Microbiology 213 Social Issues in Biology- January 26, 2012
Please fill out the sign-up sheet and return it to me if you haven't yet.

What is Science: Evolution vs. Intelligent Design

The first session will be a viewing of the PBS Nova Film: "Judgment Day: Intelligent Design on Trial" and discussion of it along with the reading: J.D. Mills, E.C. Scott and S. Okamoto. **Public acceptance of evolution**. Science **313:**765-766 (2006). The next session will continue this discussion along with additional readings.

This film is based on a 2004 court trial about the teaching of evolutionary theory in the schools of Dover, Pennsylvania. The portion in which the trial itself is "filmed" uses actors to represent those participating in the trial. Actual films or videos of the trial were not available.

In watching this film, please take notes if you can during the film and consider the questions below.

Primary Questions:

1. The film claims that "the nature of scientific inquiry is on trial." How so? What is science? How is it defined, particularly, in this film, by Kenneth Miller? Do you agree with his points, with regard to Evolutionary theory, or to science, in general?
Is astrology a scientific theory? What is said to distinguish Evolutionary theory as science compared to Intelligent Design theory?

2. The population of the United States lags behind that of most other "Western" countries in its belief in evolutionary theory? (e.g. Read the article given for this session.) What difference does it make? Do you see any way in which it is a problem for this country? What harmful consequences might there be? Does it really make any difference?

3. If you think this is a problem and that the resistance to teaching evolution by those presenting creationist/intelligent design alternatives is a problem, who should be counteracting these ideas? How?

Other questions:

1. Notice who the funders for this film are. Any comments?

2. Do you think that the arguments made by scientists against specific criticisms made by Intelligent Design advocates are airtight: for example on the issues of the flagella or the immune system?

3. Is the show objective?

4. What is meant by the word paradigm in this context? What is your understanding of the word?

5. One of the people interviewed in the film is Steve Fuller who is a sociologist of science. Do you understand what point he is trying to make?

FYI: the book by P. Kitcher. "Evolution, Design and Faith" Oxford University Press (2007) presents both a discussion of the nature of science re: these debates and the implications or lack thereof of evolutionary theory for believers in religion. (This is not required reading.)

Microbiology 213
Social Issues in Biology
February 2, 2012
What is Science: Evolutionary Theory II

(This looks like a lot of reading, but most are short 1 or 2 page articles.)

Most of this week's readings relate to the ongoing controversy over whether evolution and more religiously-inspired, suggested "scientific" explanations of human origins should be taught in schools together, separately, or only one or the other, or both not taught at all. The debate raises questions about what establishes something as science and what causes scientific theories to be accepted. While a few scientists support such theories as "Intelligent Design," the overwhelming majority of scientists do not. Many scientists consider the efforts to teach "scientific" theories that cohere with religious beliefs theories to be a rejection of the scientific approach and that evolutionary theory is part of the progress in human culture and awareness that began with the Enlightenment. Last session, we read an article that puts the United States population next-to-last amongst industrialized societies in its acceptance of evolutionary theory article. We will continue to discuss some of the questions raised by the film seen in the first session and proceed to today's readings. Today's readings also raise questions about what strategies: court cases, public debate, debunking; educational programs, politics, boycotts, working through scientific associations, more experimental work(?), etc. might be effective in influencing public attitudes towards evolutionary theory?

1. J. Mervis. Tennessee House Bill opens Door to Challenges to Evolution, Climate Change. **332:**295 (2011). "Academic Freedom" Brian McGuffie's article on Indiana.

This is just one example of the many efforts in various states to thwart the teaching of evolution. It suggests that winning arguments over the validity (or scientific nature) of evolutionary vs. "creation science" or "intelligent design" in court or in debates doesn't settle the story.

Consider the following questions:

QUESTION 1. Does it matter to society whether people accept evolutionary theory or not? Please think about this question and come in with reasons why you think the teaching of evolutionary theory or it's acceptance by society is or isn't important for society.

QUESTION 2. If "evolution does matter," should scientists be involved in finding ways to contribute to public understanding of the difference between evolutionary theory and other explanations of human origins?

Orr says in the article below: "Clearly a policy of limited scientific engagement has failed." Is there a "social responsibility" of scientists to participate.

QUESTION 3. What are the best strategies for engaging in this public issue?

Defining Science

For many, primary questions are can we or how do we define science in these efforts?

What follows are different descriptions about science that have been used by various writers of the articles below in defense of evolutionary theory.

"a good theory is one that inspires new experiments and provides unexpected insight into familiar phenomena" (H.A. Orr)

"I would henceforth call [my] talk [not] why evolution is right [but] "Why evolution is probably right, and creationism is certainly wrong" (Steve Jones)

"Virtually all of science is an exercise in believing where we cannot prove." Philip Kitcher (a strong defender of the theory of evolution)

"Even though our present evidence does not *prove* that evolutionary theory is true-….-evolutionary biologists will maintain that the present evidence is overwhelmingly in favor of theory and overwhelmingly against its supposed rivals." Philip Kitcher

Do these comments accurately reflect "what is science."

2. H.A. Orr. Devolution. The New Yorker, May 30, 2005 pp.40-52,

Mostly recapitulates the film.

This article is an evolutionist's response to "Intelligent Design." Is it satisfactory? Can you think of responses to the Intelligent Design's example of flagella? If you were trying to "combat" the ID position, is the New Yorker the best place to publish? Why?

p. 52 "A good theory….."

Public debates and discussions?

3. S. Jones. Islam, Charles Darwin and the denial of Science. The Telegraph (London newspaper). Added: Wednesday, 07 December 2011 at 2:16 PM.

The writing of this is interesting. The "hook" of the hernia- testes. Valid?
How could Darwinism be linked to Nazism.

"But why train to be a biologist if you don't believe in evolution?
How can you put a body right…" VALID?

T.O. Baldwin. Engaging the Public. ASBMB Today. April 2010.

"If every college…." Do you agree?

Steve Jones is a former Professor of Genetics, University College, London, now involved in education programs in the U.K. Tom Baldwin is a biologist at the University of California, Riverside. How do these articles and activities contribute?

Education?

4. EurekAlert. Engaging prior learning on creationism and evolution may benefit college biology students. EurekAlert, AAAS (Publisher of Science Magazine) Nov. 2005.

Whether the study on which this news article is based seems solid or not, the idea of comparing e.g. evolution with intelligent design in the classroom is interesting. What do you think of this approach? If you think it sounds reasonable, why features of it might make it work? (The following is <u>not required reading</u> for this session. It is the original study on which the news article is based. S. Verhey. BioScience **55:**996-1003 (2005).)

Teaching material includes discussion of "current thinking about the nature of science" (NOS) What impact- what aspects would you thin would help? Fruitfulness of theory testability/ Look up McComas

Boycotts?

5. B. Barrow. National science group boycotting Louisiana in protest of Science Education Act, The Times-Picayune (Newspaper), New Orleans, Monday, February 16, 2009, Updated: Wednesday, March 11, 2009.

Mention longer Scientific American Article

Why? Why not? Law allows the schools to provide the teachers with other materials. Evolution is a "controversial theory"

History of Acceptance of Evolutionary Theory: Is Rhetoric Important to the Progress of Science?

6. P. Kitcher. Persuasion. In *Persuading Science*, eds. M. Pera and W. R. Shea. Science History Publications, USA, Canton, MA. pp. 3-28 (1991).

