

**Course Description:** BISC406L is the capstone course for the Minor in Biotechnology offered by the College of Letters, Arts and Sciences and the Marshall School of Business. The course will focus on the impact of the biotechnology revolution on health care in this age of molecular medicine. Topics to be covered include: (1) Genetic engineering, molecular cloning and animal cloning; (2) Antibodies and vaccines; (3) Small-molecule drugs; (4) Cell and tissue therapy; and (5) Biotechnology regulation. We will address the ethical, legal and social implications of advances in biotechnology and will discuss governmental regulation of food, drugs, and biotechnology itself. The laboratory exercises will focus on recombinant DNA and other DNA techniques, which have played a fundamental role in the "new biotechnology" revolution.

**Lectures:** TTh 1:00-1:50 PM ZHS472

**Lab:** Thu 2:00-5:00 PM ZHS472

**Instructor:**

Prof. Miriam (Mimi) Susskind

Office: ZHS470. Office hours: by appointment arranged by email.

Prof. Susskind will also be available in the lab portion of the course.

Tel/voicemail: 213-740-5553.

E-mail: susskind@usc.edu

**Laboratory Director:**

Celeste Chong-Cerrillo, Ph.D.

Office: ZHS450

Tel/voicemail: 213-740-6085.

E-mail: chongcer@usc.edu

**Teaching Assistant:**

Nan Chen

Office hours: TBA

E-mail: nanchen@usc.edu

**Web:** Blackboard will be used to communicate with you. The course webpage is <<http://www.usc.edu/dept/LAS/biosci/courses/bisc406.html>>

**Prerequisites:** BISC320L (Molecular Biology) is a firm prerequisite for this course. BISC325 (Genetics) is recommended, as is BISC330L (Biochemistry). You should review the reading assignments that were covered in BISC320L (Molecular Biology) on biotechnology, recombinant DNA, viruses, and cancer, since we will assume you have already learned that material. You are encouraged to refer to your texts from previous BISC courses (see References section of the lab manual) to help you understand the readings in this course.

**Grading:**

Lecture:

Midterm exam 100 pts

Final exam 100 pts

Class participation

& class quizzes 50 pts

Laboratory: 250 pts

TOTAL 500 pts

Letter grades are determined by a curve based upon total points. You are encouraged to look at the exams from previous semesters, which will be posted on Blackboard. Some assigned readings in this semester differ from those in previous semesters, so some exam questions will be mysterious. You will be able to obtain information about grading of your own work via Blackboard.

**Reading Assignments:**

There is no required text for this course. **Lecture periods will usually involve DISCUSSION BY STUDENTS OF READING ASSIGNMENTS. Participation in these discussions is an important part of the course.** A TENTATIVE reading list is given on p. 3-4 of this course syllabus. A document called "Assigned Readings" on Blackboard will specify when each assigned article will be discussed. The Assigned Readings document will be continually revised during the semester, and you should check it often. **You should be prepared to discuss reading assignments on the day listed in the Assigned Readings document ON BLACKBOARD. Most of the assigned readings will be available as PDFs posted on Blackboard for you to print for yourself. A few reading assignments are not available as PDFs and will be given to you as hard copies.** Each student will serve as "point-person" for one or more reading assignments. Prof. Susskind will sometimes provide additional background on the topic in a previous or concurrent lecture.

As discussed under "Prerequisites," you should refer to your textbooks from previous BISC courses. In addition, you will benefit from the use of a good, unabridged dictionary, such as *The American Heritage Dictionary of the English Language* (4th ed.) and an intelligible medical dictionary, such as *Dorland's Pocket Medical Dictionary*, which is sold in the USC HSC bookstore.

