

BISC 406L: Biotechnology

4 Units

Fall 2017

Lecture:

Tu and Th 1:00-1:50 p.m.

Lab:

Th 2:00-5:00 p.m. (sometimes we will begin lab at 1:00, followed by lecture)

Room: ZHS 472

Instructor: Christa Bancroft, Ph.D.

Office: ZHS 470

Office Hours:

M: 10:45-11:45 a.m. and Th 11:45-12:45 p.m.

Contact Info:

Email: cbancrof@usc.edu (best choice)

Phone number: 213-740-5552

I will typically reply to emails within 24 hours during the workweek and 48 hours over the weekend.

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

Office: ZHS 450

Contact Info: chongcer@usc.edu

Teaching Assistant: TBD

Office:

Office Hours:

Contact Info:

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) Recombinant DNA technology; (2) Genomics and Proteomics; (3) Manipulating Prokaryotic and Eukaryotic gene expression; (4) Molecular Diagnostics and Therapeutics; (5) Vaccines and Gene Therapy; (6) Genetic Engineering of Plants and Animals and; (7) 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 techniques, which have played a fundamental role in the "new" biotechnology revolution.

Learning Objectives

Explain the difference between historical biotechnology and modern biotechnology.

Provide examples on how to use microbes and mammalian cells for the production of pharmaceutical products.

Explain the concept and application of monoclonal antibody technology and the development of vaccines.

Explain the general principles of using DNA technology to generate transgenic plants, animals and microbes.

Provide examples of current applications of biotechnology and advances in different areas: medical, microbial, environmental, bioremediation, agricultural, plant, animal, and forensic science.

Name important regulatory divisions of government and demonstrate explain types of oversee that they administer.

Discuss ethical implications of biotechnology research and development.

Design an experiment with step-by-step instructions to address a research problem.

Demonstrate proficiency of technical skills in a variety of biotechnology methods.

Explain relevant background content, interpret data and critically evaluate conclusions of a scientific research paper. Effectively communicate the information to peers in a classroom setting during discussions and presentations.

Prerequisite: BISC 320L

Recommended Preparation: BISC 313 or BISC 325

Course Notes

Lectures: The lecture slides will be posted on the course Blackboard internet site as .ppt and .pdf files (<https://blackboard.usc.edu>). All course materials, information, announcements and grades will be posted on Blackboard until the end of the semester.

Class lectures periods will either be lectures given by the instructor (labeled Lect. on syllabus calendar) or discussions of reading assignments by students (labeled Disc. in bold red on syllabus calendar). Participation in these discussions is an important part of the course. A TENTATIVE reading list is given in the course syllabus below the topic calendar. If we deviate from this version of the reading list, a new, dated version of this syllabus will be posted on Blackboard. You should be prepared to discuss reading assignments on the days specified as discussions. Questions will be assigned ahead of time that each student will answer and discuss during the discussion period.

It is important to attend all of the lectures during the course and to take good notes for study. Prior to attending each lecture, it is important to have read the appropriate papers. However, many of the lectures will contain new and additional information that is not in those readings. Examinations will be based on information in lecture slides, communicated during lecture, discussed during class discussions and presented in assigned readings. In studying for examinations, complete and accurate lecture and discussion notes are of prime importance.

Lecture and Discussion Absences:

Attendance at all lecture and discussion sections is expected. If you must miss a discussion due to illness or valid USC travel, please present Dr. Bancroft with evidence of the reason for absence and you will be allowed to make-up the discussion assignment within 1 week of the missed lecture period.

Exams:

In case the midterm exam must be missed for legitimate reasons, discuss the situation with the course instructor **prior** to the exam, if possible. If the midterm is missed for an emergency or for a valid health reason (with written documentation), the score of the final exam will be used to comprise your total point score for course exams.

Regrades:

In the event an error is made in the grading of your exam, written submittal a description of the error, using the regrade form posted on Blackboard, with the exam should be returned to Dr. Bancroft within a week after receiving your graded exam. After this time period, exams will not be regraded.