Philip Kitcher is a philosopher of science (biology) who has written a number of books on biological issues in a more accessible style than many other philosophers. This article is given for two reasons:

1)It describes the controversy between representatives of religion and Darwin over his newly introduced theory of evolution, parallel in some ways to today's controversies. Are they parallel? What are the differences? Are the reasons for the controversy the same today? Are the discussions of "what is science" relevant?

2)Kitcher points out the importance of rhetoric in promoting acceptance of new ideas. Can you see ways in which scientists use the "rhetorical art" today? In defense of evolution?

3) How important do you think rhetoric is? (Pardee story)

Assets: 1)Explain how it enjoys virtues over its rivals- e.g how many puzzling things can be explained; 2)Beauty of the language; explaining away weaknesses; 3)underplaying human evolutionto avoid conflict, while using biblical language. Is this OK?; 4)"p. 20 "join me" (or you'll miss out)

P, 20 what is Wilson and Sociobiology; what is the second quote (W-C)

Next paragraph- any "grubby purposes" youa re aware of today?

p. 23 Summarize argument- do you agree.

An Historical Parallel to this Debate: Activism in Professional Societies

The issues and even some of the same names referred to in some of the articles above appear in the following article by Wolfe on the response of geneticists to the growth and eventual dominance of Lysenkoism in the Soviet Union during the 20th century. Together these two conflicts raise issues about the part scientists should play in such controversies and how the debate should be waged.

7. A. Wolfe. What does it mean to go public? The American response to Lysenkoism, reconsidered. Historical Studies in the Natural Sciences. **40(1):**48-78 (2010).

The following brief article covers recent results from Sue Lindquist of MIT that revive the idea of Lamarckian inheritance. Of what interest is that to the issues discussed today?

8. J.L. Fox. Citing Lamarck, Lindquist Slyly Challenges Gene Dogma**.** Microbe, September, (2011).

MICROBIOLOGY 213. Social Issues in Biology: February 9, 2012

What is Science?

Read Thomas Kuhn's book "The Structure of Scientific Revolutions," (1962) University of Chicago Press third edition (available downstairs at the Medical Coop on Longwood Ave.) which includes a 1969 postscript. Focus on the pages that are the original text of his book (pp 1-173), although you might want to read the Postscript (optional).
Read also: K. Popper, Normal Science and its Dogmas in "Criticism and the Growth of Knowledge," eds. I. Lakatos and A. Musgrave. Cambridge University Press. (1980) pp.49-58 (with an intro).

The 20th century was a period in which historians and philosophers of science challenged the view of science as a purely objective pursuit. Preceding Kuhn, Karl Popper, reacting against the positivist position, had proposed that science as a process could be defined as one in which hypotheses are tested by the process of falsification. Only a falsifiable theory could be considered science. While Popper's proposal was accepted by many, Kuhn's book is part of, or may have even initiated debates and controversy that continue to this day. These include questioning of the specifics of Kuhn's thesis including whether revolutions in science really take place as he describes. His book has also influenced academics in other fields who study the scientific process, leading them sometimes to using Kuhn to argue, at the extreme, that scientific "truths" are relative just like other truths. Some scientists fear that these arguments hurt science and blame Kuhn for this result.

Aside from the question of how widely Kuhn's descriptions can be applied to science, I, personally, have found the book to be rich with insights into the scientific process. Not only do I think that these insights are useful, at the least, in musing about the science we do, but also in considering many of the issues we will discuss this semester.

As you read the book, please be thinking about the set of issues/questions I have listed below. For each of these, do you find Kuhn's explanations compelling or do you see problems with them? Come prepared to talk on either "side." There is practically no biology in this book. Why? As you read through the book, can you think of examples from biology/genetics/molecular biology that would fit into the discussion?

Can you relate Kuhn's ideas to aspects of the discussions we have had about "what is science" in talking about Evolution vs. Intelligent Design? Also, how does the Kitcher article about "Persuasion" that we read last time relate to Kuhn's anlaysis?

1. What is "normal science?" (A brief summary of what is a paradigm is necessary here.) What do "normal scientists" do? How does normal science make it difficult for new paradigms to emerge? Does normal science resist "novelty?" Is this a good thing for scientific progress? Can you seek novelty? How does normal science result in paradigm changes? The Karl Popper article for today says pretty strong things about Kuhn's idea of "normal science." **I would like some of you to prepare an argument that supports**

Popper's comments about normal science and criticizing Kuhn's, and I would like others to prepare an argument supporting Kuhn's position and criticizing Popper's.

2. How does a paradigm shift take place? What are the factors that Kuhn says make successful acceptance of the shift (or cause resistance to the shift)? Make a list of these factors which might include the scientific, personal, social, political and the psychological (others?). These would include features of the paradigm itself and other extraneous factors. Would you add any of your own?

3. What does it mean to talk about fields of research that are paradigm based or non-paradigm based or pre-paradigmatic? Examples?

4. Explain Kuhn's use of the term "incommensurability" of competing paradigms. (pp.98-100; 103-104) is one place where this is discussed. Do you have any problems with this characterization?

5. Kuhn mentions scientific positivism, verificationism and falsificationism (Karl Popper). Do you know what these terms mean. Do you agree with his critique of each individually as a critique of the description of how science is done?

6. The book actually begins with a critique of the education of scientists. Is the education/texts that he criticizes something you have experienced or is it different from what he describes? If some of his criticisms (also throughout the book) of the education of scientists are accurate, should the education of scientists be changed?

7. Perhaps most disturbing to many is the idea summarized on p. 170 that "We may…. have to relinquish the notion….. that changes of paradigm carry scientists and those who learn from them closer and closer to the truth." What does he mean by this? Does he believe in progress? Do you agree or disagree? **Again, I would like members of the class prepared to take one side or the other.**

8.. As indicated above, come with some thoughts about paradigm changes in biology. Kuhn talks of some of the big paradigms, but he also allows one to think in the same terms of smaller "paradigms." So, don't restrict yourself to just major paradigms of biology.

Finally, do Kuhn's ideas challenge any of your own beliefs about science? Do you disagree with his ideas? If that is the case, come with arguments for why you think some of his analysis is incorrect? And, do you think it makes any difference whether or not people accept his views of science? Which people? Scientists? The Public? Journalists?

FYI: Read Interview with Harvard physicist Lisa Randall, Boston Sunday Globe, October 23, 2011. Some of Randall's descriptions of science seem to reflect the changes that have taken place in the thinking about "what is science."

Microbiology 213
Social Issues in Biology
February 16, 2012

The Science of Behavior, Ethnicity and Race: History

This is the first of three sessions that will include at least some discussions of issues of race and science. This session focuses largely on historical examples. There have been repeated controversies during the last two centuries over the use of science to make arguments about human races. This has led to often bitter debates between scientists. Maybe even more bitter than Newt-Mitt battles.

The required book, S.J. Gould's "Mismeasure of Man," should be available at the Harvard Medical Coop or probably easy to find otherwise. I will be lending copies of my book "Making Genes, Making Waves".

Readings:

1. S. J. Gould. **The Mismeasure of Man** (revised and expanded). Norton paperback. (1996). Please read pages **51-105 and 176-222 and** pp. **264-269** on Sir Cyril Burt (up to "Correlation …..)

Stephen Jay Gould was a paleontologist/evolutionist who made major contributions to his field and was a popularizer of evolutionary biology. He testified at court trials in defense of the teaching of evolution in evolution/creation conflicts. But, he was also a critic of scientific research which claimed scientific support for theories of racial and gender inequality. **The Mismeasure of Man** is a summary of much of his criticisms. The issues he dealt with have long engendered a contentious debate amongst scientists and some of Gould's work has itself been recently criticized, including in a reading for today. I have been giving readings from Gould for many years and I think it is an important book worth reading in its entirety. We may be reading a couple of short sections in subsequent sessions.

