BIOL 10XX - The DNA Revolution
University of Virginia - Spring 2016

Course Description:

> *We are here to celebrate the completion of the first survey of the entire human genome. Without a doubt, this is the most important, most wondrous map ever produced by human kind.*
>
> - William Jefferson Clinton, 2000

Imagine a world, not far off, where your DNA can sequenced for less than a hundred dollars in a matter of minutes and where any human gene can be altered at will. A fundamental goal of this course is to address the question: how can our society become better prepared for this transformation in science?

This course will begin by outlining the history and projecting the future of the DNA revolution; the spectacular increase in our ability to collect DNA sequence data and reconstruct our genetic blueprints. This course will build a base understanding of the modern science of genetics and genomics. Students will then explore how DNA data is revolutionizing science, including examples such as the study of cancer, diabetes, human evolution and the domestication of dogs.

The DNA revolution is also having profound effects on broader aspects of our society such as business, law, ethics, medicine and public policy. Is genetic privacy achievable or genetic discrimination avoidable? Who really owns your genes and what does the law have to say about it? To what extent do your genes drive your medical future? Should Wooly Mammoths and Neanderthals be rescued from extinction? Now that genetically engineering humans is becoming scientifically easy, should we ban it? Who should be responsible for answering questions like these?

Classes will bring to bear the diversity in perspectives offered by its students and will involve discussions with leading experts in science, policy, ethics and law. Students can be expected to learn both the promises and limitations of genomic research and the future societal impact of us having nearly ubiquitous genetic information.

Course Objectives:

The goal for Biology 10XX is for students to understand the rapidly changing landscape of the genome sciences and its potential impact on science and society. By the end of this course, students will be able to:

- Quantify the rapid growth of DNA sequencing technologies and be able to project this trend into the future.
- Recognize how your genetic makeup may or may not affect your future.
- Integrate the conflicting views of scientists, lawyers, patients, parents, children and the public, on issues such as genetic privacy and genetic discrimination.
- Evaluate, from an informed perspective, media, political discourse and ethical debates

about laws and regulations in genomics.
- Identify areas where future developments in law, policy and ethics would benefit from a more scientific perspective, and areas of science that need to be more clearly regulated because of legal and ethical concerns.

Evaluation and Assessment:

Exams: This course will have three regularly-spaced exams, each worth 20% of your final grade. Exams will be largely multiple choice and will emphasize conceptual understanding over memorization of details. On exam day, class time will involve a review and extended Q&A, after which the exams will be administered online, closed book, with a deadline 24 hours after the exam is distributed.

Homework and Other Activities: This course will involve a series of assignments and exercises that can be loosely described as homework. These assignments will involve analyses or commentaries about media articles or blogs, and discrete writing and research prompts to help you develop your policy paper. Others will involve an evaluation of your learning progress or an evaluation of your professor. Although they will not be graded individually, your participation in these activities will combine to contribute 15% of your final grade.

Policy Paper: A key aspect of this course will be to integrate the science of genomics with the opinions and concerns held by many other constituents in our society. This assignment is a multi-week project, comprising 25% of your final grade. Students will work together in small groups to produce a two-page public policy 'position paper'. A 'position paper' involves a clear articulation of your perspective, but also involves a detailed understanding of another entity's points of view. Your group might be representing a lobbying firm, a political caucus, a business interest, or a concerned group of voters that feel strongly about an important issue in genomics. Should we be altering the human genome? How hard should we work to preserve genetic privacy? Can your employer or insurance company access your genetic information? This is your opportunity to seriously contemplate the directions our society should take with respect to the future of genomics law and policy.

Where and when:

TBD

Instructor:

Douglas Taylor, Commonwealth Professor
Office: 059 Gilmer Hall
Email: drt3b@virginia.edu
Office hours TBD and by appointment

*T**extbook/Materials:***

We do not have a text for this course. Reading materials and other media will be communicated via Collab. You may record class for your own use, but UVA policy prohibits

the posting of course notes and materials on 3rd party web sites.

Attendance: I do not keep track of attendance. This class will have a mixture of lectures, in class Active learning activities, prominent outside speakers, and open discussion. Therefore, you may find it difficult to keep up with the course if you are not in the habit of coming to class.

