HISTORY 30902:
HISTORY OF BIOTECHNOLOGY

COURSE DESCRIPTION

This class examines historical intersections between engineering and biology in the Western world. The course starts off by considering several possible meanings of "biotechnology." Next, it examines how and why different "biotechnologies" have arisen, changed over time, and affected society in specific historical contexts from the 19th century to the present. We will study vaccines and beer-making in the 19th century, cell culture, birth control pills, and DNA sequencing in the 20th century, and 21st-century genome editing and synthetic biology, for example. Overall, this course argues that biotechnologies have always forced human beings to consider whether living and non-living entities are made up of the same fundamental "stuff," and the implications of manipulating living things. Thus, biotechnologies exemplify how science and engineering have impacted society, and vice versa, both historically and today.

COURSE OUTCOMES

By the end of the course, students will be able to:

1. Identify and describe examples of biotechnologies and explain why they are (or could be considered) biotechnologies.
2. Describe and explain how and why major biotechnologies have arisen, changed through time, and impacted society within specific historical contexts, for example by way of interactions with science, medicine, engineering, politics, wars, social movements, industry, economics, gender, race, religion, sexual orientation, age, culture, disability, and class.
3. Investigate the history and social impacts of a biotechnology of their choosing that has not been discussed in depth in this class.
4. Identify and describe this technology; explain why it can be considered a biotechnology; and describe and explain how and why this biotechnology arose, changed over time, and has impacted society within specific historical contexts (using historical methods).
5. Examine and critique the impacts of biotechnologies on society, using some of the principles of bioethics.
6. Understand major questions and methods in the history of science and technology and science and technology studies (STS).

STATEMENT ON FREEDOM OF EXPRESSION

In this class, students are encouraged to exercise their right to free inquiry and expression. You are welcome to express any view on the subject matter introduced by the Instructor or other class members, within the structure of the course. Relatedly, while you are responsible for learning the content of this course, you remain free to take reasoned exception to the views presented and to reserve judgment about matters of conscience, controversy, or opinion. For instance, if/when you encounter ideas that you find offensive, unwise, or immoral, you are encouraged to engage them with reasons, evidence, and arguments.

Your course grade will be based on your academic performance, not on the opinions you express. Our commitment to freedom of expression means that no relevant ideas or positions are out of bounds, but disruptive or disorderly behavior, threats, or harassment are strictly prohibited and will be reported to the Office of the Dean of Students. For further information, see the University's "Commitment to Freedom of Expression" and "Bill of Student Rights" in the University Policies and Statements module on Brightspace.

REQUIRED READINGS

Available at the University Bookstore and Amazon**:**

Hallam Stevens: *Biotechnology and Society: An Introduction* (University of Chicago Press, 2016).

Various additional articles, chapters, and primary sources will be available on Brightspace.

STUDENT RESPONSIBILITIES

1. Attending class sessions.
2. Reading assigned material on time.
3. Actively participating in "Ask the Prof" (ATP) sessions (see below).
4. Completing 3 in-person exams (2 multiple-choice Midterms and 1 written Final).
5. Completing a written draft OR outline of Recorded presentation transcript (see below).
6. Completing a Recorded presentation, with a written transcript, about the history of one biotechnology not discussed in depth in this class and its relevance for society.
7. Maintaining respect for others despite differing views on controversial subjects.

FINAL GRADE DISTRIBUTION & SCALE

Assignment	Points
Participation / "Ask the Prof" (ATP) sessions	150
Midterm exam #1 (multiple choice)	150
Recorded presentation draft OR outline	100
Recorded presentation	200
Midterm exam #2 (multiple choice)	150
Final exam (written)	250
Total	**1000**

A: 930-1000 A-: 900-929
B+: 880-890 B: 830-879 B-: 800-829
C+: 780-799 C: 730-779 C-: 700-729
D+: 680-699 D: 600-679
F: <600

Course Format, Participation, & Attendance

Course Format: This course generally will consist of Tuesday lectures and Thursday discussions. In addition to Ask the Prof (ATP) sessions, most discussions will be guided by questions provided by the Instructor.

