

**Honors Collegium 70A**  
**Genetic Engineering In Medicine, Agriculture, & Law**  
**Dr. Bob Goldberg**  
**Winter 2004**

**A Trans Pacific Interactive Distance Education (TIDE) Class Between UCLA & The University of Kyoto**  
**Sponsored by the HHMI University Professors Program**

**LECTURES & FILMS:** Tuesday & Thursday 3:30-6:00 Knudsen 1240B

**DISCUSSION SECTIONS:** Wednesday: 2-4 (Malik), 4-6 (Mai), & 6-8 (JinSun) Life Sciences 2320;  
Thursday: 6-8 (Kyoto – Tomo) Knudsen 1240B

**REQUIRED TEXTS:** *DNA Technology* (I. E. Alcamo)  
*The Double Helix* (J. D. Watson)  
*Scientific American & Other Articles* (CD & HC70A Website)

**OFFICE HOURS:** Thursday 1-3 PM Life Sciences 2832  
Phone: 825-9093; Email: bobg@ucla.edu

**GOLDBERG LAB/TEACHING WEBSITE:** <http://www.mcdb.ucla.edu/Research/Goldberg>

**CLASS WEBSITES:** UCLA: <http://www.lsic.ucla.edu/classes/winter04/hnrs70a.html>  
KYOTO: <http://www.media.kyotou.ac.jp/distlearn/japanese/biology2003/index.html/>

**ADMINISTRATIVE ASSISTANT:** Greta Nelson, Life Sciences 2835 (825-3270/gnelson@lifesci.ucla.edu)

**TEACHING ASSISTANTS:** Malik Francis (mfrancis@mednet.ucla.edu), Mai Pham (AF99gal@aol.com),  
JinSun Choi (jinsunc@ucla.edu), Tomokazu Kawashima (tomokazu@ucla.edu)

**TEACHING ASSISTANT OFFICE HOURS:** Monday 11-1 (Mai); Tuesday 11-1 (Malik); Wednesday 11-1  
(JinSun); Friday 11-1 (Tomo), 1-3 (Mai), 3-5 (Malik & JinSun)

**LECTURES:** Lectures will be recorded digitally and can be viewed on either the UCLA or Kyoto class websites.

**FILM/SPEAKER DISCUSSIONS:** Guest speakers and films will be used to highlight the impact of genetic engineering on society and will be on specific Thursdays 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 evening of each week, a take-home quiz will posted on the class website that 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.

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**ESSAY:** You will write an essay on *The Double Helix* by J. D. Watson. The essay will count 100,000 points and will be graded for content, style, and grammar. Essay guidelines will be handed out in class.

**The *Double Helix* Essay is due at the beginning of class on Tuesday, January 27 (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/hhmi-index.htm>.

The movie will be shown to the entire class on **Tuesday, March 16 (Week 10)** and will count 75,000 points.

**EXAMS:** Exams include a **Take-Home Exam** and an **All-Class Oral Exam**. Take-Home Exam questions will be handed out in class during Week 5. The Oral Exam questions will be handed out on the last lecture day of class (March 11). The Take-Home Exam will count 350,000 points and the All-Class Oral Exam will count 150,000 points. The Exam Schedule is:

**Take-Home Exam: Due Tuesday, February 24 at the beginning of class (Week 8)**

**All-Class Oral Exam: 3:30 – 6 PM, Tuesday, March 16, Knudsen 1240B (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:

	<u>Total Points</u>	<u>% Grade</u>
Essay	100,000 points	10%
Movie Project	75,000 points	7.5%
Discussion Quizzes	225,000 points	22.5%
Discussion Participation	100,000 points	10%
Take-Home Exam	350,000 points	35%
<u>All-Class Oral Exam</u>	<u>150,000 points</u>	<u>15%</u>
<b>TOTAL</b>	<u>1,000,000 points</u>	<u>100%</u>

