

Course Information

Biology 140/Chemistry 140 "Science, Policy and Biology"
Winter 2013

Course goals: In this course, we will explore three current topics in biology that are widely discussed by the news media and portrayed in some popular television shows and movies: 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 a significant impact on our lives, potentially affecting decisions we make about medical treatments, the environment, and what we choose to eat. For each specific topic, we will examine the underlying biology and explore how scientific reasoning and methods develop this understanding. We will also discuss the types of policy decisions that regulate studies related to this biology or its application to human or environmental health. During the course you will learn how to 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. 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?

Lecture 1 – What is this course about? This lecture will provide an overview of the topics covered in this course and how they impact our lives. We will discuss strategies that will be employed during the course to optimize your learning. During this lecture the class will break into groups that will last throughout the term. You should be part of a group and have gotten to know the other group members during this class period. You will need to watch the movie GATTACA before Lecture 2.

Lecture 2 – How does science impact our lives? 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 strategies to lessen the potential negative impacts while retaining the positive impacts of genome sequencing. We will also discuss current newborn genetic testing done in Oregon and other places and how it compares to what was portrayed GATTACA. At the end of this lecture you should understand what genetic testing is, what testing is done in Oregon, and why genetic testing is done routinely. This lecture should also help you begin to formulate questions you and your group will address in your presentations.

Lecture 3 – What is the relationship between cell structure and function and 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. At the end of this lecture, you should understand the similarities and differences between a variety of cell types, and how structures within these cells function. This information will also be important later in the term, to understand how organisms, including humans, can be genetically modified. In this lecture we will also discuss the processes that occur during

animal development. At the end of this lecture, you should know about the stages of animal development, how and when cells influence one another during development, and the types of experiments used to reveal the capabilities of developing cells.

Lecture 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. At the end of this lecture, you should understand the nuts and bolts of the cloning process, how cloning can be used, and why some applications are controversial.

Lecture 5 – Martin Luther King Holiday

Lecture 6 – What are stem cells and what do they have to do with cloning? This lecture will draw on the discussions in previous lectures of cell structure and function, animal development, and cloning, to elucidate stem cells. At the end of this lecture, you should understand when and where stem cells arise, how they can be made, and what they might be used for.

Lecture 7 – What policies regulate human cloning and stem cells? The controversies surrounding stem cells and cloning have resulted in sometimes bewildering regulatory policies. At the end of this lecture, you should understand the concerns related to human cloning and stem cells, as well as the regulations that govern the use of human stem cells and the regulations that govern whether or not humans can be cloned.

Lecture 8 – 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.

Lecture 9 – 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. At the end of this lecture, you should understand the relationship between DNA, genes, and proteins; how information is stored in DNA and how changes in DNA structure result in changes in DNA function; and that the genetic code is the same in all living organisms on earth.

Lecture 10 – 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. At the end of this lecture, you should understand the basis of genetic inheritance, as well as how environmental factors can affect DNA function and an animal's traits by a process referred to as epigenetics.

Lecture 11 – Truth in advertising? Understanding scientific controversies. Controversies surround the interpretation of scientific results related to many aspects of human health. At the end of this lecture, you should understand what kinds of conclusions can be drawn from different types of scientific studies, how scientific controversies arise, and what types of research could help to resolve contradictory findings.

Lecture 12 – Making designer animals and plants by modifying their genes. How are the genes of plants and animals modified? At the end of this lecture, you should understand how plant and animal husbandry has been used for thousands of years to select species with desirable traits. You should also understand the modern molecular methods that are used to modify species, and some of the rationale for selecting traits to be modified.

Lecture 13 – 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. At the end of this lecture, you should understand the types of studies that are necessary to assess the impact of GMOs on the environment, and how development of new organisms can lead to unanticipated consequences.

Lecture 14 – 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? At the end of this lecture, you should know the answers to these questions.

Lecture 15 – 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.

Lecture 16 – Genetic diseases and genetic testing. What is a genetic disease and how do you know if you have one? At the end of the lecture, you should understand the basic principles of human inheritance, some causes of genetic diseases, and methods used to diagnose them.

Lecture 17 – 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. At the end of this lecture, you should understand how these variations are found, what they can tell us about our ancestry, how they may define our physical traits, and what they can reveal about our susceptibility to some kinds of genetic diseases.