One of the themes that runs through this book is that a scientists' personal biases and those of the society around them can influence their research and that this is of particular concern when the research relates to societal questions. Recently, an article (for today's reading) has argued that Gould himself was biased and that this bias influenced his scientific analysis of Samuel Morton's data. As one discussion point for this class, I would like you to consider Gould's section on Morton and the article included that criticizes Gould's analysis of Morton (see Readings 2 below). **What conclusions do you draw about the validity of Gould's claims? What is going on with the vituperation?** (I will ask students to take different positions on this controversy. It may be useful to look at the video link I have included.)

Overall, as you read Gould, think about his critiques in terms of the issues we have discussed in the earlier sessions (see e.g. p.54). Were researchers such as Agassiz, Morton, Goddard, etc. doing science? Do you consider these cases represent good science, bad science, or just science? Why might Burt have gone to such extremes in concocting data in his identical twin studies? Gould himself repeatedly states that non-objective factors are just as prevalent in all the science we do. Are his arguments convincing? **What factors might have influenced**

their science, their assumptions even to the point of apparently committing fraud in the case of Burt? Are we free of such influences today? **What factors might have influenced or provoked Gould's critique?** Do the concepts of paradigms, normal science or pre-paradigmatic science have any relevance here?

Be prepared to discuss each example of research and theories offered by the various scientists Gould cites.

On p. 269, Gould says that Burt's work has "affected millions of lives." What is he referring to?

Other themes that come up in Gould:

His repeated point that quantitation in science is often misused as the ultimate objective criteria. (first brought up on p. 58)

In page 77-78, issues arise as to why certain scientific subjects are studied.

The failure to consider alternative hypotheses for data also comes up.

On page 186, be sure you understand the "two false implications" that he describes.

I have not required reading of the section on factor analysis in the Gould book as I thought there was already a substantial amount of reading and this would require significantly more work and I'm not very good at it.

2. J. E. Lewis *et al.* **The Mismeasure of Science: Stephen Jay Gould vs. Samuel George Morton on Skulls and Bias.** *PLoS Biology* **9:** Issue 6 e1001071 pp.1-6 (2011). Plus two commentaries on the paper- Hawks and Horgan). Plus a video, if you want to put in the time, which includes the skulls! A confusing video of commentary by one of the authors: http://www.youtube.com/watch?v=emDuNjVs7f8&feature=channel_video_title

This paper is the one referred to above that criticizes Gould. It involves a re-analysis of Morton's work and comes to different conclusions from Gould and draws certain conclusions about Gould. The two commentaries make strong statements on opposing sides of this issue. I will assign certain people to make the best case for Gould and criticize this paper and others to make the best case for the Lewis et al. paper.

3. a)Figure (cartoon) of the Kallikak family from a widely used psychology text published in the early 1960's. b)L. Zenderland. (1998) **Measuring Minds: Henry Herbert Goddard and the Origins of American Intelligence Testing.** Cambridge Univ. Press. Cambridge, England. (paperback), pp. 352-353. and c)discussion of Goddard's Regrets.

4. J. Beckwith. Chapter 7 "Their Own Atomic History" in **Making Genes, Making Waves: A Social Activist in Science.** Harvard University Press, Cambridge (Hardback) pp. 98-115 (2002).

This is my brief summary of and take on the eugenics movement in the early part of the 20th century.

Did you learn about eugenics in any of your previous courses? Were they science courses?

How much blame for the consequences of this movement, if any, should be put on the shoulders of the scientists involved? What could they or might they have done differently?

Why do you think that most geneticists believed in eugenics ideas, at least early on?

Some would argue that this 20th century eugenics movement gave the word "eugenics" a

bad reputation and that there is a good eugenics. What does that mean? Are there arguments for the eugenics being made today that resemble the ideas put forth ~100 years ago?

Microbiology 213, February 23, 2012
Race and Genetics into the 21st Century

During the class, I will call on students to talk about some of the questions raised.

As last week's session may have indicated, there is an ongoing debate over studies on race and genetics. How people look at data and how seriously they take arguments on one or another side may be influenced by their social perspectives. Do you have any reason to think that this is the case again in today's readings?

1. A brief history of the idea of race

S.J. Gould. **The Mismeasure of Man** . Norton paperback (1996). Page 398 (beginning with 2d paragraph) through page 412. (read from your copy of the book)

This excerpt gives some history of the origin and development of the concept of human races. Keep the question of the meaning of race in mind during the discussion of the papers below. Is race a valid term to use for human populations? How do you define race or would you? Why is it useful to define race?

2, The Human Genome and Race as of 2000:

In 2000. as the U.S.Govt. celebrated the nearly complete sequence of the human genome leaders of the two research groups spoke to the press, saying the following:

Craig Venter- "There is no basis in the genetic code for race."
Eric Lander- "There is no scientific evidence to support substantial differences between groups."
Aravinda Chakravarti "The differences we see in skin color do not translate into widespread biological differences that are unique to groups."
…. And Bill Clinton "I'm happy that today, the only race we are talking about is the human race."

As a result, the NY Times headline reporting on the achievement was: "Do Races Differ? Not Really, Genes Show."

Yet, just two years later, scientists and others began to debate again whether there was a reality to the idea of race. The next paper played an important role in that debate.

For sections 3 and 4, I would like you to observe the transfer of information from the researcher to the journal to the media and the social implications of its representation to the public. How does this process take place at each step?

3. Use of human genetics to distinguish "groups" (2002-now) and its relevance to Race

I. N.A. Rosenberg et al., Genetic structure of human populations. Science 298:2381-2385 (2002). N. Wade Gene Study Identifies Five Main Populations. NYTimes Dec, 20, 2002.

First, read the Rosenberg *et al.* paper. Note the report by Wade in the New York Times and its focus on race; this was a harbinger of a much broader interest in genetics and race both in the public and amongst scientists. Does the Rosenberg et al. paper say anything about race? Why not?

Some of you may be familiar enough with this work and the STRUCTURE program to understand at least roughly how the analysis in this report was achieved. If not, **were you able to figure out roughly how it was done? T**he two **following papers just below** should help. (Everyone in the class should read them anyway. There is more to them than the technical points.) Wade's article is an example of media coverage. Evaluate it.

Next year, include King and Motulsky and then Wade (after Feldman and bolnick)

II. M.W. Feldman and R.C. Lewontin. "Race, Ancestry and Medicine" pp. 89-101; D. Bolnick. "Individual Ancestry Inference and the Reification of Race as a Biological Phenomenon" pp. 70-85. both are chapters in Revisiting Race in a Genomic Age, eds. B.A. Koenig, S.S.-J. Lee and S.S. Richardson. New Brunswick, NJ. Rutgers University Press. (2008).

Did they help you understand the Rosenberg et al. paper? Did they change your view of the meaning/significance of the findings? Note a coincidence concerning one of the chapters' authors. The question here is what does this science tell us about whether one can define races biologically. **I would like some to argue for the biological idea of race and some against.**

The second major question is: if one believes that the Rosenberg et al. paper lent itself to misinterpretation, are there ways in which the authors could have presented their paper differently that might have avoided some of the ways in which it was extended to the concept of race? **Come prepared either to argue that the paper need not have been changed or that it should have been.**

If you had read the paper when it was published, do you think that you would have been concerned about what its effects might be?