**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:**

<b>DATE</b>	<b>TOPIC</b>
1/8	<b>Lecture 1:</b> <i>The Age of DNA – What is Gene Engineering?</i> <b>Demonstrations:</b> DNA Spooling & Classical Genetic Engineering <b>Film:</b> <i>Cutting &amp; Splicing of DNA</i>
1/13	<b>Lecture 2:</b> <i>What Are Genes?</i>
1/15	<b>Lecture 3:</b> <i>How Do Genes Work &amp; How Are They Detected?</i> <b>Film:</b> <i>Kerry Mullis &amp; PCR</i>
<b>DISCUSSION 1:</b>	<i>The Manipulation of Genes</i> <i>Recombinant DNA Debate</i> <i>A Twist of Fate</i> <i>The Future of Medicine</i>
1/20	<b>Lecture 4:</b> <i>How Are Genes Cloned &amp; Engineered?</i> <b>Demonstrations:</b> Gel Electrophoresis & Bacterial Gene “Cloning”
1/22	<b>Movie:</b> <i>The Race For the Double Helix</i>
<b>DISCUSSION 2:</b>	<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>
1/27	<b>Lecture 5:</b> <i>21<sup>st</sup> Century Genetic Engineering Applications</i> <b>DOUBLE HELIX ESSAY DUE</b>
1/29	<b>Film:</b> <i>History’s Harvest</i> <b>Speaker:</b> <b>Dr. Alan Mc Hughen</b> -- <i>GMOs: What’s All the Fuss About?</i>
<b>DISCUSSION 3:</b>	<b>Play:</b> <i>Golden Rice</i> <i>Edible Vaccines</i> <i>Seeds of Concern</i> <i>Transgenic Livestock As Drug Factories</i>
2/3	<b>UCLA KYOTO EXCHANGE WEEK</b> <b>Lecture 6:</b> <i>Science &amp; the Constitution: How Is Science Regulated?</i>
2/5	<b>Lecture 7:</b> <i>Science &amp; the Constitution: Who Owns Our Genes?</i> <b>Speaker:</b> <b>Dr. Richard Hamilton</b> -- <i>The Making of a Biotech Business</i>
<b>DISCUSSION 4:</b>	<i>Chromosome Mapping With DNA Markers</i> <i>Grading the Gene Tests</i> <i>Testing Your Future</i> <i>A Laws Fetal Flaw</i>

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### LECTURE SCHEDULE CONTINUED:

<b>DATE</b>	<b>TOPIC</b>
2/10	<b>Lecture 8:</b> <i>The Human Genome Project: Potential for Immortality</i> <b>TAKE-HOME EXAM QUESTIONS HANDED OUT</b>
2/12	<b>Films:</b> <i>Murder, Rape, &amp; DNA; Genetics &amp; Privacy</i>
<b>DISCUSSION 5:</b>	<b>Play:</b> <i>Trial of the Century</i> <i>When Science Takes the Witness Stand</i> <i>The DNA Detectives</i> <i>Jefferson's Secret</i>
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2/17	<b>Lecture 9:</b> <i>Genetic Sleuthing -- A Molecular Sherlock Holmes?</i> <b>Demonstration:</b> <i>DNA Fingerprinting HC70A Students</i>
2/19	<b>Movie:</b> <i>Lorenzo's Oil</i>
<b>DISCUSSION 6:</b>	<i>Embryonic Stem Cells for Medicine</i> <i>Whose Blood Is It Anyway?</i> <i>The First Human Cloned Embryo</i>
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<b>KYOTO UCLA EXCHANGE WEEK</b>	
2/24	<b>Lecture 10:</b> <i>Identifying Human Origins: Are There Races?</i> <b>TAKE HOME EXAM DUE</b>
2/26	<b>Films:</b> <i>Genetic Prophecy; Perfect Baby</i> <b>Speaker:</b> <i>Ethical Issues in Human Genetics &amp; Cloning</i>
<b>DISCUSSION 7:</b>	<i>Gene Therapy</i> <i>Overcoming Obstacles to Gene Therapy</i> <i>What Cloning Means for Gene Therapy</i>
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3/2	<b>Lecture 11:</b> <i>Genetics, Cloning, &amp; the Law – Past &amp; Present</i>
3/4	<b>Movie:</b> <i>GATTACCA</i>
<b>DISCUSSION 8:</b>	<i>The Genetic Basis of Cancer</i> <i>Tumor Busting</i> <i>The Magic of Microarrays</i> <i>New Hope for Cancer</i>
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3/9	<b>Lecture 12:</b> <i>Genetics, Cloning, &amp; the Law -- Future</i> <b>Film:</b> <i>Knowledge or Certainty</i>
3/11	<b>Films:</b> <i>Ebola; Bioterror</i>
<b>DISCUSSION 9:</b>	<i>Attacking Anthrax</i> <i>Technology Against Terror</i> <i>Vigilance Defense</i>
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3/16	<b>FINAL ALL-CLASS ORAL EXAM &amp; CLASS PROJECT DUE</b>
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**TEXT READING ASSIGNMENTS FOR LECTURES AND DISCUSSIONS:**

