BIOT 419: Understanding Genetically Modified Organisms

Spring 2016

Instructor:
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Office Hours Wednesday 3-4pm.

Prerequisite: BCH 400.

Time: Wednesdays, 4:30-5:40pm

Credit Hours: 2

Maximum class size: 40 students

Course Description: This course is designed to introduce science majors to the science and controversy behind genetically modified organisms (GMO’s). Specific examples will be covered, followed by presentations and discussions. We will also explore how differences in culture can influence the practices of a nation. Policy, business practices and the role of GMOs in food security will also be covered.

Class Structure: The first half of each class period will focus on quizzes and lectures by the instructor and guest speakers. The remaining portion will be devoted to discussion and student presentations.

Reading Materials:


Selected Videos:
PBS-Harvest of Fear, King Corn, Living on One Dollar.

Student Learning Outcomes:
Core Objective 9. Science, Technology and Society
Core Objective 11. Global Context
Learning Outcomes and Assessment as Applied to this Course:

1. **Core Objective 9 Science, Technology and Society**
   Students will be able to connect science and technology to real-world problems by explaining how science relates to problems of societal concern; be able to distinguish between sound and unsound interpretations of scientific information; employ cogent reasoning methods in their own examinations of problems and issues; and understand the applications of science and technology in societal context.

   - In this course students will be able to understand basic scientific concepts related to genetic engineering in order to develop core knowledge in this area. In addition, students should understand the application behind the science and the problem this application was originally intended to solve. Knowledge will be gained through reading and lectures. The students will be tested on their basic understanding using clicker quizzes.

   - Students in this course will also be able to integrate and synthesize core knowledge and analyze open-ended problems or complex issues. Students will be able to distinguish between sound and unsound interpretations of scientific information and employ cognitive reasoning skills to determine if the specific GMO application poses potential risk. Presentation and peer discussion will allow students to express ideas, correct misconceptions, and work together to synergistically establish a list of possible outcomes. Individuals will weigh and evaluate these outcomes after having expanding their knowledge base and have identified potential stakeholder bias.

2. **Core Objective 11 Global Context**
   Students will apply and evaluate modes of academic inquiry, creative expression, or results of research to problems in historical and contemporary global contexts. Students will articulate connections among local, national, and international contexts and evaluate the ways that historical and contemporary global influences affect their current situations.

   In this course students will develop an understanding of how local, national, and international influences affect policies concerning GMO’s. The influences of culture, politics, science, and business will be expanded in order to gain a better understanding of GMO policies and philosophies in various regions throughout the world. Students will give a 20 minute presentation or write a 10 page paper on a topic related to a specific GMO and expand on the beliefs and policies in an identified region of the world.
Grade Scale:
A = 100-90%; B = 89-80%; C = 79-70%; D = 69-60%; F = 59% or lower

Assignments and Grading Criteria:
30% of grade = Weeks 1-15: Class participation and attendance. Also remember to be courteous to your instructor, TA, and fellow students. Be respectful to others opinions. We are all here to learn and won’t always agree on all subjects.

20% of grade = Weeks 1-9: quizzes on readings

5% of grade = Week 6: Pick a possible topic and report it to the instructor and teaching assistant in class.

5% of grade = Week 7: Turn in an electronic copy of a publication you have found on your possible topic.

10% of grade = Week 8: Make a final decision on your topic, write up a one page summary report on your findings so far, and report if you want to give a talk or write a paper.

5% of grade = Write up the possible impact, if any, that you think GMO’s would have on the Guatemalan people from Living on one Dollar. Write up a one page summary on your thoughts.

25% of grade = On the day of the final, turn in both an electronic copy on WebCampus and a hard copy in class of your paper or PowerPoint presentation (pdf printout).

Plagiarism and other forms of Academic Dishonesty

Plagiarism is trying to receive credit for material that was actually written by someone else. The most common form of plagiarism involves copying sections or statements directly from the literature without proper citation. Even if citations are included, it is not appropriate to turn in work by appending direct quotations from others, including materials from the web or your laboratory partners.

The student will also refrain from other forms of academic dishonesty including, but not limited to, cheating, fraudulently obtaining grades, forgery, and threats. For more details go to the NSHE Standards of Conduct (6.2.2) in the UNR academic catalog.

If an instructor feels that there is an instance of academic dishonesty, each student involved will be given a zero on the assignment, demoted one letter grade, and will be reported to University Department of Judicial Affairs. A second instance of plagiarism or dishonesty will result in automatic failure in the course.

Students with Disabilities

The Biotechnology Program and the Department of Biochemistry and Molecular Biology are committed to equal opportunity in education for all students, including those with documented physical disabilities or documented learning disabilities. The instructor will meet with the student and staff members of the Student Services Center to formulate a written plan for appropriate accommodations, if required.

Academic Success Services
If you have difficulty finding references, please contact Amy Shannon or another reference librarian at the Knowledge Center. For difficulties in writing and structure, contact the Writing Center at 784-6030 or http://www.unr.edu/writing-center and ask for a tutor that specializes in the sciences.

**Statement on Audio and Video Recording:** Surreptitious or covert video-taping of class or unauthorized audio recording of class is prohibited by law and by Board of Regents policy. This class may be videotaped or audio recorded only with the written permission of the instructor. In order to accommodate students with disabilities, some students may have been given permission to record class lectures and discussions. Therefore, students should understand that their comments during class may be recorded.