III.S. M.C. Campbell and S.A. Tishkoff.. The evolution of human genetic and phenotypic variation I Africa. Current Biology 20:R166-R173 (2010) (A PODcast interview with Tishkoff for a pretty clear description of the study can be accessed at the May 22, 2009 Science Magazine where the article was published.);

The Tishkoff paper favors 18 groups (4 of the original and 14 instead of one for Africa. Figure 1) instead of Rosenberg's 5 or 6. What did she do differently? How do Tishkoff's results affect one's thinking about the impact of the Rosenberg et al. paper?

IV. S.S.-J. Lee et al. The ethics of characterizing difference: guiding principles on using racial categories in human genetics. Genome Biology 9:404 (2008).

If we have time, I would hope to have at least a brief discussion of 1)whether such guidelines are a good or bad thing to have for science articles or 2)if you think they have some merit are there some that are unacceptable or 3)would they do any good.

4. Genes, Evolution and "Cognitive Function?" Science and the Media

This set of readings follows articles published in 2005 that attracted media attention and what followed. Read carefully and critically the one article that I have chosen for this session. Consider the **Science** news article itself and the media coverage and whether they fairly represented the science. Do you see social implications in the article, in the media coverage?

The Scientific Article

P.D. Evans *et al. Microcephalin,* a gene regulating brain size, continues to evolve adaptively in humans. Science 309:1717-1720 (2005).

Read this paper critically. I am only including one of two research papers from the same lab since they are similar. Think about the following questions:

1)What is your evaluation of the speculations made by the authors? Consider the data presented, what is known about the effects of the mutations on gene function or brain function, and what is known about when these polymorphisms arose.

2)Do the authors favor a particular interpretation of their data?

3)Do you think the speculations are warranted? Are there other equally reasonable interpretations of their data? Are there any limits on speculation in scientific papers that scientists tend to accept?

4)After you have read about the coverage below, can you think of ways that it could have been written differently to avoid what followed?

The Science News and Views article accompanying the Evans *et al.* paper

M. Balter. Are human brains still evolving? Brain genes show signs of selection. Science 309:1662-1663 (2005).

Does this Science news article fairly represent the work; the scientists' views? Science usually has a news article on only one scientific article in an issue, if any? Why was this one featured? What is the impact of featuring it?

Resulting Media Coverage

R. Kotulak. Two evolving genes may allow humans to become smarter; researchers say brain shows signs of continuing development. Baltimore Sun. 9/9/2005.
M. Inman. The New Scientist. Human brains enjoy ongoing evolution. 9/9/2005
N. Wade. Brain may still be evolving. New York Times 9/9/2005
V. Griffith. The Financial Times. Human brains still growing larger 9/9/2005

Other coverage: **a)**Chosen as one of **Discover Magazine's** top discoveries of 2005

b)here's a quote from **John Derbyshire, columnist: *National Review Online,* Nov. 2005***:*** "Our cherished national dream of a well-mixed and harmonious meritocracy…may be unattainable."

c)here's an excerpt from the **New Scientist, September 17, 2005** "Whatever advantage these genes give, some groups have it and some don't. This has to be the worst nightmare of people who believe strongly there are no differences in brain function between groups," says anthropologist John Hawks of the University of Wisconsin in Madison.

1)Do you feel that these news reports exaggerated what the scientists said in their papers or that it was perfectly reasonable speculation and correct interpretation of that speculation?

2)Do you feel that there is potential social fall-out from the speculations/news reports? If you do, and you consider the fall-out of some concern, what might you have done differently if you were part of the scientific team? Nothing? Drop out of the project? Suggest alternative interpretations? Suggest altering the paper in some way? How? <u>If</u> the representation has social fall-out, who bears responsibility for making sure no harm is done?

The Story Falls Apart

Then, in December of 2006, **Science** published another news article following-up by reporting studies that falsified the suggestion that the microcephalin polymorphisms might be involved in cognition, etc. Studies reported no correlation with intelligence or head circumference, as well as criticizing the approach used to suggest evolutionary selection had taken place.. There was no significant media coverage of this article and the falsifications. I did find one piece from the Australian Broadcasting Corporation.

M. Balter. Brain man makes waves with claims of recent human evolution. Science 314:1871-1873 (2006)

J. Skatssoon. Australian broadcast- Researchers bust head size-intelligence link. August 2, 2006.

Look at <u>abstracts</u> of papers that test predictions of Evans *et al.* which are included in the material for this week. (Timpson et al. Comment on Papers by Evans et al., ….. Science **217:**1036a (2007).; J. P. Rushton et al. Biology Letters **3:**157-160 (2007).; Mekel-Bobrov et al. Human Molecular Genetics **16:**600-608 (2007).)

Are there some lessons to be learned from this story about how the authors, the journal and the media handled it? And how to handle the retractions?

Do a Google search on J. Philippe Rushton. He is (was?) President of what Fund? What does this Fund do? Why might he have been interested in this subject?

Microbiology 213
Social Issues in Biology
Class for Thursday, March 1, 2012
(To see the play "Photograph 51" Sunday, March 4 at 2 PM, please be at the box office of the Central Square Theater, 450 Massachusetts Avenue, Cambridge by 1:30. I think, but am not sure, that you just have to say that you are one of the student tickets under the name Beckwith. I will be there, anyway.)
GET BOOKS FOR NEXT WEEK

Science Meets the Powerless: Communication and Exploitation?

Please buy and read in its entirety the book "**The Immortal Life of Henrietta Lacks" by Rebecca Skloot**. Published in 2010 and in paperback in 2011. Also for an update on one aspect, read **M. Walter, "First Do Harm" Nature 462:148-152 (2012).** (I just had to add this latter reading today- Feb. 24, as I just came across it- as it is so relevant to a portion of the book.)

Please consider and think about the following issues as you read the book:

1. **Section of book on medical research practices generally that seem repugnant to us today: history and evolution (including the extra reading from *Nature* that I have included)**
   What was the state of ethics in medical research at the time that some of these events (e.g. the Tuskegee Syphilis "Study") took place? Do you think that some of the practices were largely widely approved? Do we learn here of instances where such practices were opposed? When did this happen? How have practices changed over time during the history reported here? What policy changes have taken place? Have they been effective? Can you relate this discussion to any of the topics we have talked about in previous classes?
   Do you think that these issues are gone now or is it difficult to anticipate further evolution of mores/ethics etc.
   How has this history affected the attitudes of groups toward medical research? Do these attitudes seem reasonable given the history?

2. **The taking of Henrietta Lacks' cells for research purposes**
   Do you find any faults with the taking of Lacks' cells for cancer research? Should she have been informed? Would it be required that she be informed today? How do you deal with contrast between the poverty of the Lacks family and the amount of money, fame, etc. that some scientists or companies earned? Should people be paid for their cells? What are the pros and cons of paying people for their cells: the economics, ethics and the effects on research?

3. **What role did racism, its history, the attitudes of that time play this story?**
   What indications are given in the book of degree of racism in society ~1951.

4.The nature of communication between medical/scientific researchers and the black community, poor people

or the public, in general.

This is one of the most important issues in the book, at least for me.
There are a number of scientists in the book who had contact with either Henrietta or later her family and particularly Deborah. There are differences in how effective they were (or wanted to be) in these communications. Examine these various interactions, both positive and negative. Do these reflect any problems for the relationship between researchers and the public, in general, or groups within society, in particular?