Email Communication:

To ensure privacy, only student's USC email accounts may be used for email communications. Students are responsible for understanding the content of email messages that the instructor sends to their USC accounts. Therefore, each student must check their USC email regularly and make sure their account is not over quota, so new messages can be received.

Required Readings and Supplementary Materials

There is no textbook for the course. All reading assignments will be posted on Blackboard in .pdf format for you to access.

Description and Assessment of Assignments

Midterm and Final Exams will include multiple choice, short answer and mathematical problems that can be done without a calculator. **Classroom discussion questions** will be assigned to each lab partner group a week ahead of the class discussion. Pairs will present relevant data and figures to answer the questions during class discussion time. Points will be awarded based in participation of each member and correctness of answer.

Student presentations will occur during the last three weeks of class. Presentation dates will be assigned at least 3 weeks ahead of the first scheduled presentation. Detailed information about this assignment is posted on Blackboard under Course Documents. During group presentations attendance is mandatory and all students are expected to listen attentively and ask questions of other groups. Missing another group's presentation without a valid excuse will result in a 5 pt. deduction from your own presentation score.

Laboratory work assignments are discussed in more detail in the laboratory manual.

Grading Breakdown

The course grade will be based upon 625 possible points:

Assignment	Points	% of Grade
Midterm Exam	150	24
Final Exam	150	24
Classroom Discussion	40	6.4
Student Presentations	30	4.8
Laboratory	255	40.8
TOTAL	625	100

Course letter grades:

Course final grades will be determined using the following scale:

A	90-100
A-	87-89.9
B+	82-86.9
B	77-81.9
B-	72-76.9
C+	67-71.9
C	62-66.9
C-	57-61.9
D+	52-56.9
D	49-51.9
D-	46-48.9
F	45 and below

Student Presentation Guidelines and Rubric

Will be posted to Blackboard website under Content and “Student Presentations”.

Grading Timeline

Grades for Midterm Exams will be posted within one calendar week following the exam date.

Course Schedule:

Wk	Type	Date	Lecture Topic	Reading
1	Lect.	Aug 22	Intro to Biotechnology	1
	Lect.	Aug 24	Recombinant Proteins	2
2	Lect.	Aug 29	Recombinant Proteins	2
	Lect.	Aug 31	Immunology, pt.1	3
3	Lect.	Sept 5	Immunology, pt.2	3
	Disc.	Sept 7	Vaccine Development	4 and 5
4	Disc.	Sept 12	Cancer Vaccines	6 and 7
	Lect.	Sept 14	DNA Technology	8
5	Disc.	Sept 19	DNA Techniques in forensics	9/9a
		Sept 21	No Lecture, Lab only	
6	Disc.	Sept 26	DNA Techniques in diagnostics	10
	Lect.	Sept 28	Drug Development	11
7	Disc.	Oct 3	Monoclonal Antibodies as Drugs	12
	Disc.	Oct 5	Drugs for Genetic Diseases	13
8		Oct 10	Midterm Exam	
	Lect.	Oct 12	Plant Biotechnology	14
9	Disc.	Oct 17	Plant Biotechnology	15 and 16
	Disc.	Oct 19	Harvest of Fear Video and Discussion	www.pbs.org/wgbh/harvest
10	Lect.	Oct 24	Animal Biotechnology	17
	Lect.	Oct 26	Intro to Cell Therapy	18
11	Disc.	Oct 31	Tissue Engineering	19 and 20
	Disc.	Nov 2	Stem Cell Therapy/Gene Editing	21 and 22
12	Disc.	Nov 7	Gene Therapy/Gene Editing	23 and 24
	Disc.	Nov 9	Animal Engineering	25
13	Disc.	Nov 14	Microbial Biotechnology	26 and 27
	Lect.	Nov 16	Student Presentations	
14	Disc.	Nov 21	Biotechnology Ethics and Regulation	28
		Nov 23	No lecture, Thanksgiving	
15	Lect.	Nov 28	Student Presentations	
	Lect.	Nov 30	Student Presentations	
17		Dec 12	FINAL EXAM: 11 a.m. to 11:50 a.m.	

