

Course Information

Biology 140/Chemistry 140 "Science, Policy, and Biology"
Winter 2016

Course goals: In this course, we will explore three current topics in biology that are widely discussed by the news media, portrayed in some popular television shows and movies, and used to make important scientific policy decisions:

1. stem cells and cloning,
2. genetically modified organisms, and
3. the human genome and human genetic diseases.

All three of these topics are likely to have significant impacts on our lives, potentially affecting decisions we make about medical treatments, the environment, and what we choose to eat.

Course outcomes:

For each specific topic (stem cells and cloning, genetically modified organisms, and the human genome and human genetic diseases), students will be able to:

1. describe the underlying biology and explore how scientific reasoning and methods develop this understanding,
2. discuss the types of policy decisions that regulate studies related to this biology or its application to human or environmental health, and
3. evaluate scientific information so that you can distinguish reliable information from propaganda, how scientific controversies can arise when the same scientific questions are approached in different ways, and why some types of biological issues trigger regulatory decisions that can affect both research that would deepen our understanding of the issue and application of the results of that research in policy.

Because scientific research on the topics covered by the course is expanding nearly every day, leading to new policy decisions, the lectures and reading material in the syllabus are designated as *tentative*. Most, perhaps all, of the topics and reading materials will remain as they are listed in the syllabus. However, if new research, new controversies, or new policy issues arise related to the course topics, one or more of the lectures and associated readings may be changed to incorporate the new material. Because the underlying biology of topics covered by this course includes knowledge derived from both biological and biochemical research, students can take this course as either a Biology course or a Chemistry course.

Topics and expectations:

TOPIC I: STEM CELLS AND CLONING: This topic is the source of a lot of controversy that receives considerable media coverage. What's the controversy all about?

Class 1 – What is this course about? This class will provide an overview of the topics covered in this course and how they impact our lives. Students will be able to:

- discuss strategies that will be employed during the course to optimize learning,
- examine how scientific research is portrayed in the media.

You will need to watch the movie GATTACA before Class 2.

Class 2 – GATTACA: how far off is it really? You should identify scientific and policy questions and controversies that the movie GATTACA raised for you and be prepared to discuss them in class. During this lecture we will discuss current technological advances in genetic analysis, including newborn and adult testing in Oregon and other states, and how these relate to what was portrayed in GATTACA. We will also discuss current technology that is leading us closer to designer babies. Students will be able to:

- explain what genetic testing is and what testing is done in Oregon,
- examine why genetic testing is done routinely, and
- evaluate where we currently stand relative to the future envisioned by the movie.

This lecture should also help you begin to formulate questions you and your group will address in your presentations.

Class 3 – How do animals develop? Before you can understand what stem cells are or how an animal is cloned, you need to know the basics of how cells work and the processes that occur during animal development. Students will be able to:

- describe the processes underlying sexual and asexual division of animal cells,
- explain the stages of animal development,
- compare how and when cells influence one another during development, and
- interpret the types of experiments used to reveal the capabilities of developing cells.

Class 4 – What’s the big deal about cloning? The cloning process often involves taking a single cell from an animal and coaxing that cell to develop into an adult. In this lecture we will talk about different types of clones and how they are made. Students will be able to:

- describe the nuts and bolts of the cloning process,
- explain how cloning can be used, and
- discuss why some applications are controversial.

Class 5 – What are stem cells and what do they have to do with cloning? This lecture will draw on the discussions in previous lectures about cell structure and function, animal development, and cloning, to elucidate stem cells. Students will be able to:

- give examples of when and where stem cells arise,
- describe how stem cells can be made, and
- predict what stem cells might be used for.

Class 6 – What policies regulate human cloning and stem cells? The controversies surrounding stem cells and cloning have resulted in sometimes bewildering regulatory policies. Students will be able to:

- evaluate concerns related to human cloning and stem cells,
- evaluate the regulations that govern the use of human stem cells, and
- assess the regulations that govern whether or not humans can be cloned.

Class 7 – First Midterm Exam

TOPIC II: GENETICALLY MODIFIED ORGANISMS: Should you care whether your food is genetically modified? Understanding how it’s done and potential environmental impacts is an important aspect of answering this question.

