Supplemental Materials for
Integration of Ethics across the Curriculum:
From First Year through Senior Seminar
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Table of Contents
(Total pages 11)

Appendix 1: Syllabus for IDNM 200: Introduction to Careers in Science, Technology and Mathematics
Appendix 2: Syllabus for IDNM 101: Using Information Effectively in the Sciences
Appendix 3: Syllabus for MBBB 493: Bioethics Seminar
Appendix 4: Assessment rubric
Appendix 5: Additional teaching resources (including websites, case study resources, and potential films for discussion)

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IDNM 200: Introduction to Careers in Science, Technology and Mathematics Course Syllabus

Course Schedule

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Assignment and Due Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 30, 2014</td>
<td>Welcome—Review Class Objectives and Syllabus</td>
<td></td>
</tr>
<tr>
<td>February 6, 2014</td>
<td>Summer Internships/Research and the Interviewing process—Career Center</td>
<td>1. Identify two summer research programs/internships that interest you – due 2/20</td>
</tr>
<tr>
<td>February 20, 2014</td>
<td>Strategies for Networking with Faculty Members</td>
<td>2. Prepare a packet for requesting a letter of recommendation – due 3/6</td>
</tr>
<tr>
<td>March 6, 2014</td>
<td>Career Preparation—requirements for graduate school and jobs</td>
<td>3. Identify three experiences and/or skills that will help you obtain the career you want – due 3/27</td>
</tr>
<tr>
<td>March 27, 2014</td>
<td>Ethics and case studies evaluation</td>
<td>4. Case studies work sheet and discuss chapters 1-12. – due 4/10</td>
</tr>
<tr>
<td>April 10, 2014</td>
<td>Class Discussion I—The Immortal Life of Henrietta Lacks</td>
<td>5. Find a peer reviewed research paper that uses HeLa cells and be prepared to explain the paper to the class and discuss chapters 13-25– due 4/24</td>
</tr>
<tr>
<td>April 24, 2014</td>
<td>Class Discussion II—The Immortal Life of Henrietta Lacks</td>
<td>6. Be prepared to discuss chapters 26-38 and ask our seminar speakers one question– due 5/1</td>
</tr>
<tr>
<td>April 30, 2014 @ 7pm</td>
<td>The Immortal Life of Henrietta Lacks – Seminar</td>
<td></td>
</tr>
<tr>
<td>May 1, 2014</td>
<td>Class Discussion III—The Immortal Life of Henrietta Lacks</td>
<td>7. STEM RLC Activities Summary. – due 5/8</td>
</tr>
<tr>
<td>May 8, 2014</td>
<td>Class Evaluation</td>
<td></td>
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</tbody>
</table>

Assignment Descriptions:
1. Identify two summer research programs/internships that interest you. Here are some sites that may be of interest:

2. Letter of recommendation (LOR) packets should include:
   a. Current resume or CV (see example CV)
   b. Letter to faculty expressing interest and program/internship of interest.
   c. Copy of unofficial transcripts
   d. Addressed and stamped envelope or LOR uploading procedures

3. List three skills and/or experiences important for your career path. If you do not have three then list others that you plan to acquire and how you will acquire them.

4. Complete the case studies worksheet listed in the “content” folder on blackboard.

5. Find a peer-reviewed journal that uses HeLa cells and be prepared to discuss the paper with the class. Some sites that may be of interest: http://www.ncbi.nlm.nih.gov/pubmed/ - If you cannot access a journal here try the next site. http://www.doaj.org - A search for HeLa will produce hundreds of results

6. Continue reading and be prepared to discuss chapters 26-38 and ask our speakers one question.

7. Brief Summary of STEM Residential Learning Community Events attended: Write a paragraph or two about TWO STEM Residential Learning Community or FCSM Activities you attended. These can be activities sponsored through the STEM Residential Learning Community or a major-specific activity, such as attendance at a seminar or FCSM club event.