***DNA TECHNOLOGY, 2ND EDITION***

<b>LECTURE 1</b>	Chapter 1
<b>DISCUSSION 1</b>	Chapters 2, 4 & 5
<b>LECTURE 2</b>	Chapters 1 & 2
<b>DISCUSSION 2</b>	Chapters 3, 4, 5, & 6
<b>LECTURE 3</b>	Chapter 3
<b>DISCUSSION 3</b>	Chapters 10 & 11
<b>LECTURE 4</b>	Chapters 4 & 5
<b>DISCUSSION 4</b>	Chapter 9
<b>LECTURE 5</b>	Chapters 6, 10, & 11
<b>DISCUSSION 5</b>	Chapter 9
<b>LECTURE 6</b>	None
<b>DISCUSSION 6</b>	None
<b>LECTURE 7</b>	None
<b>DISCUSSION 7</b>	Chapter 8
<b>LECTURE 8</b>	Chapter 12
<b>DISCUSSION 8</b>	Chapter 8
<b>LECTURE 9</b>	Chapter 9
<b>DISCUSSION 9</b>	None
<b>LECTURE 10</b>	Chapter 9
<b>LECTURE 11</b>	None
<b>LECTURE 12</b>	None

**SUPPLEMENTAL READING:** Reading that complements your textbook will be handed out in class. This material represents selected chapters on DNA, Gene Activity, Recombinant DNA, Genetic Engineering, Human Genetics, Biotechnology, and Medical/Agricultural Applications of Genetic Engineering from introductory biology textbooks. ***These chapters should be read and studied for lectures, discussions, and exams where relevant.*** They represent an up-to-date conceptual resource for learning the material covered in HC70A. Most of the figures in these chapters provide an excellent conceptual view of the major concepts and techniques covered in the class. Keep in mind that “a picture tells a thousand words!”

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**REFERENCE MATERIAL:** These books are on reserve in the Powell Library (<http://ereserves.library.ucla.edu/coursepage.asp?cid=5276>), 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 assignment, the exams, the 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** – Seventh 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** -- Third Edition -- V. Holde et al.  
**Biochemistry** -- Forth Edition -- L. Stryer  
**Biology** -- Sixth Edition -- Raven & Johnson  
**Biology Of Cells** - Fifth Edition --Curtis And Barnes  
**Biotechnology** - An Introduction -- Barnum  
**Chemical & Biological Warfare** – Eric Cody  
**Clone: The Road To Dolly & The Path Ahead** – G. Kolata  
**Coning 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 (**Class Text**)  
**Double-Edged Sword** -- K. Drlica  
**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 -- 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** -- Second Edition -- Strachan & Read  
**Introduction To Molecular Medicine** -- Leder et al.  
**Life: The Science Of Biology** – Sixth Edition -- Purves et al.  
**Molecular Biology Of The Cell** -- Third Edition -- Alberts et al.  
**Molecular Biotechnology** -- Second Edition -- Glick & Pasternak  
**Molecular Cell Biology** – Forth 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

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### REFERENCE MATERIAL CONTINUED:

**The Cell- A Molecular Approach** -- Cooper  
**The Double Helix** -- Watson (Class Text)  
**Understanding DNA & Gene Cloning** -- Second Edition -- K. Drlica

**DISCUSSION SECTION BIBLIOGRAPHY:** These articles are required reading for Discussion Section and are on the CD that was handed out the first day of class. They also can be downloaded from the HC70A class website.

### 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. Michael D. Lemonick, *A Twist of Fate*. **Time**, February 17, 2003, pgs. 49-61.
4. Walter Isaacson et al., *The Future of Medicine: How Genetic Engineering Will Change Us in the Next Century*. **Time**, January 11, 1999, pgs. 42-91.

### 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. William H. R. Langridge, *Edible Vaccines*, *Scientific American*, September, 2000, **283 (3)**, 66-71.
3. Kathryn Brown, *Seeds of Concern*, *Scientific American*, April, 2001, **284 (4)**, 52-57.

### 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 – Using 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. Barbara Murray and Brian Duffy, *Jefferson's Secret Life*. *U.S. News & World Report*, November 9, 1998, pgs. 58-66.
4. Eugen A. Foster et al., *Jefferson Fathered Slave's Last Child*. *Nature*, November 5, 1998, **396**, 27-28, 1998.

### DISCUSSION SIX – 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. Ian Wilmut, *Cloning For Medicine*. *Scientific American*, December 1998, **279 (6)**, 58-63.
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.
5. Wendy Goldman Rohm, *Seven Days of Creation: The Inside Story of a Human Cloning Experiment*, *Wired*, January, 2004, 122-129.

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**DISCUSSION SEVEN – 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 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.

**DISCUSSION NINE – Anthrax and Defending Against Bioweapons**

1. Matthew S. 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.
4. Mark Williams, Stephen Herrera, and Philip Ross. *Biowarfare: A Collection of Articles*. *ACUMEN*, **1 (4)**, 40-70.