Class 8 – Introduction to DNA and the genetic code. Before you can understand how plants or animals are genetically modified, you need to know about the molecule that carries the genetic code: DNA. Students will be able to:

- characterize the relationship between DNA, genes, and proteins,

- describe how information is stored in DNA and how changes in DNA structure result in changes in DNA function; and
- explain why the genetic code is the same in all living organisms on earth.

Class 9 – Is it all in our genes? Genetics and epigenetics. The DNA we inherit from our parents encodes all of our traits. However, DNA doesn't operate in isolation; other factors also affect what goes on in our cells. Students will be able to:

- generalize the basis of genetic inheritance,
- identify how environmental factors can affect DNA function and an animal's traits by a process referred to as epigenetics.

Class 10 – Truth in advertising? Understanding scientific controversies. Controversies surround the interpretation of scientific results related to many aspects of human health. Students will be able to:

- draw conclusions from different types of scientific studies,
- examine how scientific controversies arise, and
- articulate what types of research could help to resolve contradictory findings.

Class 11 – Making designer animals and plants by modifying their genes. How are the genes of plants and animals modified? Students will be able to:

- describe how plant and animal husbandry has been used for thousands of years to select species with desirable traits, and
- recognize the modern molecular methods that are used to modify species, and some of the rationale for selecting traits to be modified.

Class 12 – How do GMOs impact the environment? Many different types of organisms have been genetically modified, and it looks like genetically modified organisms (GMOs) are here to stay. Students will be able to:

- describe the types of studies that are necessary to assess the impact of GMOs on the environment, and
- assess how development of new organisms can lead to unanticipated consequences.

Class 13 – What policies regulate GMOs? How do you know whether the food you buy in the grocery store is genetically modified? Who decides whether genetically modified organisms or products derived from them can be marketed? Students will be able to:

- evaluate concerns related to GMOs,
- evaluate the regulations that govern the use of GMOs, and
- assess the regulations that govern GMOs.

Class 14 – Second Midterm Exam

TOPIC III: GENES, GENOMES AND HUMAN DISEASE: Can we genetically modify humans? Should we do so? What do we know about the role of genes in human disease? How safe is our genetic information? Answering these questions has implications for a variety of choices we make about the ways we decide to live.

Class 15 – Genetic diseases and genetic testing. What is a genetic disease and how do you know if you have one? Students will be able to:

- explain the basic principles of human inheritance,
- describe some causes of genetic diseases, and

- analyze methods used to diagnose them.

Class 16 – Genomes R Us? Amazing technological advances over the last few years make it possible for each of us to learn about many of the genetic variations in our DNA. Students will be able to:

- discuss how these variations are found, what they can tell us about our ancestry, and how they may define our physical traits, and
- analyze what they can reveal about our susceptibility to some kinds of genetic diseases.

Class 17 – Time to change your genes? Is there anything that can be done to repair a genetic disease? Students will be able to:

- generalize how research on animal models is contributing to development of therapies for human genetic diseases, and
- relate therapies to the kinds of research that can be done on humans during clinical trials.

Class 18 – Bioethics: What policies regulate human genetic testing and gene modification? Who decides whether someone should be tested for a genetic disease, or have their genes modified? Who decides how genetic information can be used? *You will need to watch the movie Jurassic Park before Lecture 19.* Students will be able to:

- evaluate concerns related to bioethics of human genetic testing,
- evaluate the regulations that govern bioethics of human genetic testing, and
- assess the regulations that govern bioethics of human genetic testing.

Class 19 – Course finale: Can we regenerate extinct species? You should identify scientific and policy questions and controversies that the movie Jurassic Park raised for you and be prepared to discuss them in class. Similar to what is portrayed in the movie, the genomes of several extinct species have recently been elucidated. Students will be able to:

- explain the experiments used to elucidate these genomes as well as methods that could be used to regenerate extinct species and
- evaluate some of the ethical issues involved.