IDNM101: Using Information Effectively in the Sciences Course Syllabus

Resources:  
Feldman, S. and Bruce, S. 2014. IDNM101 Course packet. Towson University, MD  
Longman, Inc., NY  
National Academy of Sciences, Committee on Science, Engineering, and Public Policy.  
1995. On Being a Scientist: Responsible Conduct in Research. 2nd ed. National  
Academy Press, Washington, DC. (Available online in full text at  
http://www.nap.edu/readingroom/books/obas/)

Sample Assignments:

1. Worksheet on Scientific Ethics:
List and briefly define in your own words the six ethical values upon which scientific research is based.

What is individual knowledge?

How is individual knowledge gained in science?

List three means of converting individual knowledge to public knowledge.

What is the role of peer-review in the conversion of individual knowledge to public knowledge?

2. Responsible Conduct in Research Case Study Assignment:
Each group of students will be assigned one of the 12 case studies in the On Being a Scientist book by your  
instructor. As a group read and discuss the case study. Answer the questions at the end of the case study. Be  
prepared to describe the case study to the class briefly, address the questions at the end of the case study, discuss  
points of consensus and/or disagreement among the group, and discuss which of the six ethical values of research  
presented in the book are covered by the case study. Each group will turn in a brief written statement addressing the  
points above.

3. Worksheet: The Tuskegee Study (Can be done individually and then come together to discuss in a larger  
group setting)
List and briefly describe at least two of the most ethically disturbing aspects of the Tuskegee syphilis project.

Which core value(s) of scientific research (as discussed in On Being a Scientist) were lacking in these two aspects of  
the Tuskegee study?
List and briefly describe at least one scientifically flawed aspect of the Tuskegee syphilis project. How does this flaw relate to the currently accepted process of scientific inquiry and elements of an experimental design?

MBBB 493: Seminar in Bioethics Course Syllabus

Texts:  I have not found an ideal text for this class, so none is absolutely required but the two below will be very helpful. The first book (On Being a Scientist) is free if you read it on line so there is no excuse not to.

1) *On Being a Scientist*, 3rd edition. 2009. National Academy of Sciences. This text can be ordered on-line as a physical book (~$7.50), a PDF (~$6.50 or $0.70/chapter), or read on-line for free (www.nas.edu).

Assignments:

Case Study Write Ups:  Students will be assigned five case studies for which a written summary is required. Write ups will be based on the questions associated with each case study and should be 1000 - 2000 words in length. You must use and cite sources. DUE DATES SHOWN IN COURSE SCHEDULE.

Oral Presentation:  Students will be assigned to a presentation date and a topic or current event that has bioethical implications. Two or three students will be presenting on related projects so both students presenting on the same day need to coordinate presentation topic and order. Each student will present a 30 - 35 minute summary of their topic, which should include technical and ethical issues related to their specific topic. Presentations must include a literature cited slide. Presentations are to be prepared in PowerPoint and the presentation file must be submitted at the time of the presentation.

Written Report:  Each student will submit a written report on the same subject as their oral presentation. This report should be 3000 - 4000 words in length, and include a references cited section. The report should provide a similar level of detail as provided in the oral presentation and should reflect my evaluation of your oral presentation. Soon after each oral presentation I will meet with the student to provide feedback and a grade. That feedback should be used to improve your written report.

Each student’s oral and written report must address and will be graded on the following aspects. In addition, the oral presentations will be graded on organization, clarity and the appropriate use of visual aids.

