INTEGB 190 Ethical Implications of Biological Advances
3 Units
MWF 11-12pm with one hour of discussion

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COURSE DESCRIPTION: Explores issues involving biology, technology, and society. Topics covered include genetic information and privacy, genetic evidence in criminal cases, cloning, CRISPR/Cas and gene editing, organ transplants, drug research and development, eugenics, end-of-life issues, vaccine development and human trials, animal use in research, biodiversity preservation, GMOs, human population growth, the biology of race, historical and contemporary conflicts between science and religion, and the power and limitations of the scientific process. Writing-intensive course.

PREREQUISITES: Biology 1B or equivalent (may be taken concurrently) or consent of instructor


A significant portion of the supplemental readings for this course will come from current scientific and popular media. In discussion, students will be expected to compare the presentation of the material in different media sources.

OFFICE HOURS: I encourage you to come to my office for any questions or concerns you may have that weren’t addressed in lecture. If your schedule conflicts with posted hours, we can set up an appointment for a mutually convenient time to meet. E-mailed questions that are pertinent to the entire class can be posted on the course website.

GRADING: A total of 750 points is possible for this course:

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<th>Component</th>
<th>Points</th>
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<tr>
<td>Best three of four exams during the semester</td>
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<tr>
<td>Comprehensive final exam</td>
<td>150</td>
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<td>Reading quizzes in lecture</td>
<td>100</td>
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<td>Term paper</td>
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<td>Short writing assignments</td>
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The grading scale will be as follows:

- 90% and above                         A (675 and above)
- 80% - 89.5%                           B (600-674)
- 70% - 79.5%                           C (525-599)
- 60% - 69.5%                           D (450-524)
- ≤ 59.5%                                F (≤449)

MISSED CLASSES/EXAMS: Five points will be deducted from the course point total for each unexcused absence. Because you have the option of dropping your lowest exam score, I do not allow students to make up missed exams unless they have notified me well in advance.
in advance (i.e., more than 48 hours) that they will not be present in class for some legitimate reason. I will not change the date of the final exam for individual students.

If you practice a faith that does not allow you to attend class on high holidays, you must notify me by the first Wednesday of the semester of any classes you will miss and make arrangements to complete the required work ahead of time.

GENERAL INFORMATION: Ten percent of the possible score will be reduced for each day an assignment is late (including weekends).

Please turn off and put away your cell phones during class. You may use laptops, tablets, etc. for your reading material and to take notes, but I expect all students to be engaged with course material and participate actively in the discussion.

Because the issues we will discuss in this class are sometimes extremely difficult and challenging, it is ESSENTIAL that students feel they are able to state their opinions freely. There will be times you strongly disagree with others in the class. In order to have a productive discussion, however, we will establish some “common ground” rules.

You must expect that your opinions will be questioned by others in the class. You must be prepared to defend an opinion, and be willing to accept that others will not agree. You should also feel you are able to change your mind and restate your opinion without ridicule.

Additionally, I expect you to question others’ opinions in the class, and you must be willing to accept that you may change your mind, or you will not agree, but you will treat other persons in the class with respect and dignity. Occasionally, I may ask you to argue for an opinion with which you disagree in order to better understand the opposing position. Be prepared!

STUDENTS WITH DISABILITIES: If any student feels that he or she has a disability and needs special accommodations, please let me know during the first week of class.

TENTATIVE LECTURE SCHEDULE: dates and topics covered may change!

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<th>Week</th>
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<td>1</td>
<td>Introduction; Discussion Ground Rules, First Writing Exercise</td>
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<td>Gene therapy/germ line therapy—How does gene therapy work? How are the genes introduced into the body? What’s the difference between somatic therapy and germ line therapy? What is the current status of gene therapy trials and treatments in the United States? CURRENT ARTICLES</td>
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<td>Stem cells—Where do stem cells come from? Why are they so powerful and what promise do they hold? Why is there a debate about stem cell lines? Which states in the U.S. are pushing stem cell therapies forward and what has it meant for research in those states? What are other nations doing?</td>
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Genetic information privacy/patents—Should insurance companies have access to your genetic information? Should your employer? If you are part of a study group, like the man who was discovered to be immune to HIV, who owns your genetic information? Can we patent organisms for profit? Some nations, like Iceland, have generated huge genetic databases of their citizens. Should companies have access to that information? Did the citizens know they were giving information that could be used for research companies? How should we ensure consent has been given?

Federal and state criminal DNA databases/ inmate exoneration—some death row and life-sentence inmates have been exonerated through DNA evidence. In Louisiana, appeals courts gave a man who had been in prison for twenty years access to DNA testing ONLY if he waived the right to sue the state for wrongful incarceration if he were found innocent. The DNA evidence excluded the prisoner as the criminal. How powerful is DNA evidence? What safeguards need to be taken to ensure it is reliable? How is DNA evidence used to identify the remains of soldiers who have been dead thirty years, or victims of genocide in Guatemala and Rwanda?

VIDEO

Specific gene cloning, human therapeutic cloning and human whole embryo cloning—What is the difference between cloning a gene for insulin to provide drugs for diabetics, cloning human stem cells for tissue transplants, and cloning a whole human being? What are the pitfalls of whole-organism cloning? What nations have already cloned or are pursuing human cloning?

Trans-species cloning—Is it ethical to put flounder genes into a strawberry so that the fruit is more frost-tolerant? What about human genes into a pig to produce a human protein for hemophiliacs?