Lecture 18 – Time to change your genes? Is there anything that can be done to repair a genetic disease? At the end of this lecture, you should understand how research on animal models is contributing to the development of therapies for human genetic diseases. You should also understand the kinds of research that can be done on humans during clinical trials.

Lecture 19 – 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? At the end of this lecture, you should be able to answer these questions. You will need to watch the movie Jurassic Park before Lecture 20.

Lecture 20 – 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. At the end of this lecture, you should understand the experiments used to elucidate these genomes as well as methods that could be used to regenerate extinct species. You should also understand some of the ethical issues involved.

General Course Information:

- Instructors:** Judith Eisen
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For email, please use Bi140 and/or Ch140 in the subject header
- Time:** Lectures: Monday and Wednesday 2-3:20 pm
Discussion Sections: Friday 9 am, 12 pm, 2 pm, 3 pm
- Places:** Lectures are in HEC 220; Discussion Sections are in KLA 107
- Office Hours:**
- | | | |
|---------------|-------------|---------|
| Judith Eisen | Thurs 12 pm | 315 HUE |
| Andy Berglund | Wed 10 am | 334 WIL |
| Erica Elliott | Fri 1 pm | 47A COL |
- 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 **Blackboard**.
- Website:** All class information will be posted on **Blackboard**. 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 eight hours yourself outside of class doing the reading, preparing assignments, and studying for exams.
- Required Text:** Gilbert, Tyler & Zackin "Bioethics and the New Embryology"
Sinauer Assoc 2005 (available in the Duck Store)
- Required Supplies:** iClicker (available in the Duck Store)
- 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 **Blackboard** 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 lecture or discussion section for which they are indicated.

Homeworks: The schedule for Homework Assignments is listed on the OVERVIEW OF LECTURES, DISCUSSIONS, READINGS, HOMEWORKS, AND EXAMS. Homeworks will be posted on **Blackboard** either the evening following lecture or the next morning. Homeworks will be due **before** lecture as posted in the syllabus. Homeworks will concentrate on Lecture topics, but may also cover Discussion topics. If you have not previously used Blackboard for homework assignments or tests, prior to doing the homeworks, you should look at "Test Taking in Blackboard" which is available at: <http://library.uoregon.edu/scis/blackboard/help/students.html>

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 lectures, readings, and discussion sections. 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. Exams will probably be a combination of multiple choice, true-false, and short answer questions. The schedule for the exams is listed on the OVERVIEW OF LECTURES, DISCUSSIONS, READINGS, HOMEWORKS, AND EXAMS. Question/answer review sessions for the exams will be held Tuesday, January 29, Sunday, February 24, and Monday, March 18; the time and place will be announced in class.

Surveys: There will be two surveys that will help us gauge attitudes about science. These will be posted on **Blackboard** as indicated in the OVERVIEW OF LECTURES, DISCUSSIONS, READINGS, HOMEWORKS, AND EXAMS.

Discussion Assignments: These are posted on **Blackboard** 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 listed on the OVERVIEW OF LECTURES, DISCUSSIONS, READINGS, HOMEWORKS, AND EXAMS. Attendance at discussion sections is mandatory. If for some reason you cannot attend your normal discussion section, you may not attend another discussion section.

Grading: 40% Exams (20% for one of the first two exams; 20% for the third exam)
20% Homeworks
30% Discussion (15% for Discussion Assignments; 15% for presentation)
10% Participation (95% iClicker; 5% surveys)

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 cell phones or iPods during discussions. During some discussions computers may be allowed. When this is the case, your co-instructor or GTF will inform you.
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, the GTF, or other students in the class, please be respectful in your email. When emailing instructors or the GTF, please use Bi140 and/or Ch140 in the subject line of the email.

Instructors and co-instructors 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:

UO is working to create inclusive learning environments. Please notify the faculty instructors if there are aspects of instruction or design of this course that result in barriers to your participation. Please also notify us if you need to use a computer for taking class notes. You may also wish to contact Disability Services in 164 Oregon Hall at 346-1155 or disabsrv@uoregon.edu.

Plagiarism and cheating will not be tolerated. You are expected to do your own work on lecture 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. All students are expected to conform to the student conduct code (<http://uodos.uoregon.edu/StudentConductandCommunityStandards/StudentConductCode/tabid/69/Default.aspx>); students not in compliance will be brought to the attention of the university.