University Policies & Statements

For further University Policies and Statements, please see the module on Brightspace.

COURSE SCHEDULE AND READINGS

This schedule is subject to change.

Week 1: Defining "Biotechnology"

LECTURE 1: Course Overview / What is 'biotechnology'?

- Stevens, pp. 15-20 (Ch. 1).

Week 2: Engineering Food & Drink I

LECTURE 2: Brewing Beer & 'Zymotechnology'

- Baxter, Alan G. *Nature Reviews Immunology* 1, no. 3 (2001): 229–32.
- Stevens, pp. 21-32 (Ch. 2).

Week 3: Engineering Food & Drink II

LECTURE 3: Genetically Modified Foods (GMFs)

- Stevens, pp. 97-115 (Chs. 7-8).

Week 4: Public Health in Peace & War I

LECTURE 4: Vaccines

- Plotkin, Stanley A., and Susan L. Plotkin. *Nature Reviews Microbiology* 9, no. 12 (2011): 889–93.
- Plotkin, Stanley. *Proceedings of the National Academy of Sciences* 111, no. 34 (2014): 12283–87.

Week 5: Public Health in Peace & War II

LECTURE 5: Vitamins & Antibiotics

- Quinn, Roswell. *American Journal of Public Health* 103, no. 3 (2013): 426–34.
- Wendt, Diane. *Distillations Magazine*, June 7, 2012.

Week 6: Making Cells Immortal

LECTURE 6: Cell Culture

- Carrel, Alexis. *Science* 73, no. 1890 (1931): 297–303.
- Stevens, pp. 133-143 (Ch. 9).

Week 7: Intervening in Sex & Reproduction

LECTURE 7: The Pill & IVF

- Stevens, pp. 223-235 (Ch. 15).
- Watkins, Elizabeth Siegel. *American Journal of Public Health* 102, no. 8 (2012): 1462–72.

Week 8: FALL BREAK

Week 9: MIDTERM EXAM #1

Week 10: The Dawn of Genetic Engineering

LECTURE 8: Recombinant DNA

- Berg, Paul, David Baltimore, Herbert W. Boyer, Stanley N. Cohen, et al. *Science* 185, no. 4148 (1974): 303.
- Stevens, pp. 35-64 (Chs. 3-4).
- **Supplemental:** Stevens, pp. 65-94 (Chs. 5-6).

Week 11: Wonder Drugs

LECTURE 9: Prozac & Viagra

- Stevens, pp. 279-291 (Ch. 19).

Week 12: Manipulating Biological Time

LECTURE 10: Cloning & Stem Cells I

- Stevens, pp. 236-249; pp. 253-268 (Chs. 16-17).

LECTURE 11: Cloning & Stem Cells II

- Maienschein, Jane. *The American Journal of Bioethics* 2, no. 1 (2002): 12–19.

Week 13: Analyzing, Editing, & Building Genomes

LECTURE 12: Genome Sequencing & Personalized Medicine

- Stevens, pp. 159-173; pp. 174-191; p. 195-206 (Chs. 11-13).
- **Supplemental:** Stevens, pp. 269-276; pp. 292-309 (Chs. 18 and 20).

LECTURE 13: Genome Editing & Synthetic Biology

- Stevens, pp. 345-357 (Ch. 23).
- Doudna, Jennifer A., and Emmanuelle Charpentier. *Science* 346, no. 6213 (2014): 1077, 1258096-1-9.

Week 14: THANKSGIVING HOLIDAY

Week 15: MIDTERM EXAM #2

Week 16: Implications of Biotechnologies

LECTURE 14: Bioethics

- Stevens, pp. 207-219 (Ch. 14).
- **Supplemental:** Stevens, pp. 313-342 (Chs. 21-22).