General Course Information:

Instructors: Judith Eisen
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BULA: Joelle Bruckert-Frisk
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For email, please use Bi140 and/or Ch140 in the subject header

Time: Classes: Monday and Wednesday 2-3:20 pm (MCK 240a)
Discussion Sections: Friday 12, 1, 2, 3 pm (KLA 107)

Office Hours:

Judith Eisen	Tuesday	2-3	315 Huestis
Leslie Coonrod	Friday	10-11	334 Willamette
Thom Nelson	Thursday	3-4	360 Onyx
Levi Simonson	Monday	1-2	360 Onyx

Inclement weather:

If there is a winter storm, it is possible that we will cancel classes, even if the University remains open. Cancellation notices will be posted on **Canvas**.

Website:

All class information will be posted on **Canvas**. This course is part of the UO Science Literacy Program (more information at scilit.uoregon.edu).

Work Load:

The standard expectation for a four-credit course is that you will receive four hours of instruction and put in at least twelve hours yourself outside of class doing the reading, preparing assignments, and studying for exams.

Required Text:

Gilbert, S. F., Tyler, A. L., & Zackin, E. (Eds.). (2005). *Bioethics and the new embryology: springboards for debate*. Macmillan (available in the Duck Store)

Required Supplies:

i>clicker (available in the Duck Store): Be sure to register your i>clicker on **Canvas**.

Additional Readings:

There is no perfect textbook for this course. The required textbook covers some of the material we will investigate this term, but not all of it. Therefore, there will be additional readings, outside of the textbook, for most of the lectures and for some of the discussions. These readings are listed in the readings overview and will be posted on **Canvas** as pdf files that can be downloaded. In some cases URLs for websites, podcasts, or videos will be given instead of or in addition to pdfs. In total you can expect to do several hours of reading per week. The course is about science and policy: we won't directly discuss politics, rather we will discuss what triggers policy decisions and how they are made. Since some of the topics we will cover are controversial, there will be some discussion of ethical implications, as this is often what drives policy decisions.

Reading Assignments:

Reading assignments should be completed **before** the class or discussion section for which they are indicated. Reading Questions will be posted on **Canvas** and are due **before** the class for which they are indicated.

Homeworks:

The schedule for Homework Assignments is listed on the syllabus schedule overview. Homeworks will be posted on **Canvas** either the evening following class or the next morning. Homeworks will be due **before** class as posted in the syllabus. Homeworks will concentrate on Class topics, but may also cover Discussion topics.

Exams:

There will be three exams: two midterms and one final. The final will be essentially a third midterm. Exam material is cumulative because concepts carry over from one topic to the next. However, each exam will primarily focus on material covered within the specific section of the course preceding that exam. Exams will include material from class, readings, and discussions. The one of the first two exams with the lowest grade will be dropped. Thus, the exam part of the course grade will be based on the best of the first two exams plus the third exam. Question/answer review sessions for the exams will be held prior to the exams; the time and place will be announced in class.

Surveys:

There will be one online survey that will help us gauge attitudes about science. This will be posted on **Canvas**.

Discussion Assignments:

These are posted on **Canvas** under the appropriate discussion date. The Discussion Assignments should be downloaded, printed, and brought to the Discussion Section. Completed Discussion Assignments will be due at the end of the Discussion Section meeting, according to the schedule. Attendance at Discussion Sections is mandatory. If for some reason you cannot attend your normal Discussion Section, you may not attend another discussion section. If you must miss a Discussion Section, please contact your GTF and Co-Instructor, preferably before your absence.

Grading:

- 30% Exams (15% for one of the first two exams; 15% for the third exam)
- 20% Homeworks (the lowest Homework score will be dropped)
- 30% Discussion (20% for Discussion Assignments; 10% for presentation; the lowest Discussion Assignment will be dropped)
- 10% Reading Questions (the lowest Reading Question score will be dropped)
- 10% Participation (95% i>clicker; 5% surveys; one unexcused absence allowed from class without penalty)

General Policy on Missed Assignments:

The general policy of this course is that: 1) Assignments must be turned in on time; 2) There are no early exams or make up exams; 3) Because Discussion Assignments cannot be completed without attending Discussion Section, there are no make ups for missed Discussion Assignments. If you are ill or have an emergency and cannot attend class, or you miss an exam or an assignment because of illness or an emergency, please contact one of the course instructors. It is best if you can contact an instructor prior to missing an exam or an assignment. If you will miss Discussion Section because of illness or an emergency, please also contact your Co-Instructor and Graduate Teaching Fellow (GTF).