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

Class	Date	Lectures, Discussions, and Exams	Readings and other assignments
TOPIC I: STEM CELLS AND CLONING			
Lect 1	1/7	What is this course about?	watch GATTACA before Lect 2
Lect 2	1/9	How does science impact our lives? HOMEWORK #1 DUE BEFORE CLASS	X prize; http://genomics.xprize.org/ ; Couzin-Frankel
Disc 1	1/11	Discussion: Group presentations	
Lect 3	1/14	What is the relationship between cell structure and function and how do animals develop? SURVEY DUE BEFORE CLASS	Gilbert pp 3-14 & 18-22; NIH NCBI Cells
Lect 4	1/16	What's the big deal about cloning?	Gilbert pp 111-121, 123-124, 15-17; Sci Amer
Disc 2	1/18	Discussion: Fertilization and development DISCUSSION ASSIGNMENT #1 DUE AT END OF CLASS	
Lect 5	1/21	Martin Luther King Holiday – no class	
Lect 6	1/23	What are stem cells and what do they have to do with cloning?	Gilbert pp 143-158 Kolata; RG cloned monkeys
Disc 3	1/25	Discussion: Scientific Method & Research resources	Kimball Scientific Methods pp 1-5 PRESENTATION TOPIC DUE AT BEGINNING OF CLASS
Lect 7	1/28	What policies regulate human cloning and stem cells? HOMEWORK #2 DUE BEFORE CLASS	Gilbert pp 136-140; 165-169 http://www.aaas.org/spp/cstc/briefs/stemcells/ ; http://stemcells.nih.gov/
Lect 8	1/30	FIRST MIDTERM EXAM	
TOPIC II: GENETICALLY MODIFIED ORGANISMS			
Disc 4	2/1	Discussion: Presentation preparation	
Lect 9	2/4	Introduction to DNA and the genetic code	Gilbert pp 179-191
Lect 10	2/6	Is it all in our genes? Genetics and epigenetics	Gilbert pp 227-239; Cloud
Disc 5	2/8	Discussion: Isolation of DNA DISCUSSION ASSIGNMENT #2 DUE AT END OF CLASS	MEET IN KLA 5
Lect 11	2/11	Truth in advertising? Understanding scientific controversies HOMEWORK #3 DUE BEFORE CLASS	Mooney; Harmon autism; What is Autism; History of Vaccines
Lect 12	2/13	Making designer animals and plants by modifying their genes	Barnum #1; Nexia; Cowell; http://www.webertube.com/video/8468/eyes-of-nye---genetically-modified-foods
Disc 6	2/15	Discussion: Do we need genetically modified organisms? DISCUSSION ASSIGNMENT #3 DUE AT END OF CLASS	PRESENTATION OUTLINE DUE AT BEGINNING OF CLASS
Lect 13	2/18	How do GMOs impact the environment?	Butterflies; Streams; Boars&Deer; Stokstad; Callahan
Lect 14	2/20	What policies regulate GMOs? HOMEWORK #4 DUE BEFORE CLASS	Barnum #2; FDA; NAS; Palca; Maxmen; Perrone
Disc 7	2/22	Discussion: Presentation Preparation DISCUSSION ASSIGNMENT #4 DUE AT END OF CLASS	
Lect 15	2/25	SECOND MIDTERM EXAM	
TOPIC III: GENES, GENOMES AND HUMAN DISEASE			
Lect 16	2/27	Genetic diseases and genetic testing	NCI Gene Testing; Harmon; Couzin-Frankel Feb 2011; CF; Sample
Disc 8	3/1	Discussion: Relationship between SNPs, disease, and treatment DISCUSSION ASSIGNMENT #5 DUE AT END OF CLASS	DNA & medication MEET IN KLA 5
Lect 17	3/4	Genomes R Us? HOMEWORK #5 DUE BEFORE CLASS	Macur; Goetz 23&me; GAO; Joh
Lect 18	3/6	Time to change your genes?	Gilbert pp 191-197; Barnum #3; Behar; Pollack; Ritter; human SCNT
Disc 9	3/8	Discussion: Presentations	
Lect 19	3/11	Bioethics: What policies regulate human genetic testing and gene modification? SURVEY DUE BEFORE CLASS	Gilbert pp 207-212; Javitt watch Jurassic Park before Lect 20
Lect 20	3/13	Course finale: Can we regenerate extinct species? HOMEWORK #6 DUE BEFORE CLASS	Wade mammoth; Pennisi; Viegas; Dinosaur; Gross; Nicholls
Disc 10	3/15	Discussion: Presentations	
FINAL	3/19	3:15 PM	