5. **Other questions of interest**

Would you point to any heroes in this story either related to the Lacks' or in other incidents covered in the book?
What do you think was the story referred to on p. 167 where African-American children were screened for a genetic predisposition to criminal behavior?
You might be interested to look up the history of Alexis Carrel who is mentioned several times in the book.
What do you think of the press coverage of the potential of HeLa cells?
Does the problem with HeLa contamination of other cell lines tell us anything about scientific research?

Microbiology 213 Social Issues in Biology - March 8, 2012
"Shades of Gray: Personality and Science and its Public Presentation"
Class Discussion led by Roberto Kolter, Jon Beckwith and Ben Morris

As in all human endeavors, the way individual scientists carry out their careers is greatly influenced by personality. The environments we work in, the questions we ask, the approaches we take, and how we interpret and communicate our results are all shaped by our personality. In practice, personality differences may result in different operational definitions of what is proper behavior. What might be considered an unethical practice by one scientist might be considered ethical by another. So, it is not always easy to define right and wrong actions in scientific conduct. This is perhaps best brought to light by the historical analyses of the events leading to the publication, in 1953, of three articles in Nature under the umbrella heading "Molecular Structure of Nucleic Acids". We are lending you two books for today's readings. In order to give a historical framework from where to begin our discussion, we are asking you to read an excerpt from Brenda Maddox's 2002 book entitled: "Rosalind Franklin - The Dark Lady of DNA". The four chapters we have selected cover the period from May 1951, soon after Rosalind Franklin arrived at King's College London, to March 1953, when Watson and Crick built the double helix model for DNA. We are also asking you to read Jim Watson's "The Double Helix" (which is not so heavy reading as it might appear).

Based on the facts presented in these chapters (and in any other texts you may wish to consult) we should discuss: The personalities of many of the individuals involved: Franklin, Gosling, Wilkins, Randall, Watson, Crick, Bragg, Corey, Linus & Peter Pauling, Kendrew, Perutz, Chargaff, Donohue, and others... The use by Watson and Crick of "Photograph 51" and the MRC report on the biophysics committee's December 1952 visit to King's. The factors that might have influenced who was included as author in each of the papers. How the personality of each of the key players might have influenced the events leading to the building of the double helix model. In addition, how did these personalities continue to affect subsequent developments in molecular biology.

Further, what do you think were the factors that led to the strained relationship between the Watson/Crick team and Franklin and the bad working relationship between Wilkins and Franklin? How did each important piece of data that supported the double helix model come to be know to all of these scientists?

Finally, we will consider the presentation of the controversy to the public, in this case the theater. Do you think that the play "Photograph 51" gives a reasonable presentation of the issues? Do you think that the theater does or can provide an effective means in educating, interesting or changing people's views of science and scientists? Does this play do some of that?

The preparation for this week's class includes:

1. Read pp.141-213 of B. Maddox, "Rosalind Franklin- The Dark Lady of DNA" (2002)
2. Read the book "The Double Helix" by James Watson.
3. See the play on Sunday, March 4, 2 PM at the Central Square Theater, Mass. Ave., Cambridge..

Microbiology 213
Social Issues in Biology
March 22, 2012 (Week 8)
No class on March 15, undergrad vacation week

Science and Journalism: From the Scientific Journal to the Public.

Guest: Karen Weintraub (Boston Globe science/medicine reporter)

Karen (if there is no breaking story at the Globe) will arrive at the beginning of the class and stay until the break. **After reading the materials below, PLEASE COME PREPARED WITH QUESTIONS YOU WOULD LIKE TO ASK HER.**

Articles on Science Journalism.

1) J.A. Winsten. Science and the Media: The Boundaries of Truth. Health Affairs, Spring, 1985. pp. 5-23.

2) V. de Samir et al. Press Releases of Science Journal Articles and Subsequent Newspaper Stories on the Same Topic. *JAMA* 280:294-5 (1998).

3) T.M. Bubela and T.A. Caulfield. Do the print media "hype" genetic research? A comparison of newspaper stories and peer-reviewed research papers. Canadian Medical Association Journal **170:**1399-1407 (2004).

4) C. Condit commentary on Bubela and Caulfield article. CMAJ **170:**1415-1416 (2004).

5) R. Weiss. Behavioral Genetics and the Media. in *Wrestling with Behavioral Genetics: Science, Ethics and Public Conversation,* eds. E. Parens, A.R. Chapman and N. Press. Johns Hopkins Univ. Press. pp 309-326 (2006).

6) C. Condit. How geneticists can help reporters get their story right. *Nature Reviews Genetics* 8:815-20 (2007).

7) H. P. Peters *et al.* Interactions with mass media. Science **321:**204-205 (2008).

8) C. Dean. The Scientist as Citizen. In *Science and the Media*, eds.. D. Kennedy and G. Overhilser, eds. American Academy of Sciences, Cambridge. Pp 74-79 (2010).

9) _____ Filling the Void. Nature **458:** 260 (2009)

10) G. Brumfiel. Supplanting the old media? Nature **458:**274-277 (2009)

11) S. Jaschik. New Outlet for Sharing Science. In Inside Higher Education (Web). Sept. 15, 2009.

Read these in preparation for Karen Weintraub's visit and for discussion in the second half of the class. It is possible that much of this discussion may not be relevant if the communication of science to the public changes very much from what it has been recently. This question is raised particularly by the last three readings.

The issues here are not simply about the role of the science journalist, but about the dynamics of competing interests: editors, journalists and scientists. Consider the following questions, as you read these articles:

1. From readings in some of the course's sessions, we have seen how science is transmitted to the public by a series of steps. Recall the coverage of the Microcephalin story.. If you think there are problems in accurately 1)communicating and 2)reporting such stories, where does the blame fall?
2. Did these readings change any of your views about science reporting? How?
3. What is your impression of science journalism today?
4. What are the goals of a science journalist and should they be any different? What are the constraints on science journalists? How do the goals and constraints conflict?
5. What should and do scientists expect from the science journalist? How can scientists best achieve these goals? Are these goals valid? When and why do scientists want coverage of their work?
6. What are the consequences of misrepresentation of scientific findings? Are they serious or not too serious? Who is responsible for misrepresentation? Scientists, journalists, editors, the public?
7. Any solutions to any of the problems discussed? Some have suggested reporting science more as "trends in research" rather than breakthroughs. Is that a good idea? Is it possible? How might scientists better handle communication with journalists? How can journalists better survey scientific opinion on a particular study? Is that the problem?
8. Does genetics raise particular problems in communication of science to the public? What do you think of the suggestions made with regard to genetics reporting by several of the articles?
9. Who writes the headlines on science articles?
10. Can you relate the issues in this session to any of the analysis of Kuhn or of readings we have done in subsequent weeks? Given perhaps a better appreciation of science and its development, can you suggest different ways for the journalist and scientist to approach the reporting of science?
11. **Given the rapid decline of newspapers and, among other things, the contraction in science news, perhaps the most important question is how will the public learn about science in the future? Blogs, university press releases, …..? Come in with your thoughts on these questions and in whether any the alternatives are better, worse or the same.**

Microbiology 213
April 29, 2012
Genetics, the Law and the Criminal Justice System

Part I: Crime and Behavioral Genetics

These readings examine some aspects of the field of behavioral genetics and its intersection with the criminal justice system.

1. J. Beckwith, Making Genes, Making Waves: A Social Activist in Science (Harvard University Press, Cambridge, 2002), Chapter 8. "The Myth of the Criminal Chromosome," pp. 116-134.