Week		Important Deadlines (in progress)
1	Why are you in this class and how will we teach it?	
2	What is DNA and what's in your genes?	Meet your group
3	Genome wars!	
4	How to build a genome from scratch.	Policy Paper Planning in class
5	How much does your genome affect your future?	Exam 1(7PM)
6	How do you find a genetic needle in a genomic haystack?	
7	Your inner Neanderthal	Paper prospec-tus due
8	Spring Break	
9	Who domesticated whom? The evolution of dogs	
10	Is Cancer a genomic disease?	Exam 2 (7 PM)
11	Schizophrenia, diabetes and basketball player genes	Policy Paper Research Forum (meet similar groups)
12	Should we rescue Woolly Mammoths and Neanderthals from Ex-tinction?	
13	Want to get your genome sequenced? There's a Facebook App for that!	
14	Who owns your genes?	Policy Paper Drafting
15	Is genetic privacy already dead?	
16	Is our society ready for the DNA revolution?	Exam 3 (7PM)

Class Schedule:
Formal Syllabus ends here, items below flesh out the assignments and such …

Active Learning Tools to be used: (note that BIOL 10XX is designed for 100-200 students)

1) **JiTT - Just in time teaching.** Students will be given frequent reading and/or video assignments. I will use Collab administer a multiple web based questionnaire about the readings, due two hours before class. I will analyze the results and work them into class, addressing misconceptions, correcting my mistakes and emphasizing areas where students are particularly enthusiastic.
2) **PBL - Project Based Learning.** The Position Paper is a PBL activity. Please see below for details.
3) **Message Board.** Piazza.

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THE POSITION PAPER

1. What is a position paper?

Position papers mean different things in academia, law and politics, but the idea is to write a detailed opinion about which direction should our society be headed. Academics use position papers to outline the direction the academic field should be going. Political campaigns use position papers to influence the reader's perspective on a topic that is being publicly debated. Lobbyists write position papers to get votes from legislators. Although the organization writing a position paper has a definite point of view, they represent the opposition well on the way to making a convincing case. The idea is to succinctly lay out differences in opinion and propose a politically or legally plausible way forward.

2. A position paper in a science class?

Many problems in biology resist attempts at a pat answer. There are many controversies and loose ends stemming from both incomplete or ill-considered theory and the paucity of well-executed experiments. Even for those scientific findings established enough to be considered "facts", the implications of those findings for public policy, medicine and law are uncertain and open to debate. The uncertain future of scientific discoveries makes all this even more complicated. These papers are designed to give you some first hand experience at addressing an issue in the genomics and to propose a policy solution that balances the needs and interests of various constituents. Get involved! What do YOU think about the issue and the direction we should be going?

3**. Topics**

I have listed below some topics that touch on a few topics in Genomics that are pertinent to the course. These are only suggestions to get you thinking. If you select one of them, you must still define a justified position to take the country. You should feel free to come up with your own idea within the context of the course.

To help structure this paper, I am assigning a "Paper Prospectus" that gives us the opportunity to talk about your paper early on. My experience has been that this prospectus helps develop your topic and not have things come at you last minute.

Your paper prospectus is due at 5PM on March ?. I will have comments on your prospectus by the end of spring break, which will give you lots of time for you group to proceed.

3. Cautions

I do not want a long regurgitation of facts and minutiae (you have only 2 pages). Use factual detail as evidence for particular points, but do not over-elaborate. I do not want a literature review, but a reasonably documented presentation of the arguments.

4. General Style of an essay

State the issue in the introduction, discuss it in the body of the paper, then draw conclusions (this should not be news to you).

5. Logistics

Early in the semester, you will be assigned into groups of approximately 5 students and have opportunities within class and outside of class to work together to develop topics/positions, gauge your progress, draft your arguments, and get feedback from your Professor. Since the assignment involves bringing different perspectives to bear on a problem in genomics, groups will be comprised of students with diverse disciplines and areas of enthusiasm.

The length of the paper is limited to 1000 words, plus a bibliography and title page. An electronic version of the paper is due by 5PM, April ??. Late papers will have a partial letter grade deducted for each day they are late. The paper is worth 25% of your grade.

6. A Word to the Wise

You may think that two pages is not much, but, in fact, it is more difficult to write clearly, conceptually, and concisely in two pages than to blubber on for ten (remember what Pascal said, "If I had more time, I'd write a shorter letter"). Doing well means researching the literature and being familiar with it, firmly grasping the concepts, and presenting a thoughtful analysis of the issue. Use your teammates. If you come across a paper in the literature that you need help with, I would be very pleased to provide assistance.