**Other Policies:**

1. Exam dates are firm. There are no makeup exams. If you miss an exam due to a true medical emergency, you must, in a timely fashion, give Prof. Susskind documentation on official letterhead from a physician who: (a) is unrelated to you by blood, marriage, and/or adoption; AND (b) is currently licensed to practice medicine by The Medical Board of California (see their website); AND (c) is willing to provide confirmation by phone that he or she saw you. A psychiatric excuse should be from an M.D. who is Board-certified in Psychiatry.
2. Regrading of lecture exams will be done only by Dr. Susskind, and only within one week of the day the exam is initially returned to the class. To request a regrade, give Prof. Susskind your exam and a **typewritten** explanation why you believe you should have received more points.
3. The only assignments for extra credit are a few questions in the lab manual (marked EXTRA CREDIT) and an occasional question in class (announced as extra credit), to stimulate discussion. No special assignment for extra credit is given to an individual student or subset of students.
4. You will be able to obtain information about grading of your own work via Blackboard. Final lecture exams will be kept by Prof. Susskind for the required length of time in ZHS470.
5. Academic integrity policies of the university will be **strictly** followed. Infractions can result in severe penalties. An electronic copy of your laboratory Formal Report will be analyzed for plagiarism. No one will be admitted to an exam after the first student has left the exam.
6. It will undoubtedly be necessary to make some adjustments in the syllabus and reading list during the semester.
7. Students with disabilities: Any student requesting academic accommodations based on a disability is required to register with the Office of Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Be sure that the letter is delivered to Dr. Susskind as early in the semester as possible. DSP is located in STU 301 and is open 8:30-5:00, Monday through Friday. The telephone number for DSP is 213 740-0776.

**Lecture/Discussion Schedule:**

No.	Day	Date	Topic	Reading*
1	Tue	28 AUG	Introduction to the course	-
2	Thu	30	Introduction to biotechnology: perspective	-
3	Tue	4 SEP	Introduction to genetic engineering	1,2
4	Thu	6	Proteins as therapeutic agents	3,4
5	Tue	11	Transgenic (TG) animals as bio-reactors	5,6,7
6	Thu	13	Why make recombinant proteins in mammals?	8
7	Tue	18	Hello Dolly	9,10
8	Thu	20	Antibodies	11
9	Tue	25	Antibodies	11
10	Thu	27	Antibodies	11
11	Tue	2 OCT	New-age vaccines and controversies	12,13
12	Thu	4	Monoclonal antibodies as drugs	14,15
13	Tue	9	Drug development	16
14	Thu	11	Advances in drug discovery & delivery	17,18
15	Tue	16	<b>MIDTERM EXAM</b>	
16	Thu	18	Antiviral drugs	19,20
17	Tue	23	Of mice and Mensa	21,22,23
18	Thu	25	Gleevec: a great success story	24,25
19	Tue	30	Receptors as drug targets	26
20	Thu	1 NOV	Controlling pain and brain	27,28,29
21	Tue	6	Intro to cell & tissue therapy	30,31,32
22	Thu	8	Mending hearts	33,34,35
23	Tue	13	A tale of two organs	36,37
24	Thu	15	Clinical trials and biotech regulation	38,39,40
25	Tue	20	Legal issues	41,42,43,44
Thanksgiving - University holiday				
26	Tue	27	Gene therapy	TBA
27	Thu	29	Gene therapy	TBA
28	Tue	4 DEC	Gene therapy	TBA
29	Thu	6	Gene therapy	TBA

**Tue 18 DEC FINAL EXAM (CUMULATIVE) 11 AM - 1 PM**

\*Numbered as in the list below.

Part 1, sessions 3-7, readings 2-10:	Genetic engineering
Part 2, sessions 8-12, readings 11-15:	Antibodies
Part 3, sessions 13-20, readings 16-29:	Small-molecule drugs
Part 4, sessions 21-23, readings 30-37:	Cell and tissue therapy
Part 5, sessions 24-25, readings 38-44:	Regulating biotechnology
Part 6, sessions 26-29, readings TBA:	Gene therapy

**WARNING: This is the TENTATIVE reading list. CHECK THE DOCUMENT "ASSIGNED READINGS" ON BLACKBOARD FOR THE UP-TO-DATE READING LIST.**