Why did the XYY story gain so much attention so quickly and last so long?
Do you think that the long-lasting popular culture image of the XYY male is just good entertainment or might have some other consequences? If the latter, do you think they are serious enough to be concerned about?
What responsibility do scientists have who publish papers with potential social impact in confronting misrepresentations, etc.?
What, if anything, could have been done or can be done to arrest this type of inaccurate dissemination?
With regard to the study in which newborn male infants were screened for the XYY genotype, when is it appropriate for e.g. institutional committees to stop a scientific study?

2. Caspi A. et al. (2002) Role of genotype in the cycle of violence in maltreated children *Science* 297, 851-4.
Z. Prichard et al. (2008) No evidence for interaction between *MAOA* and childhood adversity for antisocial behavior. *American Journal of Medical Genetics* 147, 228-32.

Compare the findings presented in Caspi et al. (2002; the first study presenting a gene-environment interaction for criminal/antisocial behavior with maltreatment) and that of Prichard et al. (2008; the largest study to date attempting to replicate the Caspi findings). What do you think of the conclusions and the recommendations of the Caspi study? Do they follow from the findings? Are they appropriate? Do you think they are reasonably careful about what they say. What are some of the possible reasons for the dramatically different findings presented in the two studies? Methodological? Statistical? Cultural? What are the implications?

3. C. Morris, A. Shen, K. Pierce, J. Beckwith. 2007. Deconstructing Violence. *Gene Watch* Volume 20 Number 2, pp. 3-10, March - April 2007.

Are the premises and methods investigating links between behavior and genetics sound? How does social context inform this study? If the Caspi et al. conclusions were eventually to become scientifically well established by further replication, what do you think the social implications would be? Would genetic screening be a good idea? Who should be screened? How should the screening information be used?

4. W. Bernet et al. (2007) Bad nature, bad nurture, and testimony regarding MAOA and SLC6A4 genotyping at murder trials. *Journal of Forensic Sciences* 52(6): 1362-71.

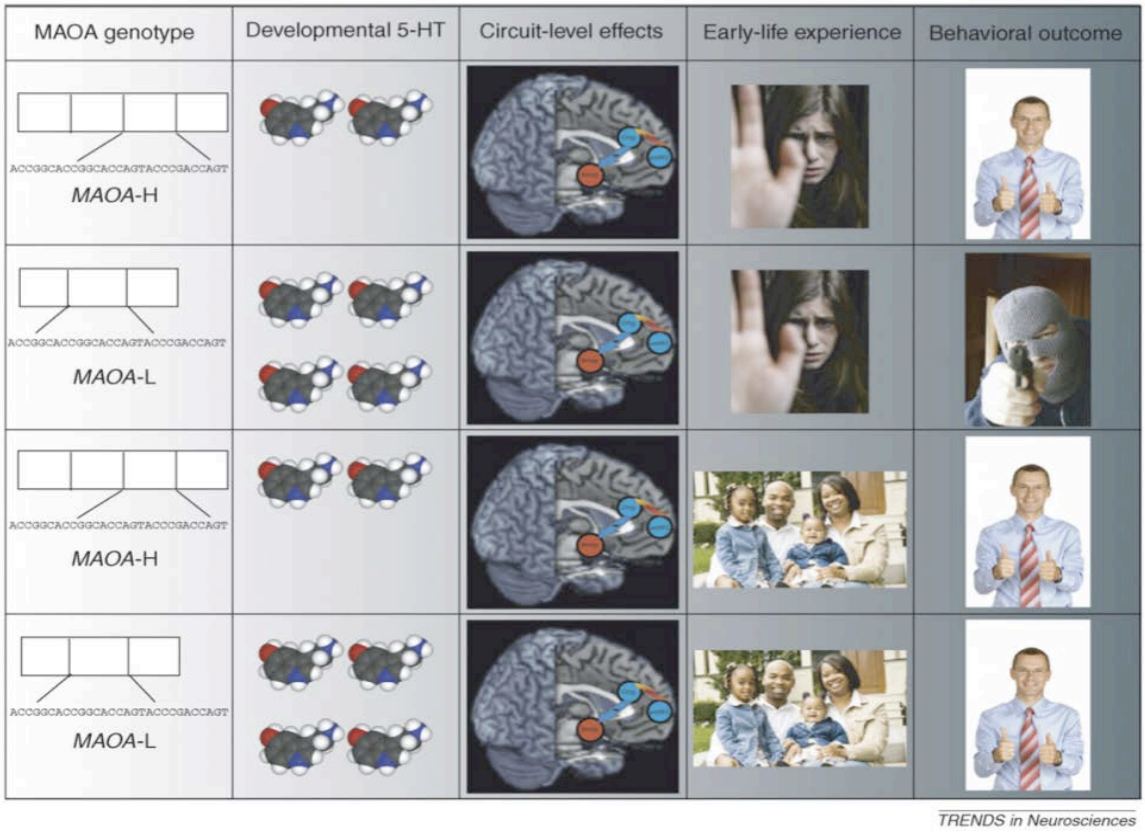
C. Dean. When Questions of Science Come to a courtroom, Truth has Many Faces. New York Times Dec. 5, 2006, p.3

How is MAOA genotyping (along with SLC6A4 genotyping) being used in these legal cases? What kinds of problems occur when science enters the courtroom? Does it seem from the cases discussed here that the "gate keeping" mechanism is working? Does the science substantiate usage in court? What is the nature of a scientist's responsibility for the use of science in the courtroom?

What do you think of the current legal status of discussion of science issues in the courtroom as indicated in the Dean article? Can you suggest better ways of handling these issues?

Do you think studies such as those on MAOA could be useful in court cases?

These articles are a few years old. Spend some time looking online for any more recent attempts to replicate the Caspi study. Also see if you find other examples of MAOA violence/criminality/aggression research making its way into more popular literature by searching Google Books, or other online sources. Bring a couple examples of what you find.



While this course has focused a lot on genetic research, similar issues as those we have discussed may arise in other areas such as neuroscience/brain science.
Figure above from Feb. 2008 *Trends in Neuroscience* article on "MAOA and the neurogenetic architecture of human aggression" depicting MAOA genotype and early-life experience in "predicting adult antisocial behavior." (Buckholtz and Meyer-Lindenberg). After doing the Part One readings, what are your reactions to the images and the headers in the table above? Does it really matter? What makes you think so or not?

Part II: DNA Forensics and Databases

This section deals with the use of genetics as a law enforcement tool. Again, consider both the scientific merit of the technologies as well as how the technologies interact with existing institutions and social contexts.

1. Rosen J. 2009. "Genetic Surveillance for All?" Slate.com March 17, 2009. (8 pages)
2. Gershaw, C.J., Schweighardt, A.J., Rourke, L.C., and Wallace, M.M. "Forensic utilization of familial searches in DNA data bases. Forensic Science International: Genetics 5:16-20 (2011).
3. Seringhaus M. "To stop crime, share your genes." New York Times. March 15, 2010. And Letters to the Editor in reply.

> These three articles discuss the expansion of DNA databases, which will now include the DNA of anyone arrested for a federal offense (regardless of whether one is guilty or convicted). The Rosen article also discusses "familial searching." Several states are moving in the direction of increased inclusion and wider DNA drag nets. Does this concern you, or should it only concern those who are worried about being caught for a crime? Think about existing disparities in law enforcement. How do DNA databases and familial searches further amplify these disparities? Are there ways that these disparities could be addressed so as to make a DNA database "fair"? Do you see any intersection between these databanks and the information in Part I of the readings today?
>
> I will be asking some students to take either a pro-, con- or "intermediate way" of instituting DNA data bases for criminal justice purposes.