1) Technical Aspects: You must explain HOW the technique is carried out. This should include molecular-level detail. It should also include risks if appropriate. The discussion of techniques should be complete but should not exceed 10 minutes of presentation time or two pages of the written report.
2) Examples of Applications: You must give at least three examples of the application of the subject/procedure. For example, if you are discussing genetic testing for late onset human diseases, you would give examples of at least three such diseases and the consequences of such diseases.
3) Current Rules/Laws: You must explain the state of current rules and regulations governing the subject/procedure. You must do so for the U.S and other countries.
4) Utilitarian Analysis: You must examine the consequences of the subject/procedure on everyone who may be impacted and the likelihood of such effects. Those affected will include individuals directly involved (the person receiving gene therapy for example), special interest groups (farmers affected by transgenic crops for example), society as a whole (the consequences of potential life-span extension via stem cell therapy for example) and even the environment. For each you must assess the likelihood of an impact and the degree of that impact. For example, pre-implantation genetic testing is certain to have a dramatic impact on the parents to be because it can be used to prevent the birth of children affected by disabling or even deadly inherited conditions. By contrast the potential to impact society by leading to eugenics, while very severe, is very unlikely because there is little chance a significant number of couples will ever use in vitro fertilization. This is NOT where you consider the concerns of those who support or oppose the subject/procedure based on purely ethical concerns. For example, you would not include the Catholic Church’s objection to embryonic stem cell therapies based on their opposition to abortion.
5) Ethical Analysis: You must present all relevant ethical concerns related to the subject/procedure and present a case either for or against. You MUST include the utilitarian analysis but you must also consider purely ethical concerns. For example you would discuss the opposition of animal rights groups to genetic engineering of animals on the basis cruelty to animals. Your final conclusion does not have to be derived solely from the utilitarian analysis. For example, your utilitarian analysis may indicate that an embryonic
stem cell therapy is a net benefit for society and yet your ethical analysis may conclude that it should not be pursued because of the religious prescription against the destruction of human embryos.

The general topics and examples of specific subjects are listed below. Each student will deal with one specific subject. If you have an idea for a specific subject that is not listed you must receive approval in advance to present that subject.

Animal Cloning       Genetically Engineering Plants
  a. Cloning of farm animals          a. Disease and pest resistance
  b. Cloning of pets
Stem Cell Therapies and Research
  a. Adult stem cell therapy
  b. Embryonic stem cell therapy
Gene Therapy
  a. Genetic disease treatment
  b. Germ-line therapy
  c. Potential for enhancement
Genetic Engineering in Animals
  a. Growth rate/size
  b. Research
  c. Farmaceuticals
Gene Therapy
  a. Genetic disease treatment
  b. Germ-line therapy
  c. Potential for enhancement
Genetic Engineering in Animals
  a. Growth rate/size
  b. Research
  c. Farmaceuticals

Genetic Testing Related to Reproduction
  a. Pre-Implantation genetic testing (BABI) during in vitro fertilization
  b. Pre-conception testing for prospective parents
Genetic Testing NOT Related to Reproduction
  a. Testing for late onset diseases
  b. Personalized medicine (Pharmacogenomics)
DNA Databases
  a. Use of DNA databases in forensics
  b. Use of DNA databases of large populations for medical research

Extra Credit:
Students will be able to earn up to 3 points (3% of the total grade) by completing one of two assignments.

1. Attend the Henrietta Lacks Memorial Lecture Saturday, Oct 5th at the Johns Hopkins Medical School and submit a minimum 1000 word summary. Attendance at the lecture is limited and you must register. You can register at http://ictr.johnshopkins.edu/service/lecture/.

2. Submit a minimum 2000 word paper summarizing the issues of informed consent, privacy and ownership of biological information through the context of the story of HeLa cells and Henrietta Lacks.

Course Schedule:

<table>
<thead>
<tr>
<th>Date</th>
<th>Topic</th>
<th>Assignment Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>8/30</td>
<td>Introduction: Philosophical Approaches to Ethical Decisions. What is Bioethics?</td>
<td></td>
</tr>
<tr>
<td>9/6</td>
<td>Responsible Conduct of Research</td>
<td></td>
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<tr>
<td>9/13</td>
<td>Historical Cases of Scientific Fraud/ Data Collection, IRB and IACUC Oversight Committees</td>
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</tr>
<tr>
<td>9/20</td>
<td>Beyond Darwin Video—Biotechnology and Bioethics</td>
<td>Case Study 1 Write Up Due</td>
</tr>
<tr>
<td>9/27</td>
<td>Overview Medical Applications</td>
<td></td>
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<tr>
<td>10/4</td>
<td>Overview Agricultural and Ecological Applications</td>
<td>Case Study 2 Write Up Due</td>
</tr>
<tr>
<td>10/11</td>
<td>Presentation Topic 1: Animal Cloning</td>
<td></td>
</tr>
<tr>
<td>10/18</td>
<td>Presentation Topic 2: Stem Cell Therapies and Research</td>
<td>Case Study 3 Write Up Due</td>
</tr>
<tr>
<td>10/25</td>
<td>Presentation Topic 3: Gene Therapy</td>
<td></td>
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<tr>
<td>11/1</td>
<td>Presentation Topic 4: Genetic Testing Related to Reproduction</td>
<td>Case Study 4 Write Up Due</td>
</tr>
<tr>
<td>11/8</td>
<td>Presentation Topic 5: Genetic Testing Not Related to Reproduction</td>
<td>Case Study 5 Write Up Due</td>
</tr>
<tr>
<td>11/15</td>
<td>Presentation Topic 6: DNA Databases</td>
<td></td>
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<tr>
<td>11/22</td>
<td>No Class: Thanksgiving Break</td>
<td></td>
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<tr>
<td>11/29</td>
<td>Presentation Topic 7: Genetically Engineering Plants</td>
<td></td>
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<tr>
<td>Date</td>
<td>Event</td>
<td>Notes</td>
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<tr>
<td>12/6</td>
<td>Presentation Topic 8: Genetic Engineering in Animals</td>
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<tr>
<td>12/18</td>
<td>Final Exam Period 8:00 – 10:00</td>
<td>All Written Reports Due</td>
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<tr>
<td></td>
<td>Future Issues</td>
<td></td>
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</tbody>
</table>
Case Study 1:
You are a graduate student working on your PhD in a neurophysiology laboratory. You are trying to determine the role of a specific neuroreceptor in long-term memory formation using transgenic rats whose gene for that protein has been mutated, inactivating the protein. It is possible that if this receptor does play a role in long term memory formation a drug could be developed to treat those with memory problems. You research involves the use of a highly sophisticated in vivo brain imaging system. The use of that system is very expensive and time on the machine is limited. You have waited 6 months to use the instrument. You cannot expect to use the instrument again for at least a year. Your experiment yields data which largely confirms your hypothesis but there are several data points that appear to be “outliers.” If those data points are included in your data analysis there would be no statistically significant difference between your control and experimental groups of animals. You noticed during the experiment that there were several small voltage spikes. You suspect that these voltage spikes may have caused the unexpected data points. You did not record information about the voltage spikes (timing, amplitude or duration) in your lab notebook at the time. You have data from techniques which support your hypothesis. It is likely that you could publish the results of the other experiments in a lower tier journal, but without the brain imaging results you cannot publish in a top tier journal. You hope to finish your doctoral work in the next six months and apply for faculty positions.

A. Under what conditions if any can you discount specific data points?
B. Under what conditions if any can you discount the entire experiment?
C. Identify all the stakeholders who will be affected and what that affect will be if in fact the results are published without the contradictory data/experiment and the published results prove to be inaccurate.
D. Explain what you would do and why.

Case Study 2:
You are a graduate student in a university biomedical research laboratory. The laboratory works on the effects of man-made compounds which mimic estrogen. These compounds are used in a variety of products because they improve the functionality of the products and lower the cost of production. They are interested in these compounds because they frequently escape into the environment and have been correlated to the incidence of birth defects in aquatic animals, lowered fertility in both aquatic animals and humans, and cancer in humans. There have been few controlled experiments conducted to test whether or not that correlation reflects a causal relationship. Your lab is conducting such experiments and preliminary results indicate that the synthetic estrogens do cause birth defects in aquatic animals. That work has been published. Your lab is now planning on starting work on the relationship between these agents and cancer in humans. The results of such experiments may form the basis for regulation of the use these agents but the principal investigator (PI) of the lab has not been able to secure funding for the project from the normal federal sources.

Your PI has been in contact with a large chemical company about funding the work. The company has offered to support the work. As is typical with such private funding, the company has several requirements for such work, including access to the results before publication when the company could use them to guide its own research and development or manufacturing. The company does not currently produce any products containing the synthetic estrogens but they have in the past and could in the future and their competitors do use such chemicals in similar products now.