- Diamond, J.** 1997. How to make an almond, p. 114-130. *In* Guns, Germs and Steel: The Fates of Human Societies. W.W. Norton & Co. New York.
- Goeddel, D.V., D.G. Kleid, F. Bolivar, H.L. Heyneker, D.G. Yansura, R. Crea, T. Hirose, A. Kraszewski, K. Itakura, and A.D. Riggs.** 1979. Expression in *Escherichia coli* of chemically synthesized genes for human insulin. *Proc. Natl. Acad. Sci. USA* **76**:106-110.
- Glick, B.R., and J.J. Pasternak.** 2003. *Molecular Biotechnology*, 3<sup>rd</sup> ed., p. 256-267. ASM Press, Washington, D.C.
- Stix, G.** 2005. A toxin against pain. *Sci. Am.* **292(4)**:88-93.
- Velander, W.H., H. Lubon, and W.N. Drohan.** 1997. Transgenic livestock as drug factories. *Sci. Am.* **276(1)**:70-74.
- Stix, G.** 2005. The land of milk & money. *Sci. Am.* **293(5)**:102-105.
- Choi, C.Q.** 2006. Old MacDonald's pharm. *Sci. Am.* **295(3)**:24.
- Helenius, A., and M. Aebi.** 2001. Intracellular functions of N-linked glycans. *Science* **291**:2364-2369. Plus p. 2352 showing structures of sugars.

9. **Wilmot, I.** 1998. Cloning for medicine. *Sci. Am.* **279(6)**:58-63. A figure goes across p. 60-61.
10. **Cibelli, J.B., R.P. Lanza, and M.D. West, with C. Ezzell.** 2002. The first human cloned embryo. *Sci Am.* **286(1)**:44-51. A figure goes across p. 46-47.
11. **Clark, M.** 2001. Immunochemical applications, p. 503-530. In C. Ratledge and B. Kristiansen (ed.), *Basic Biotechnology*, 2<sup>nd</sup> ed. Cambridge University Press, Cambridge, U.K.
12. **Rappuoli, R., and A. Covacci.** 2003. Reverse vaccinology and genomics. *Science* **302**:602.
13. **Glass, R.I.** 2006. New hope for defeating rotavirus. *Sci Am.* **294(4)**:46-55.
14. **Gura, T.** 2002. Magic bullets hit the target. *Nature* **417**:584-586.
15. **Stix, G.** 2006. Blockbuster dreams. *Sci. Am.* **294(5)**:60-63.
16. **Berg, J.M., J.L. Tymoczko, and L. Stryer.** 2007. *Biochemistry*, 6<sup>th</sup> ed., Chapter 35: Drug development. W.H. Freeman and Company, New York.
17. **Couzin, J.** 2005. The brains behind the blockbusters. *Science* **309**:728-730.
18. **Langer, R.** 2003. Where a pill won't reach. *Sci. Am.* **288(4)**:50-57.
19. **Laver, W.G., N. Bischofberger, and R.G. Webster.** 1999. Disarming flu viruses. *Sci. Am.* **280(1)**:78-87.
20. **Haseltine, W.A.** 2001. Beyond chicken soup. *Sci. Am.* **285(5)**:56-63.
21. **Tsien, J.Z.** 2000. Building a brainier mouse. *Sci. Am.* **282(4)**:62-68.
22. **Hall, S.S.** 2003. The quest for a smart pill. *Sci. Am.* **289(3)**:54-65.
23. TBA
24. **Goldman, J.M., and J.V. Melo.** 2001. Targeting the BCR-ABL tyrosine kinase in chronic myeloid leukemia. *N. Engl. J. Med.* **344**:1084-1086.
25. **Drucker, B.J., M. Talpaz, D.J. Resta, B. Peng, E. Buchdunger, J.M. Ford, N.B. Lydon, H. Kantarjian, R. Capdeville, S. Ohno-Jones, and C.L. Sawyers.** (2001). Efficacy and safety of a specific inhibitor of the BCR-ABL tyrosine kinase in chronic myeloid leukemia. *New Engl. J. Med.* **344**:1031-1037.
26. **Kenakin, T.** 2005. New bulls-eyes for drugs. *Sci. Am.* **293(4)**:50-57.
27. **Basbaum, A.I., and D. Julius.** 2006. Toward better pain control. *Sci. Am.* **294(6)**:60-67.
28. **Nicoll, R.A., and B.E. Alger.** 2004. The brain's own marijuana. *Sci. Am.* **291(6)**:68-75.
29. **Stix, G.** (2007) Better ways to target pain. *Sci. Am.* 296(1):84-88.
30. **Pedersen, R.A.** 1999. Embryonic stem cells for medicine. *Sci. Am.* **280(4)**:68-73.
31. **Lanza, R., and N. Rosenthal.** 2004. The stem cell challenge. *Sci. Am.* **290(6)**:92-99. With editorial, p. 12.
32. **Cyranoski, D.** (2007). Simple switch turns cells embryonic. *Nature* **447**:618-619.
33. **Leinwand, L.A.** 2003. Hope for a broken heart? *Cell* **114**:658-659.
34. **Cohen, S., and J. Leor.** 2004. Rebuilding broken hearts. *Sci. Am.* **291(5)**:45-51.
35. **Couzin, J.** 2006. Teams identify cardiac 'stem cell.' *Science* **314**:1225.
36. **Chung, S.Y.** 2006. Bladder tissue-engineering: a new practical solution? *Lancet* **367**:1215-1216.
37. **Visvader, J.E., and G.J. Lindeman.** 2006. Mammary stem cells and mammapoiesis. *Cancer Res.* **66**:9798-9801.
38. **Zivin, J.A.** 2000. Understanding clinical trials. *Sci. Am.* **282(4)**:69-75.
39. **Michaels, D.** 2005. Doubt is their product. *Sci. Am.* **292(6)**:96-101.
40. **Kahn, J.** (2007). Race in a bottle. *Sci. Am.* **297(2)**:40-45.
41. **Gardner, R., and R. Watson.** 2005. A patchwork of laws. *Sci. Am.* **293(1)**:A16-A21. (Special Report: The future of stem cells.)
42. **Stix, G.** 2006. Owing the stuff of life. *Sci. Am.* **294(2)**:76-83.
43. **Minkel, J.R.** 2006. Uninformed consent. *Sci. Am.* **295(4)**:22-24.
44. **Groopman, J.** 2006. The right to a trial. *The New Yorker*, Dec. 18., p. 40-47.  
PDF scan is posted on Bb. For textonly viewing, please go to [www.jeromegroopman.com/articles/right-to-trial.html](http://www.jeromegroopman.com/articles/right-to-trial.html).