Rothstein, Mark, and Meghan Talbott. 2006. The Expanding Use of DNA in Law Enforcement: What Role for Privacy? *J. Law, Medicine & Ethics* 34:153. (17 pages)

> How convincing are proposals for expanding DNA databases? What beliefs underlie these proposals for expansion? How do you evaluate "Indirect Searches" and "Low-Stringency Searches"? Finally, do you think that in a Facebook/Myspace age, privacy norms have changed? Why or why not?

Wallace, H. "Police DNA database to be rolled back in Britain." In Biopolitical Times on website of the Center for Genetics and Society. March 10, 2011 (4 pages)

Langley, W. "The Case against DNA." Same website (from The Telegraph) March 6, 2012 (5 pages).

These are reports from England which has had the largest DNA database in the world (I think). Do you agree with these negative steps and arguments?

Microbiology 213
Social Issues in Biology
April 5, 2012

Prenatal Screening, Gene Therapy/Genetic Enhancement and Society

Today's readings represent a selection of papers and book chapters that give views on the benefits and problems associated with various genetic approaches that are allowing or present in the future more and more choices to be made by parents in what their children will be. These include, prenatal screening and abortion, genetic enhancement using "gene therapy" techniques and even synthetic biology. There are a variety of perspectives on whether the genetic advances that allow these choices are beneficial or not. How informed does the basic science researcher have to be in this area? What role should geneticists play in these discussions?

To my mind, these readings are all related to some extent. After having read them all, what developments, if any, do you think to be of particular concern? Why and can or should anything be done to deal with these concerns?

Readings:

1. H.T. Greely. Get ready for the flood of fetal gene screening. Nature 469:289-291 (2011).

Issues are raised either directly or indirectly on prenatal screening in many of the following readings that come from some time ago. All of them, except this one, were written when amniocentesis was the method for detecting genetic variants in fetuses. This article suggests that such screening will become much more widespread with this new non-invasive technology. Is this likely? In the context of the other readings in this session, what problems might arise?

2. Excerpts from Rayna Rapp's <u>Testing the Women, Testing the Fetus.</u> Routledge, NY. 1999. Pp. 3-8; 66-93; 185-190.

Rapp is an anthropologist who has spent many years observing and participating in interactions between pregnant women and their families and medical professionals, mainly genetic counselors. Her experiences reveal much complexity and diversity in the population in dealing with genetic information. There are a variety of issues to think about here: 1)Should genetic counseling be non-directive- can it be non-directive? 2)How does different cultural/ethnic/class background influence attitudes towards screening and reproductive decisions? 3)How is normality defined or should it be? 4)How do we deal with issues of science literacy in areas like this where scientific information is being communicated?

3. A. Asch. Prenatal diagnosis and selective abortion: a challenge to practice and policy. Am. J. Public Health. 89:1649-1657 (1999). PLUS T. Lee. You probably won't like James Watson's ideas about us. Ragged Edge. Mar/Apr. p. 16 (1998).

For these readings, I will ask someone to defend Asch's position and someone to offer a critique of it. Rapp, in her book, touches on issues of disability. The Asch article raises questions that arise from the development of new genetic tests, presenting a significant point of view within the community of people with disabilities. Does this influence your thinking about prenatal testing, etc.? Asch is trained in social psychology. Do you think Watson's ideas may be widely shared or more acceptable if less inflammatory language were used?

4. Buchanan, D. W. Brock, N. Daniels and D. Wikler. Excerpt from Chapter 4, "Why not the best?" in *From Chance to Choice: Genetics and Justice*. Cambridge University Press pp. 156-196 (2000).

This chapter, as the book it is part of, is co-written by four moral philosophers, who overall take a favorable view of genetic enhancements. What do you think of their arguments?

5. S. Lumenello. Perfection Complex: an interview with political philosopher Michael Sandel. Colloquy (Harvard GSAS Alumni Quarterly) Fall, 2007. pp.2,3,10,11; C. Elliott. The mixed promise of genetic medicine. NEJM 365:2024-2025 (2007).

These two pieces talk about the future impact of genetics and genetic testing, although from very different perspectives and touching on different issues. I thought it would be particularly interesting to sum up this session with a discussion of what the future looks like. Sandel is more worried about how society will handle human genetic information. Elliott is, in part, responding to Sandel. Do you agree with either of their views? Do you think there is anything to worry about? If so, come prepared to talk about those issues or to argue why you don't agree with either of the authors.

For readings 4 and 5, I will ask someone to support the more libertarian approach of Chance to Choice to the use of new technologies and someone to represent the views of Sandel and Elliott (somewhat different?).

6. D. Sharp. Writing your baby's synthetic genome: Genetic Engineering for the Facebook Generation, Biopolitical Times on website of the Center for Genetics and Society. March 22, 2012.

Do you think these "synthetic biology" proposals are feasible? Assuming that they are, do you think they should be supported? Why or why not?

7, K. M. Weiss and Anne V. Buchanan. Is Life Law-Like. Genetics 188:761-771 (2011).

This is a remarkable article. Do you understand why I gave it in the context of the rest of these articles? Do you think it is overstated or not? What do you make of the last paragraph?

Microbiology 213
Social Issues in Biology
April 12, 2012

The Genomic Information Industry
Privacy, Discrimination, and Self-knowledge?

Recent years have seen the emergence of an industry providing direct-to-consumer (DTC) genetic testing services. Marketed and offered directly to individuals, and covering a broad range of phenotypic trait loci (with both potential medical and non-medical application), these broad genome scans stand in contrast to the limited genetic testing that had been performed for certain validated pathogenetic loci in the clinical setting. These companies' products vary widely in cost, the genetic tests they provide, and the interpretive information they offer. The emergence of these companies has ignited a debate over the validity and accuracy of the tests with regards to phenotypic correlations; whether or not they inappropriately offer substantive medical information without the involvement of a physician or genetic counselor; issues of privacy, discrimination, and other potential for misuse of genomic information; and what is appropriate regulatory oversight and restrictions on such tests. Please be prepared to discuss these issues.

READINGS PART A:

Direct-to-consumer genetic testing and personalized genomic medicine

1) Direct-to-Consumer Genetic Testing Companies, updated 8/11/2011. Genetics and Public Policy Center.

This table gives an overview of the number of DTC genetic testing companies, and the various tests and services they provide. Are any of these genetic test offerings surprising to you? If so, which ones and why?

2) Ng PC, et al. An agenda for personalized medicine. *Nature.* 2009. 461:724-6.

Venter *et al.* compare the results of DTC genetic testing companies on five individuals. What do you think about the findings of this comparison? What do you think, specifically, about the recommendations that they make?

3) Caulfield T. DTC genetic testing: pendulum swings and policy paradoxes. 2012. *Clinical Genetics*. 81:4-6.

This short perspectives piece gives a brief overview of the DTC industry, shifts in popular perception of the promise of genetic testing, and findings exploring the potential costs and benefits of DTC genetic testing.

4) Vashlishan Murray AB, et al. Illusions of scientific legitimacy: misrepresented science in the direct-to-consumer genetic-testing marketplace. 2010. *Trends Genet.* 26(11):459-61.

In addition to this article, explore online how 23andMe markets its tests and how the genetic information is presented: https://www.23andme.com/health/

5) Guttmacher AE, et al. Personalized genomic information: preparing for the future of genetic medicine. 2010. *Nature Reviews Genetics*. 11:161-165.

6) Frebourg T. Direct-to-consumer genetic testing services: what are the medical benefits? *European Journal of Human Genetics*. Jan 2012.