A. How could the company benefit from early access to the results if the work shows that the synthetic estrogens do cause cancer? How could they benefit if the work shows no link to cancer?
B. Does the proposed work constitute a conflict of interest for the PI of the lab? Explain. Be sure to support your answer with an accepted definition of what constitutes a conflict of interest (cite your source).
C. Assuming the work DOES constitute a conflict of interest, identify all the stakeholders who will be affected and what that affect will be if the decision is to proceed with the work under the conditions described and the results show a causal link to cancer.
D. What would you, as a graduate student in the lab do? Explain your decision.

Case Study 3:
In vitro fertilization clinics often offer blastomere analysis before implantation (BABI) is offered. A couple seeking in vitro fertilization requests that an “embryo biopsy” be tested for Sickle Cell Anemia. Both of the prospective parents are carriers (heterozygous for the recessive sickle cell version of the hemoglobin gene) and therefore have “Sickle Cell Trait.” Sickle Cell Trait does not normally have serious health affects unless the person participates in extremely strenuous physical activity under challenging conditions such as running at top speed for extended periods while at high altitude. The prospective parents request that only embryos completely lacking the Sickle Cell allele be
implanted. They do not want to limit the physical activity of their children in any way and they do not want their children to be concerned about passing on the trait when they decide to become parents.

A. How is selection against embryos that would develop into carriers different from selection against embryos that will yield children that are homozygous for the sickle cell allele? Is one ethically different from the other? If so, why?

B. Many clinics refuse to select against embryos that which would have traits that do not threaten early death or dramatically affect the ability of the child to function in society. Who should have the power to decide which traits are tested for and used for selection? Should it be the prospective parents, the clinic, the government or someone else? Defend your answer.

C. Another option for this couple is to adopt. The fact that they are attempting to use in vitro fertilization shows they would prefer their genetic children. Is it ethically sound to choose in vitro fertilization over adoption if in vitro fertilization requires the destruction of embryos with the sickle cell trait? Would your answer be affected by the knowledge that in most in vitro fertilization attempts there are many more embryos produced than are actually used and that the unused embryos are usually destroyed? Defend your answers.

D. Identify all the stakeholders who will be affected and what that affect will be if in fact the couple are allowed to select against embryos that are carriers for sickle cell disease.

Case Study 4:
The H5N1 flu virus, or “Bird Flu” is a highly virulent strain of the influenza virus, killing up to 50% of those who are diagnosed. This strain of influenza is transmitted from infected birds to humans who come into close contact with those birds. This usually means farm workers. Fortunately it is not passed easily from one human to another. Having said that, if H5N1 were easily transmissible between humans, it would be a potential biological weapon. Several laboratories have been studying human-to-human transmission of H5N1 to understand what limits its transmission so that if it ever does evolve to be more easily transmissible we may be able to develop appropriate countermeasures. Recently, two laboratories have demonstrated how the virus could be modified to make it much more easily spread. Immediately the question arose as to whether or not their work should be published and if so, whether key steps should be censored to prevent potential terrorists from obtaining a “blueprint” to the development of a bio-weapon.

A. What are the characteristics of an effective bioweapon? Is a virulent, easily transmitted influenza virus a good bioweapon? Note that you will need to do a bit of outside reading to answer this one. Remember to cite your sources.

B. What are the disadvantages to censoring (wholly or in part) this work? Answer this question from the perspective of both the scientist who conducted the work and society as a whole.

C. Who made the decision whether or not to publish this work?

D. Should government decide whether or not the work should be published?

Case Study 5:
AIDS is caused by the HIV virus which attacks immune cells through two cell surface receptors. While there are treatments for AIDS, there is no cure or vaccine. Early in the epidemic it was noted that some women who were repeatedly exposed to the virus as prostitutes did not contract the disease and in fact never tested positive for the virus. Tests have revealed that the immune cells of these individuals are not susceptible to invasion by the virus. Whole genome sequencing was conducted to identify the gene(s) which might confer immunity to HIV/AIDS. Follow up research has demonstrated that the immunity is the result of a mutation in the gene encoding one of the two cell surface receptors that HIV uses to gain entry to cells. Work is underway to identify drugs which might cause effects similar to the mutation and thus prevent infection.