Readings:

1. **Clark, D. P., and N. J. Pazdernik.** 2015. Basics of Biotechnology. In Clark, D. P., and N. J. Pazdernik. (Authors), *Biotechnology: Applying the genetic revolution*, p. 1-32. Elsevier Academic Press, San Diego, CA.
2. **Clark, D. P., and N. J. Pazdernik.** 2015. Recombinant Proteins. In Clark, D. P., and N. J. Pazdernik. (Authors), *Biotechnology: Applying the genetic revolution*, p. 305-328. Elsevier Academic Press, San Diego, CA.
3. **Clark, M.** 2001. Immunochemical applications. In C. Ratledge and B. Kristiansen (ed.), *Basic Biotechnology*, 2nd ed., p. 503-530. Cambridge University Press, Cambridge, U.K.
4. **Sanders, R. W. et al.** 2016. HIV's Achilles' Heel. *Sci. Am.* **315 (6)** : 51-55.
5. **Sanders, R.W. et al.** 2013. A Next-Generation Cleaved, Soluble HIV-1 Env Trimer, BG505 SOSIP.664 gp140, Expresses Multiple Epitopes for Broadly Neutralizing but Not Non-Neutralizing Antibodies. *PLOS Pathogens.* **9 (9)** : 1-20.
6. **Posey, A. D., June, C. H., and Levine, B. L.** 2017. Cancer Killers. *Sci. Am.* **316 (3)** : 38-43.
7. **Shannon L. Maude, M.D., Ph.D. et al.** 2014. Chimeric Antigen Receptor T Cells for Sustained Remissions in Leukemia. *N. Eng. J. Med.* **371 (16)**: 1507-1517.
8. **Clark, D. P., and N. J. Pazdernik.** 2015. Genomics and Gene Expression. In Clark, D. P., and N. J. Pazdernik. (Authors), *Biotechnology: Applying the genetic revolution*, p. 231-268. Elsevier Academic Press, San Diego, CA.
9. **Hawass, Z., et al.** 2010. Ancestry and pathology in King Tutankhamun's family. *JAMA* 303:638-647.
- 9a. on-line appendix: <http://jama.jamanetwork.com/>
10. **Chang, M. T., et al.** 2016. Identifying recurrent mutations in cancer reveals widespread lineage diversity and mutational specificity. *Nature Biotechnology* **34**:155-163.
11. **Berg, J. M., J. L. Tymoczko, and L. Stryer.** 2015. Drug development. In Berg, J. M., J. L. Tymoczko, and L. Stryer (Authors), *Biochemistry*, 8th ed., p. 1033-1056. W. H. Freeman and Company, New York.
12. **LoRusso, P. M., et al.** 2011. Trastuzumab Emtansine: A Unique Antibody-Drug Conjugate in Development for Human Epidermal Growth Factor Receptor 2-Positive Cancer. *Clin. Cancer. Res.* **17 (20)** : 6437-6447.
13. **Welch, E. M., et al.** 2007. PTC124 targets genetic disorders caused by nonsense mutations. *Nature* 447:87-91.
14. **Clark, D. P., and N. J. Pazdernik.** 2015. Transgenic plants and plant biotechnology. In Clark, D. P., and N. J. Pazdernik. (Authors), *Biotechnology: Applying the genetic revolution*, p. 397-424. Elsevier Academic Press, San Diego, CA.
15. **Nordhaus, H.** 2017. Cornboy vs. The Billion Dollar Bug. *Sci. Am.* **316 (3)** : 64-71.
16. **Baum, J. A. et al.** 2007. Control of coleopteran insect pests through RNA interference. *Nature Biotechnology* **25**: 1322 - 1326
17. **Clark, D. P., and N. J. Pazdernik.** 2015. Transgenic Animals. In Clark, D. P., and N. J. Pazdernik. (Authors), *Biotechnology: Applying the genetic revolution*, p. 425-456. Elsevier Academic Press, San Diego, CA.