This is a short commentary summarizing a research article published in the same issue. What do you make of the discordance between family history-based and personal genome scanning-based risk assessments for common cancers? What are the implications for clinical utility of this information? What about impact on healthcare costs?

READINGS PART B:

Genome-wide association studies (GWAS) and "missing heritability"

7) Maher B. Personal genomes: The case of the missing heritability. 2008. *Nature*. 456(6):18-21.

Genome-wide association studies provide much of the foundation of recent DTC genetic testing. However, for most of the traits studied, identified SNPs have very minimal effect. This article explores what the author believes may help account for the gap between expected heritability and that accounted for by GWAS. What are the original heritability estimates based upon?

8) Visscher PM, et al. Five years of GWAS discovery. 2012. *Am J Hum Genet.* 90(1):7-24.

This article reviews some of the expressed disappointment with GWAS results, as well as the findings of GWAS over the last five years. What do you think about the authors' conclusions regarding the success of GWAS?

Upcoming Event of Interest:

Deleterious Me: Whole Genome Sequencing, 23andMe, and the Crowd-Sourced Health Care Revolution
Anne Wojcicki, CEO and Co-Founder, 23andMe
April 17, 2012, 5:00pm–7:00pm.

Emerson Hall, Room 105
http://sts.hks.harvard.edu/events/lectures/wojcicki.html

Microbiology 213
Scientists in Wartime
April 19, 2012

Please buy the book "American Prometheus: The Triumph and Tragedy of J. Robert Oppenheimer by K. Bird and M. Sherwin., Knopf, New York (2005).

1. From "American Prometheus," read the short preface and Chapters 13-26. Then read ONLY Pages 31-35 of the short Oppenheimer biography in the PDF file Oppenheimer.pdf (from a University of California, Berkeley Website, http://ohst.berkeley.edu/oppenheimer/exhibit/) which gives a brief description of his loss of security clearance.

I recommend that, when you've got a chance, you read the entire book. In addition to what you've read for this session, the book presents a fascinating history of the ferment and excitement in physics in the 1920's and 1930's. Overall, the book also presents significant parts of the social and political history of the country during much of Oppenheimer's life. It is a very rich book.

Be prepared to recount the part of Oppenheimer's history in these chapters. More broadly, consider the role of different scientists in discussions of morality, ethics, politics of this science. Notice the discussions among scientists about their concerns over the development of atomic weapons. Some refused to participate, others participated in such discussions while they were doing the research, others spoke out and suggested sharing atomic secrets with the Russians. Note how many reacted after the use of atomic weapons in Japan. What role should scientists play, what role did they play, what were the effects of their actions, etc.? (On page 549, the authors state "With Oppenheimer's defrocking [1954], scientists knew that in the future they could serve the state only as experts on narrow scientific issues.") In Chapter 24, what do you think of Oppenheimer's views on the importance of science.

What were the different attitudes of scientists towards development of atomic weapons?

What did they do about it?

How and when did their discussions on ethics start?

Did they have special knowledge that made it reasonable for them to try to influence policy? Should the Russians have been invited in?

What do you think of the battle over secrecy where "the rules of science had trumped the principles of military security."

What do you think of Bohr's conception of "the communitarian nature of scientific inquiry?"

Do you get the occasional sense of the scientists' enthusiasm for the development of the bomb purely as a scientific problem? Is it understandable or disturbing?

What do you think the scientists would have done if they had obtained information earlier that led them to think that the bomb would be used in Japan to deter the Russians?

2. J. Conant. Last of the outspoken scientists. Boston Globe, April, 2005.
J. Rotblat. A Hippocratic oath for scientists. Science 286:1475 (1999).

These readings connect to two of the people who are characters in the Oppenheimer book. What role did they play? The Conant article follows the death of Phillip Morrison, who was part of the Manhattan Project. Do you agree with the thrust of her article? What do you think of Rotblat's proposal?

3. Other examples of scientists' interactions with the military.
E.C. Hayden. Bioengineers debate use of military money. Nature 479:458 (2011).
Articles about Harvard Professor Louis Fieser and napalm.

The first article describes a current controversy in science over military uses of biology. Different scientists have different positions on the issue. Where might the different positions come from? The second reading (2 articles in one file) describe Professor Fieser and his responses to the use of napalm in World War II and in the Vietnam War. Here one scientist had different reactions to military uses of his science in the case of two different wars. Why?

Microbiology 213
April 26, 2012

Social Activism in Science: The Recombinant DNA Debate and Science Activists

I. Read pages 1-67; 83 to the middle of page 90 of J. Beckwith "Making Genes, Making Waves: A Social Activist in Science" Harvard University Press (2002).

Here, I've been complaining all semester about scientists going to the media, holding press conferences, etc and contributing to misrepresentation of science. Did we (me and my colleagues) do the same thing?

The last section on the situation in my lab during this period may give a sense (perhaps) extreme of what the societal environment was like and how it invaded the lab. Any comments?

Please come prepared with your comments, criticisms and any questions you want to ask me.

II. The Recombinant DNA Controversy

P. Berg et al. Potential biohazards of recombinant DNA molecules. Science 26 July, 1974, p. 303

V. K. McElheny. "Watson and DNA: Making a Scientific Revolution." pp. 220-237. Perseus Publishing, Cambridge (2003).

N. Wade. Genetics: conference sets strict controls to replace moratorium. Science **187:**931-935 (1975).

P. Berg and M. F. Singer. The recombinant controversy: Twenty years later. Proc. Natl. Acad. Sci. USA, **92:**9011-9013 (1995).

D. Nelkin. Threats and promises: negotiating the control of research. Daedalus Spring, 1978 191-210.

This is an instance where leading scientists got together and proposed a moratorium on the use of a particular research technique (recombinant DNA) and ultimately came up with guidelines for carrying out the research. It involves several different perspectives among scientists. Among those who first proposed the moratorium, some continue to point to it as an important instance of social responsibility, while others think it was a mistake. Other scientists felt that it was an elite group of scientists who established the moratorium and guidelines and there should have been more public involvement. Finally, some scientists wanted the discussions to include the prospects of human genetic engineering (e.g.me). In some cases, the public also got involved in discussions of the issues. The debates were pretty fierce at times as you may sense from the excerpt from the biography of Watson. These readings may give you a sense of the different perspectives in the controversy. The calling of the Asilomar Conference likely reflects the environment in which activism among researchers and science students began to flourish in the late 1960's.

There are a number of important questions that arise. There are those who argue that it is a mistake and a dangerous precedent 1)to stop a scientific project that may provide great societal benefits and 2)to air the issues publicly. What do you think?

III. Scientists who acted: Why?

Arthur Galston. Science and social responsibility: a case study. Annals of the NY Acad. Sci. **196:**223-235 (1972)

M. Meselson. Averting the hostile exploitation of biotechnology. CBWCB **48:**16-19 (2000)

American Society for Cell Biology. Statement on Public Service Award to Matt Meselson, (2002)

T.O. Baldwin. Engaging the Public. ASBMB Today. April 2010.

S. J. Gould. Pp. 351-353 in The Mismeasure of Man.

M. Thompson. Students on the front lines of public engagement. ASBMB News, Sept. 2011

These are four instances of scientists who became concerned about certain issues and, by the very nature of the issues, took very different approaches. Our discussion this past week about a Hippocratic Oath for scientists included comments about the difference in being precise comparing a Doctor's Oath vs. a Scientist's Oath.

What do you think of Gould's praise of "debunking?"