Paper Prospectus (to be handed out several weeks into the course)

Directions: The prompts listed below are meant to help you get started on your position paper. To begin, get together with your group. Carefully read the guidelines I have given you for the assignment. Next, respond to each of the prompts with a brief, but well-thought-out answer. You may need to do some preliminary research to complete all the prompts, but remember that this prospectus is only a plan. You will almost certainly change part of your plan, and you may even change all of it, before you complete the paper. Make your best predictions and plans as you answer, but don't be surprised or concerned if you alter them as you proceed.

Who is in your group:

Proposed Title:

General Significance (What broad issues/theories in Genomics, Law, Ethics, etc. will the paper contribute to?):

Specific Objective (What is your position? The position that you would you like other constituents to agree with you on):

Getting Going (What literature will you use (or have you used) to get started?):

Motivation (What makes this issue interesting to your group?):

Group Dynamics (Not everyone in your group needs to agree with every aspect of the position paper. Use these differences in opinion as opposition research. Do you have concerns about the group dynamic? Explain.):

Your biggest concern(s), question(s) or fear(s) about writing a position paper:

UNDER CONSTRUCTION

Paper Grading Rubric: (To be handed out with the other guidelines)

Grading Papers is always going to be subjective. In working to keep my grading fair and consistent, I will use the grading rubric below. No paper will address all of these issues perfectly, but I hope it helps you see my expectations for the work.

Topic:
- Is the general significance of the topic (to Genomics, Law, Ethics, etc.) there?
- Was this general significance made clear to the reader?

Seriousness of the Effort:
- Was the appropriate scientific/legal/journalistic literature used in a thoughtful way?
- Was serious thought (as opposed to loose opinion) put into the conclusions being drawn?
- Were the conclusions coherent and stem logically from the analysis?
- When opinions/perspectives are offered, do they stem from a balanced consideration of alternative perspectives?

Originality:
- Does this paper move beyond “compare and contrast” of research to make specific recommendations?
- Is this paper something that uses some combination of the constituents’ background, training in science, or lessons gained from this course, to bring a broadly informed perspective.
- Did this paper make me think?
- Did I learn something from reading this paper?

Writing and Organization:

- How is the grammar, tense, and spelling?
- Is the paper organized with a clear introduction, development of arguments and conclusions?
- Did I struggle to read this paper or did it flow naturally?

Random Notes to self that don't belong in the syllabus:

Use Jigsaw for creating group dynamics. The students should have roles, becoming experts as different stakeholders and combine expertise in their writing. Use the different stakeholders that actually exist in public policy debates to give the students ideas. Then have the students decide who the stakeholders are and how they will fill them. Check in with them, how are the roles going? "Group work in class helps students helps them feel comfortable, group work outside class helps them learn."

Use CATME to create groups where students come from different disciplines and are have spent different amounts of time at UVA, etc. This not only creates more interesting groups, it jives with the actual assignment (requiring different perspectives) and the course itself because they bring different things to the table.

Follow Claire's lead on Piazza.

First Day notes of reassurance (opinions from talking to the students)

On the first Day, engage the students. Why are you in this class?

Recognize and embrace the diversity in the class. Some people are first years, or fourth years. Advanced students might be majors in classics or physics. This diversity is baked into the course content, and into the assessments. For example, the group assignment policy paper is explicitly designed to incorporate a diversity of perspectives. These groups will be formed by assembling people with different interests so that they can use their diversity of skills and enthusiasm to represent the diversity of views that go into a topic such as "who owns your genes".

With respect to group work, be explicit about what you expect this to be at the end, but flexible to encourage creativity. Give examples of what you want.

Before you hand out the assignment, seek student opinions, in class. Let them be part of (or think they are part of) the process…This should be done before you give the assignment … distribute the guidelines and hopefully reflect some student preferences.

Diagnostic Assessment, preconceptions …

- for/against GMOs
- you own your genes?
- give the survey early, form groups.

http://www.hhmi.org/biointeractive

review the pre-class email idea. I could send out some key links.

First day notes. Stand up if you play a sport, a musical instrument, taken a science class, etc…generate movement. Showed a baseball slide, where is the chemistry? House, where now? All over. talk to your neighbor, and see what questions would you want to answer about the Chemistry? Do something like this…don't just go through the syllabus. Start the dialogue on day one.