18. Thieman, W. J. and Palladino, M.A. 2014. Medical Biotechnology, p. 287-305. In W. J. Thieman & M. A. Palladino (Authors), Introduction to biotechnology. Harlow etc.: Pearson Education Limited.
19. Belmonte, J. C. I. 2016. Human Organs from Animal Bodies. *Sci. Am.* **315** (5) : 32-37.
20. Yamaguchi, T. et al. 2017. Interspecies organogenesis generates autologous functional islets. *Nature.* **524** : 191-196.
21. Hall, S. S. 2016. The First Tinkering with Human Heredity May Happen in the Infertility Clinic. *Sci. Am.* **315** (3) : 54-61.
22. Zhou, Q. et al. 2016. Complete Meiosis from Embryonic Stem Cell-Derived Germ Cells In Vitro. *Cell Stem Cell.* **18** (3) 330-340.
23. CRISPR identifies genes that might be targeted to hobble HIV infection Sharon Begley - <https://www.statnews.com/2016/10/25/crispr-identifies-hiv-genes/>
24. Hultquist, J. F. et al. 2016. Platform for Functional Genetic Studies of HIV-Host Interactions in Primary Human T Cells. *Cell Reports.* **17** (5) : 1438-1452.
25. Gantz, V. M. et al. 2015. Highly efficient Cas9-mediated gene drive for population modification of the malaria vector mosquito *Anopheles stephensi*. *PNAS.* **112** (49) : 6736-6743.
26. Lu, T. K. and Purcell, O. 2016. Machine Life. *Sci. Am.* **314** (4) : 58-63.
27. Mimee, M., Tucker, A. C., Voigt, C. A., & Lu, T. K. 2015. Programming a Human Commensal Bacterium, *Bacteroides thetaiotaomicron*, to Sense and Respond to Stimuli in the Murine Gut Microbiota. *Cell Systems*, **1**(1), 62-71. <http://doi.org/10.1016/j.cels.2015.06.001>
28. Clark, D. P., and N. J. Pazdernik. 2015. Bioethics in biotechnology. In Clark, D. P., and N. J. Pazdernik. (Authors), *Biotechnology: Applying the genetic revolution*, p. 665-693. Elsevier Academic Press, San Diego, CA.

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism - presenting someone else's ideas as your own, either verbatim or recast in your own words - is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" <https://policy.usc.edu/scampus-part-b/>. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct>.

Support Systems:

Student Counseling Services (SCS) - (213) 740-7711 - 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention.

<https://engemannshc.usc.edu/counseling/>

National Suicide Prevention Lifeline - 1-800-273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. <http://www.suicidepreventionlifeline.org>

Relationship and Sexual Violence Prevention Services (RSVP) - (213) 740-4900 - 24/7 on call
Free and confidential therapy services, workshops, and training for situations related to gender-based harm. <https://engemannshc.usc.edu/rsvp/>

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: <http://sarc.usc.edu/>

Office of Equity and Diversity (OED)/Title IX Compliance - (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. <https://equity.usc.edu/>

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. <https://studentaffairs.usc.edu/bias-assessment-response-support/>

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. <http://dsp.usc.edu>

Student Support and Advocacy - (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. <https://studentaffairs.usc.edu/ssa/>

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. <https://diversity.usc.edu/>

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible, <http://emergency.usc.edu>

USC Department of Public Safety - 213-740-4321 (UPC) and 323-442-1000 (HSC) for 24-hour emergency assistance or to report a crime.

Provides overall safety to USC community. <http://dps.usc.edu>