A. Legally, who owns the genetic sequence of the mutant receptors?

B. Legally, who owns that right to develop drugs based on that information?

C. If an effective prophylactic is developed, who owns that?

D. When considering the legal ownership genetic information that may lead to human drugs, who are all the stakeholders involved and how are they affected?
Appendix 4: Assessment rubric.

Sample Rubric for Oral Report (this rubric can also be used for a written summary evaluation)

MBBB493: Bioethics Seminar: Evaluation Rubric for Oral Presentations

<table>
<thead>
<tr>
<th>Presentation Components</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technical Aspects</strong></td>
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<tr>
<td>Depth of coverage</td>
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<tr>
<td>Accuracy of coverage</td>
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</tr>
<tr>
<td><strong>Examples of Applications</strong></td>
<td></td>
</tr>
<tr>
<td>Example 1:</td>
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<td>Depth of Coverage</td>
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<td>Accuracy of Coverage</td>
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<tr>
<td>Example 3:</td>
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<td>Accuracy of Coverage</td>
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<tr>
<td><strong>Current Rules/Laws</strong></td>
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<td>Depth of Coverage</td>
<td>4</td>
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<tr>
<td>Accuracy of Coverage</td>
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<tr>
<td><strong>Stake Holder Analysis</strong></td>
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<td>Immediate stakeholders identified</td>
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<tr>
<td>Consequences identified</td>
<td>5</td>
</tr>
<tr>
<td>Probability of effect analyzed</td>
<td>5</td>
</tr>
<tr>
<td>Distant stakeholders identified</td>
<td>5</td>
</tr>
<tr>
<td>Consequences identified</td>
<td>5</td>
</tr>
<tr>
<td>Probability of effect analyzed</td>
<td>5</td>
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<tr>
<td><strong>Ethical Analysis</strong></td>
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<tr>
<td>Ethical theory used identified</td>
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<tr>
<td>Correct application of that theory</td>
<td>10</td>
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<tr>
<td>Identification of personal biases</td>
<td>5</td>
</tr>
<tr>
<td>Explanation of alternative views</td>
<td>10</td>
</tr>
<tr>
<td><strong>General Presentation</strong></td>
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<tr>
<td>Organization</td>
<td>4</td>
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<tr>
<td>Clarity</td>
<td>4</td>
</tr>
<tr>
<td>Appropriate Visual Aids</td>
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<tr>
<td><strong>Total</strong></td>
<td>100</td>
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</table>

Comments:
Appendix 5: Additional teaching resources (including websites, case study resources, and potential films for discussion).

Teaching Ethics Resources:

**Web Resources (including sources for case studies):**

http://www.asbh.org (American Society for Bioethics + Humanities)
http://www.bioethics.net (American Journal of Bioethics and blog posts on many relevant bioethical topics)
http://bioethics.od.nih.gov/ (Bioethics Resources on the Web from NIH)
http://www.eugenicsarchive.org/eugenics/ (Historical images from the American Eugenics Movement from Cold Spring Harbor Laboratory)
https://kennedyinstitute.georgetown.edu/ (Kennedy Institute of Ethics at Georgetown University)
http://thehastingsscenter.org/ (The Hastings Center-bioethics research institution)
http://nationalacademies.org/ (The National Academy of Sciences-On Being a Scientist available free online)
https://www.nwabr.org/ (Northwest Association for Biomedical Research)
http://cbhd.org (The Center for Bioethics and Human Dignity)
http://www.biotech.iastate.edu/bioethics-case-studies/ (Iowa State University Office of Biotechnology)
http://sciencecases.lib.buffalo.edu/cs/ (The National Center for Case Study Teaching in Science)

**Ethics Case Study Rubric Samples:**

http://www.personal.psu.edu/faculty/d/x/dxm12/n458/sample_case_rubric.htm

**Media Resources:**

*After Darwin: Genetics, Eugenics and the Human Genome (Films Media Group)*

*Bloodlines* (www.pbs.org/bloodlines)

*Frankenstein*

*Gattaca*

*Jurassic Park*

*Miss Ever's Boys*

*My Sister's Keeper*

*The Race for the Double Helix*