You see, wire telegraph is a kind of a very, very long cat. You pull his tail in New York and his head is meowing in Los Angeles. Do you understand this? And radio operates exactly the same way: you send signals here, they receive them there. The only difference is that there is no cat. **Albert Einstein**

# Introduction to the Biotechnology Laboratory Policies

Laboratory: SCI 472, Thursdays, 1:00 p.m. – 5:00 p.m.

Laboratory Director: **Celeste Chong-Cerrillo, Ph.D.**

Office: ZHS 450

Phone: (213) 740-6085

Email: chongcer@usc.edu

Office Hours: during labs and by appointment only

TA: Nan Chen

Email: nanchen@usc.edu

Office Hours: TBA

Required Texts: “Biotechnology Laboratory Manual”, Fall 2007, Celeste Chong-Cerrillo & Miriam Susskind (USC Custom Publishing)

Web Site: Blackboard (<https://blackboard.usc.edu>)

## General Policies

You are required to attend all lab sessions. You are also required to remain for the entire lab session or until excused by your TA. You will not be able to make up any missed labs. If a student misses a lab due to a true emergency situation (accompanied with an acceptable written excuse), it will be at the discretion of the Laboratory Director to determine whether the lab will be made up.

Please come to class and lab on time and do not schedule any appointments during your regular lab period. ***Some labs may start at the beginning of class (1:00 p.m.)*** and then continue during regular lab hours.

Come to lab prepared (i.e., read and know your lab exercise before you come).

You and your partner will be assigned a set of Pipetman® micropipettors that you will use throughout the semester. Please properly handle and maintain these micropipettors (see Appendix A). They are expensive! In addition, if you over- or underset the volume, you will ruin the calibration which could alter the outcome of your experiments.

All students must sign and abide by the “Laboratory Safety Rules and Regulations”.

Keep the ringers of your cell phones either off or on vibrate. If you need to speak on the phone to anyone for any reason during class, take your conversations out of the room and down the hall (away from Dr. Chong-Cerrillo’s office).

