem Cell Challenge</i> <i>The First Human Cloned Embryo</i> <i>Pandora's Baby</i>

2/28	Lecture 10: <i>Identifying Human Origins: Are There Races - Past and Present?</i> Dinner 7
3/2	Film: <i>Outbreak</i>
DISCUSSION 8:	<i>The Genetic Basis of Cancer</i> <i>Tumor Busting</i> <i>The Magic of Microarrays</i> <i>New Hope for Cancer</i>

3/7	Lecture 11: <i>Genetics, Cloning, & the Law -- 21st Century Issues - Part 1</i> Dinner 8
3/9	Lecture 12: <i>Genetics, Cloning, & the Law -- 21st Century Issues - Part 2</i>
DISCUSSION 9:	<i>Attacking Anthrax</i> <i>Capturing the Killer Flu Virus</i> <i>Technology Against Terror</i>

Honors Collegium 70A Winter 2006
Page Five

LECTURE SCHEDULE CONTINUED:

<u>DATE</u>	<u>TOPIC</u>
3/14	Speaker: Dr. Greg Stock: <i>Ethical Issues in Human Genetics and Cloning Dinner 9</i>
Discussion 10:	<i>Overcoming Obstacles to Gene Therapy What Cloning Means for Gene Therapy Gene Doping</i>

3/16 **FINAL ALL-CLASS ORAL EXAM & CLASS PROJECT DUE**

TEXT READING ASSIGNMENTS FOR LECTURES AND DISCUSSIONS:

INTRODUCTION TO BIOTECHNOLOGY

LECTURE 1	Chapter 1
DISCUSSION 1	Chapters 2 & 3
LECTURE 2	Chapter 1
DISCUSSION 2	Chapters 2, 3, & 4
LECTURE 3	Chapter 2
DISCUSSION 3	Chapters 6, 7, 12, & 13
LECTURE 4	Chapter 2
DISCUSSION 4	Chapters 8 & 11
LECTURE 5	Chapter 3
DISCUSSION 5	None - Review
LECTURE 6	Chapter 5, 6, 7, 9, & 10
DISCUSSION 6	Chapters 8
LECTURE 7	Chapter 12
DISCUSSION 7	Chapters 11 & 13
LECTURE 8	Chapter 12
DISCUSSION 8	None
LECTURE 9	Chapters 8 & 11
DISCUSSION 9	Chapter 5
LECTURES 10 - 12	None

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.

DISCUSSION TWO – Using Genes and Genomics to Make Drugs

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.
4. Kathryn Brown, *The Human Genome Business Today*. Scientific American, July, 2000, **282 (1)**, 50-55.

DISCUSSION THREE – Using Animals and Plants as Drug Factories

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. William H. R. Langridge, *Edible Vaccines*, Scientific American, September, 2000, **283 (3)**, 66-71.
4. Kathryn Brown, *Seeds of Concern*, Scientific American, April, 2001, **284 (4)**, 52-57.
5. Editorial, *Green Gene Revolution*, Scientific American, August, 2004, **291 (2)**, 8.

DISCUSSION FOUR – Identifying and Testing for 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.
3. Jeff Wheelwright, *Testing Your Future*. Discover, July 2003, **24 (7)**, 35-40.
4. Nell Boyce, *A Laws Fetal Flaw*. U.S. News & World Report, **July 21, 2003**, pgs. 48-51.

DISCUSSION FIVE –No Articles For Discussion Five**DISCUSSION SIX – 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.

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. Robert Lanza and Nadia Rosenthal, *The Stem Cell Challenge*. Scientific American, June, 2004, **290 (6)**, 93-99.
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. Dirk M. Nettelbeck and David T. Curiel, *Tumor-Busting*. Scientific American, October 2003, **289 (4)**, 68-75.
3. Stephen H. Friend and Roland B. Stoughton, *The Magic of Microarrays*. Scientific American, February, 2002, **286 (2)**, 44-53.

4. Michael D. Lemonick and Alice Park, *New Hope For Cancer*, Time, **May 28, 2001**, pgs 63-69.

Honors Collegium 70A Winter 2006

Page Seven

DISCUSSION NINE - Anthrax, Flu, and Defending Against Bioweapons

1. John T. Young and R. John Collier, *Attacking Anthrax*. Scientific American, March, 2002, **286 (3)**, 48-59.
2. Jeffery K. Taubenberger, Ann H. Reid, and Thomas G. Fanning, *Capturing a Killer Flu Virus*. Scientific American, January 2005, **292 (1)**, 62-71.
3. Rocco Casagrande, *Technology Against Terror*, Scientific American, October, 2002, **287 (3)**, 83-87.

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.
4. H. Lee Sweeney, *Gene Doping*, Scientific American, July 2004, **291 (1)**, 62-68.

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.

Analysis Of Biological Development -- K. Kalthoff

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

Asking About Life -- Second Edition -- Tobin & Dusheck

Applied Molecular Genetics -- R.L. Miesfeld

Ascent Of Man -- Bronowski

Asking About Cells -- First Edition -- A. Tobin & R.E. Morel

Biochemistry -- Fourth Edition -- L. Stryer

Biology -- Sixth Edition -- Raven & Johnson

Biotechnology - An Introduction -- Barnum

Chemical & Biological Warfare - Eric Cody

Clone: The Road To Dolly & The Path Ahead - G. Kolata

Cloning And The Constitution - I. H. Carmen

Correcting The Code -- L. Thompson

Dealing With Genes -- Berg & Singer

DNA Science -- Miklos & Freyer

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

Eighth Day Of Creation -- Second Edition -- Judson

Essential Cell Biology -- Alberts et al.

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

Genetics -- Analysis Of Genes And Genomes -- Fifth Edition -- Hartl & Jones

Genetics -- Sixth Edition -- Klug & Cummings

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

Honors Collegium 70A Winter 2006
Page Eight

REFERENCE MATERIAL CONTINUED

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.
Molecular Cloning - Third Edition -- Sambrook et al.
Mood Genes: Hunting For The Origins Of Mania & Depression - S. Barondes
Pocket Guide to Biotechnology, R. Schmid (**Excellent Reference Book**)
Plants, Genes, & Crop Biotechnology - Second Edition -- Chrispeels & Sadava
Principles Of Genetics -- Second Edition -- Snustad & Simmons
Principles Of Gene Manipulation -- Sixth Edition - Primrose et al. (**Excellent Reference Book**)
Recombinant DNA -- Second Edition -- Watson et al.
Rosalind Franklin - The Dark Lady Of DNA - B. Maddox
The Double Helix - Watson (**Class Text**)
Understanding DNA & Gene Cloning -- Second Edition -- K. Drlica