The role of pre-natal genetic sex and genetic disease testing and the social consequences—How does sex-choosing technology work? How much does it cost and should insurance cover the cost? Should it be allowed when parents know they carry a male-linked disease, like hemophilia? Should society bear the financial responsibility for children who are born to couples knowing that the child will be born with severe mental and physical defects? When should genetic screening be allowed? For disease? For height?

CRISPR/Cas and gene editing—How does the CRISPR/Cas system work? What are the potential applications of the system, and why does it raise concerns among the scientific community? How do major scientific journals handle submissions on papers that raise ethical concerns?

CURRENT ARTICLES AND OTHER MEDIA SOURCES

EXAM I
Organ transplants—should people who smoke or drink be prioritized for transplanted organs? Should we pursue organ transplants from other mammal species if no human transplants are available? Should we invest in growing tissue cultures to supplement failing organs? Why are “organ farms” unlikely?

Drug research and the global distribution of patented medicines—Why does drug research and development cost so much? Should drug companies provide drugs to people who can’t pay for them? For HIV and other global pandemics, what are the issues surrounding drug availability and distribution in developing nations?

Eugenics—what is the history of eugenics in the United States and abroad? What legislation was passed, and in some cases, remains on the books, to promote eugenics? How do modern countries view eugenics and how are those views shaped by history? Mathematically, does eugenics work? How many generations are needed to remove “undesirable” alleles? Is there such a thing as an undesirable allele?

Assisted reproduction—How do these technologies work? Is it responsible for IVF clinics to re-implant more than 2 fertilized eggs? What happens to the embryos that aren’t implanted? Do the genetic parents of embryos have joint custody? Is it responsible to use IVF technology to help a 55-year old woman conceive a child? Should insurance companies cover the costs?

Assisted suicide/euthanasia—Do we have the right to determine how and when we die? What circumstances, if any, are acceptable for suicide? How can we be sure these are the wishes of the patient? Who should make decisions for a patient: the spouse, the child, the parent, or the family? How many states in the U.S. have laws permitting some form of suicide for terminally ill patients?

Vaccine development and human vaccine trials—How were vaccines historically developed? How do we decide when it is safe to try vaccines on humans? When using live vaccines, we expect some unintentional infection—how much is acceptable? Is it ethical to try vaccines on people who are at extreme risk for a disease without certainty of vaccine safety? Is it ethical to deny them the vaccine?

EXAM II

Is there a moral responsibility to preserve biodiversity?—How do humans view their relationship with the other organisms on the planet? Why
should we care about biodiversity? Given limited time and resources, which species should be given priority for conservation? How does the U.S. Endangered Species Act determine what is worth protecting? Is this the best criterion?

Do developed nations have the right to dictate environmental agendas in developing nations?—What are the policies of the World Bank, the International Monetary Fund, and non-government organizations around the world when dealing with tradeoffs between economics, political stability, and the environment?

Should we use genetic technologies to boost numbers of endangered species?—What role does technology play in maintaining a species’ genetic integrity? Does genetic integrity matter? How do some of these technologies work for critically endangered species in the wild? Should we resurrect extinct species? Even if they are known pathogens?—Should we try to use genetic technology to resurrect a dinosaur or a mammoth? Should we store vials of smallpox and other diseases that have been eradicated in the wild? We can now recreate smallpox de novo in the lab. Should we?

Research animal welfare issues.—When, if ever, is it reasonable to test products or drugs on animals? What rights do laboratory animals have? How should we decide what animals and tests are valuable to science? Should research animals be wild-caught?—Sometimes the animals that most closely model the human system are not abundant in captivity. Should they be caught in the wild? Do chimps and other primates have special status?

GMOs (Genetically modified organisms): do they pose a risk and should farmers grow them? How are GMOs created? Can a GMO be organic? How do corporations use technology to make sure their patents are protected? What is the global market for GMOs?

EXAM III

Global population growth and the role of science and technology in reducing selective pressures.—What is the planet’s carrying capacity? What standard of living for humans can be sustained? What roles do women’s rights, literacy and birth control play in this issue? With better health care, we are living longer and reproducing more. Should we limit that care? What about non-life threatening conditions, like myopia? How have genes for myopia changed in the last two hundred years?
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<td><em>The human animal.</em> —Is race biologically meaningful? How do we test that? Is prejudice genetic? How does cooperation evolve? What can science tell us about the evolution of prejudice, sexual attraction, aggression, and vengeance? What are potential problems with some of the studies that claim to explain some human behaviors?</td>
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<td>Relevance of God and Spirituality in an increasingly technological world—Science has left fewer and fewer natural phenomena unexplained. What is the limit of what we can know? Do religious questions have any role in scientific debate, and if so, what is that role? How do working scientists view religion, God, and spirituality? How do the major world religions view the scientific process? Does religiosity have adaptive value for the evolution of humans?</td>
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<td>Historical conflicts between Science and Religion—What can history tell us? How did Galileo, Bruno, Darwin, and Einstein struggle with the conflict?</td>
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<td>Research ethics in science—How do scientists handle the challenges of professional relationships, conflicts of interest, government versus industrial funding, and career objectives? Who owns your work? Who owns your laboratory notebooks? How do you determine authorship? How do graduate school, post-doctoral fellowships, internships, rotations, and the European habilitation system promote and inhibit the process of science?</td>
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<td>EXAM IV</td>
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<td>Review; evaluations</td>
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