## Laboratory Grade

The laboratory grade, worth 250 points, breaks down as follows:

3 Quizzes (5 points each)	15
9 Pre-lab Reports (5 points each)	45
1 Formal Report	50
5 Mini Reports (20 points each)	100
RFLP Unknown Report/Identification	30
<u>Subjective*</u>	<u>10</u>
<b>Laboratory Total</b>	<b>250</b>

\*based on class participation, attendance, initiative, attitude

*Note: There may be changes in the point distribution depending on the outcome of experiments.*

### Laboratory Quizzes

Lab quizzes will be at the beginning of the lab session and can cover material from previous labs or material from that day's lab. If the lab starts at 1 pm, then the quiz will start at 1 pm and not 2 pm.

Your quizzes will be handed back to you and reviewed in lab. If you feel something should be reviewed for a regrade, you must hand it back to your TA by the end of the lab session with a thoroughly written explanation for why you think it should be regraded. Anything brought out of the lab will not be regraded. Also, the entire question will be regraded, which may raise or lower your score.

If a student misses a quiz due to a true emergency (accompanied with an acceptable written excuse), the Laboratory Director may, at her discretion, either schedule a make-up or permit the use of the average of other quizzes in determining the grade.

### Laboratory Reports

Please refer to the "Laboratory Report Format Guidelines" (pg. xi) for policies regarding all lab reports.

### Posting of Grades

Your course and lab grades will be posted on Blackboard (<https://blackboard.usc.edu>). It is the student's responsibility to notify the TA or Lab Director ASAP in the event of any mistakes in your posted grade.

### Academic Accommodations

Students requesting academic accommodations based on an academic disability are required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP when adequate documentation is filed. Please be sure the letter is delivered to Dr. Susskind as early in the semester as possible. DSP is open Monday - Friday, 8:30 am - 5:00 pm, Student Union 301, Phone: (213) 740-0776.

## Biotechnology Laboratory Schedule

Wk	Date	Chapter	Laboratory	Lab Events
1	8/30	1	Lab Orientation The Fundamentals	
		2	Restriction Enzyme Digestion of Phage Lambda DNA in Silico <sup>§</sup>	
2	9/6	3	Restriction Enzyme Digestion and Analysis of Phage Lambda DNA	Pre-lab Report; Chap. 2 Mini Report due
3	9/13		Restriction Enzyme Digestion and Analysis of Phage Lambda DNA (cont'd)	Pre-lab Report
4	9/20	4	Restriction Fragment Length Polymorphism (RFLP) Unknown, Session 1	Pre-lab Report; Chap. 3 Mini Report due
5	9/27	4	RFLP Unknown, Session 2	Pre-lab Report
		5	Enzyme-Linked Immunosorbent Assay (ELISA), Session 1	<b>Quiz 1</b>
6	10/4	4	RFLP Unknown, Session 3	
		5	ELISA, Session 2	Pre-lab Report
7	10/11	6	Purifying DNA from your Cheek Cells	Chap. 5 Mini Report due
8	10/18	7	PCR & Sequencing of the HV1 of the mtDNA CR	Pre-lab Report; Chap. 4 Mini report / ID due
9	10/25		PCR & Sequencing of the HV1 of the mtDNA CR (cont'd)	<b>Quiz 2</b>
		8	Computer-Assisted Sequence Analysis <sup>§</sup>	
10	11/1	9	DNA Cloning by Polymerase Chain Reaction, Part I - Cloning & Transformation	Pre-lab Report
11	11/8		DNA Cloning by PCR, Part I (cont'd)	Chap. 8 Mini Report due
12	11/15		DNA Cloning by PCR, Part II - Looking for Mr. Good Clone	Pre-lab Report
13	11/22	<i>Thanksgiving - University Holiday</i>		
14	11/29	9	DNA Cloning by PCR, Part III - Plasmid Mini Prep	Chap. 9, Part I & II Mini Report due
15	12/6		DNA Cloning by PCR, Part IV - Confirmation of Plasmid Structures by <i>EcoRI</i> Cleavage	Pre-lab Report

<sup>§</sup>home-based exercise