Classroom Etiquette:

1. Please arrive on time. Lectures and discussion sections will start promptly on the hour.
2. You may not use cell phones, iPods, or computers during lectures. This means no emailing, texting, listening to music, or web surfing during lectures.
3. You may not use computers, cell phones or iPods during MOST Discussion Sections. However, some Discussion Section exercises will require that you use a computer or a compatible electronic device. These are listed in the Discussion Section information.
4. Please don't leave lecture early, as this is very disruptive to everyone. If you have an unusual circumstance and must leave early, then please sit near the exit so you can leave unobtrusively.
5. Please be respectful of your fellow students. Many of the subjects we will discuss are controversial, and people in the class may have widely differing views about them. At times we may have discussions of such controversial topics. During these discussions, it is important to respect the feelings and opinions of other members of the class.

Email Etiquette:

If you email a faculty instructor, a co-instructor, a GTF, or other students in the class, please be respectful in your email. When emailing instructors, co-instructors or the GTF, please use Bi140 and/or Ch140 in the subject line of the email. Instructors, co-instructors, and the GTFs will endeavor to answer email as quickly as possible. However, if you send them email in the evening or on weekends, they may not respond to your email until the following weekday.

Inclusiveness:

The University of Oregon is working to create inclusive learning environments. If there are aspects of the instruction or design of this course that results in barriers to your participation, please notify me as soon as possible. You are also welcome to contact the Accessible Education Center (AEC) in 164 Oregon Hall at 346-1155 or uoaec@uoregon.edu.

If you are not a student with a documented disability through AEC, but you would like for us to know about class issues that will impact your ability to learn, we encourage you to come visit with during office hours so that we can strategize how you can get the most out of this course.

Diversity:

Open inquiry, freedom of expression, and respect for difference are fundamental to a comprehensive and dynamic education. We are committed to upholding these ideals by encouraging the exploration, engagement, and expression of divergent perspectives and diverse identities.

Duty to Report:

UO is committed to providing an environment free of all forms of prohibited discrimination and sexual harassment, including sexual assault, domestic and dating violence and gender-based stalking. Any UO employee who becomes aware that such behavior is occurring has a duty to report that information to their supervisor or the Office of Affirmative Action and Equal Opportunity. The UO Health Center and University Counseling and Testing Center can provide assistance and have a greater ability to work confidentially with students. All UO employees are also required to report to appropriate authorities when they have reasonable cause to believe that any child with whom they come in contact has suffered abuse or any person with whom they come in contact has abused a child.

Academic Integrity:

You are expected to do your own work on homework, discussion section assignments, and exams. You are encouraged to discuss ideas with each other and to study together, but don't copy someone else's work and don't allow someone else to copy your work. By taking an online homework, you are certifying that you are the student entitled to log in using a specific set of credentials. Allowing someone else to log in under your name, or logging in under someone else's name, to complete a homework assignment is a breach of university regulations. Similarly, it is a breach of university regulations to use an i>clicker registered to someone else or to allow someone else to use an i>clicker registered to you. All students are expected to conform to the student conduct code (<http://integrity.uoregon.edu/>); students not in compliance will be brought to the attention of the university.

OVERVIEW OF CLASSES, DISCUSSIONS, READINGS, HOMEWORKS, AND EXAMS

Class	Date	Lectures, Discussions, and Exams	Readings and other assignments
TOPIC I: STEM CELLS AND CLONING			
Class 1	1/4	What is this course about?	watch GATTACA before Class 2 (on reserve in Law library)
Class 2	1/6	GATTACA: how far off is it really?	Newborns; Genepeeks; RG Genome; Jolie HOMEWORK #1 DUE BEFORE CLASS
Discussion 1	1/8	Discussion: How can we interpret scientific reports in the media?	Bruzek DISCUSSION ASSIGNMENT #1 DUE AT END OF CLASS
Class 3	1/11	How do animals develop?	Gilbert pp 3-14 & 18-22; 50-52
Class 4	1/13	What's the big deal about cloning?	Gilbert pp 111-121, 123-124, 15-17; Sci Amer
Discussion 2	1/15	Discussion: Group presentations	DISCUSSION ASSIGNMENT #2 DUE AT END OF CLASS
No Class	1/18	Martin Luther King, Jr. Holiday	
Class 5	1/20	What are stem cells and what do they have to do with cloning?	Gilbert pp 143-158; Kolata; Weiss; Pollack
Discussion 3	1/22	Discussion: Fertilization and development	PRESENTATION TOPIC DUE AT BEGINNING OF CLASS DISCUSSION ASSIGNMENT #3 DUE AT END OF CLASS
Class 6	1/25	What policies regulate human cloning and stem cells?	Gilbert pp 136-140; 165-169; http://stemcells.nih.gov/policy http://www.aaas.org/news/stem-cell-resources ; Cressey HOMEWORK #2 DUE BEFORE CLASS
Class 7	1/27	FIRST MIDTERM EXAM	
Discussion 4	1/29	Discussion: Presentation workday	DISCUSSION ASSIGNMENT #4 DUE AT END OF CLASS
TOPIC II: GENETICALLY MODIFIED ORGANISMS			
Class 8	2/1	Introduction to DNA and the genetic code	Gilbert pp 179-191
Class 9	2/3	Is it all in our genes? Genetics and epigenetics	Gilbert pp 227-239; Cloud; Markus; Blackwell
Discussion 5	2/5	Discussion: Isolation of DNA	DISCUSSION ASSIGNMENT #5 DUE AT END OF CLASS
Class 10	2/8	Truth in advertising? Understanding scientific controversies	NOVA; Harmon autism; History of Vaccines; ACS cell phones & cancer; NAS autism HOMEWORK #3 DUE BEFORE CLASS
Class 11	2/10	Making designer animals and plants by modifying their genes	Barnum #1; Nexia; Cowell; Pollack GMO goat; Charles apple; webertube.com/video/8468/eyes-of-nye---genetically-modified-foods ;
Discussion 6	2/12	Discussion: Preconceptions in data interpretation	DISCUSSION ASSIGNMENT #6 DUE AT END OF CLASS
Class 12	2/15	How do GMOs impact the environment?	Butterflies; Boars&Deer; Cornwall; Charles; Yoon
Class 13	2/17	What policies regulate GMOs?	Barnum #2; FDA; NAS; Pollack apple; Pollack salmon https://www.aphis.usda.gov/wps/portal/aphis/ourfocus/biotechnology/sa_regulations/ct_agency_framework_roles/ HOMEWORK #4 DUE BEFORE CLASS
Discussion 7	2/19	Discussion: Do we need genetically modified organisms?	PRESENTATION OUTLINE DUE AT BEGINNING OF CLASS DISCUSSION ASSIGNMENT #7 DUE AT END OF CLASS
Class 14	2/22	SECOND MIDTERM EXAM	
TOPIC III: GENES, GENOMES AND HUMAN DISEASE			
Class 15	2/24	Genetic diseases and genetic testing	NCI Gene Testing; Harmon; Couzin-Frankel 2011; CF 2012; Yong; http://learn.genetics.utah.edu/content/disorders/singlegene/cf/
Discussion 8	2/26	Discussion: Relationship between SNPs, disease, and treatment	DNA & medication DISCUSSION ASSIGNMENT #8 DUE AT END OF CLASS
Class 16	2/29	Genomes R Us?	Macur; Goetz 23&me; ScienceDaily; http://www.kalydeco.com/ HOMEWORK #5 DUE BEFORE CLASS
Class 17	3/2	Time to change your genes?	Gilbert pp 191-197; Barnum #3; Pollack; human SCNT; Wade; Travis; Gallagher; gene therapy breakthrough; Yin
Discussion 9	3/4	Discussion: Presentations	
Class 18	3/7	Bioethics: What policies regulate human genetic testing and gene modification?	Gilbert pp 207-212; Javitt; Collins; BuzzFeed; Harmon; Connor watch Jurassic Park before Class 19 SURVEY DUE BEFORE CLASS
Class 19	3/9	Course finale: Can we regenerate extinct species?	Wade mammoth; Dinosaur; Nicholls; Gray; Kolbert; Rich; Tierney HOMEWORK #6 DUE BEFORE CLASS
Discussion 10	3/11	Discussion: Presentations	
FINAL	3/16	2:45PM WEDNESDAY	