**Tentative Class Schedule**

**Week 1**

**Lecture**

- Introduction to course syllabus and expectations.
- Handout: Pocket size Fallacies in Logic chart to keep with you. Review of the basics.
- The history of biotechnology in crop plants before genetic engineering.
- Selective breeding, generating hybrids, using colchicine, mutagenesis techniques, chimeras and grafting.
- Defining genetic engineering and genetically modified organisms.
- *Food for Thought: Is yeast expressing insulin a GMO? Is insulin a GMO?*

**Homework:** Read two National Geographic articles on (1) Feeding Nine Billion (May 2014) and (2) The Next Green Revolution (Sept 2014).

**Week 2**

**Lecture**

- The birth of GMO’s: The first gene expression experiments in bacteria.
- Moving genes into plants: The process of plant transformation.
- The first commercial venture. Using antisense technology to creating Calgene’s Flavr Savr Tomato (1988)
- Biochemical mechanism behind ringspot virus resistance crops and its role in saving the papaya industry in Hawaii. (1998)

**Discussion** Discuss the two National Geographic Articles. What significance will GMO’s play in feeding 9 billion people by 2050?

**Homework** Read *Mendel in the Kitchen* Chapter 7. Focus on (1) Patent Laws in the US as they apply to GMO’s & (2) US Regulatory Agencies FDA, EPA and USDA and their role in GMO oversight.
Week 3

Quiz on Reading

Lecture

- Patent Laws: Recent changes in the US concerning GMO’s and Pharmaceuticals. What can be patented?
- Regulatory Agencies in the US: Oversight for GMO’s vs. conventional crops
- Regulatory oversight in Great Britain and the European Union.
- Attitudes towards food and culture: Why there is resistance to GMO’s in France and how does this compare to other European nations?

Discussion What is the role of these regulatory agencies and is it too much? Not enough? Cost? Who wins?

Homework Mendel in the Kitchen Chapter 9. Focus on Dr. Pusztai’s work and experimental controls; allergen databases and identification of allergens; outcomes for the Brazil nut 2S-high methionine albumin in soybean & Cry9 in corn.

Week 4

Quiz on Reading

Lecture

- Review of Dr. Pusztai’s research.
- Review of screening practices to detect potential GMO allergens.
  o How do we test for allergenicity?
  o Scientific oversight and discussions among scientists. Why it is important to talk about your work.
- Biochemical mechanism for glyphosate-resistance and Round-up Ready crops
- Biochemical mechanism for BT toxin and its use in both organic and conventional farming.

Discussion Poll: What do you think is the biggest concern in growing or eating BT-toxin crops? Round-up Ready crops?

- Food for Thought: Does Coca Cola contain GM protein? Are cows who eat GM corn also GM? Does a strawberry with a flounder gene produce a new chimera called a fishberry (or flounderberry)? Discuss these examples to determine which issues are most relevant.

Homework: Read Mendel in the Kitchen chapters 10 and 11: Chapter 10-Focus on the controversy behind butterflies and BT corn & good farming practices; Chapter 11-Focus on the movement of GM pollen in the environment.

Watch the movie “King Corn” available in the UNR Knowledge Center and on Netflix.
Week 5

Quiz on Reading

Lecture

- Discuss the movie “Big Corn” and farming practices in America
- The importance of GFP’s (good farming practices).
- BT toxin and the Monarch butterfly (order Lepidoptera): Controversy reviewed.
- The green revolution south of the US border: The Green Revolution in Mexico and South East Asia between the 1940s and late 1960s.
- The role of CIMMYT (Mexico) and the International Rice Research Institute (Philippines)
- Are Mexican maize lines and other land races affected by GMO cross contamination?

Discussion Should we control the spread of GMO’s using Genetic Use Restriction Technology (aka terminator seeds) in crops that outcross with wild relatives?

Homework Read *Mendel in the Kitchen* Chapter 12: Focus on the topic of organic farming. Primary literature and websites for Dr. Seralini and his studies on glyphosate toxicity.

5% of grade = Week 6: Pick a possible topic and report it to the instructor and teaching assistant in class.

Week 6

Quiz on Reading

Report in class: Pick a possible topic and report it to the instructor and teaching assistant in class.

Discussion on Dr. Sealini’s research

Lecture

- Organic Farming in the United States according to the US Department of Agriculture
- Organic Farming in Europe according to the European Commission
- The food labeling controversy. Who is affected?

Videos: Excerpts from Food Inc. and PBS-Harvest of Fear

Discussion on Labelling GMO foods

Homework: Read Chapters *Starved for Science: How Biotechnology is being kept out of Africa*. Read Forward, Preface, and Introduction: Why are Africans Rejecting Biotechnology? Also, Chapter 1: Why Rich Countries Dislike Agricultural GMOs.

5% of grade = Week 7: Turn in an electronic copy of a publication on WebCampus that you have found on your possible topic Due before class on Week 7
**Week 7**

**Quiz on Reading**

**Lecture**

- What does Organic Farming mean in Africa?
- [Video] Living on One Dollar (in Guatemala)

**Homework**

5% of grade = What impact, if any, would GMO's have on the Guatemalan people in today's movie? Write up a one page summary on your thoughts.

10% of grade = Week 8: Make a final decision on your topic, write up a one page summary report on your findings so far, and report if you want to give a talk or write a paper.

**Week 8**

**Turn in Homework Assignment**

**Class Discussion** What impact, if any, would GMO's have on the Guatemalan people in last week's movie?

**Lecture**

- The science behind the making of Golden Rice.
- The controversy surrounding Golden Rice from multiple perspectives, including Green Peace, the International Rice Research Institute, and the citizens who would most benefit.
- Monsanto's requirement for farmers to buy new BT toxin cotton seed each year. Why this business practice works in the US, but not in India.

**Guest Speaker**: Business Practices and Big Agribusiness

**Homework**: Read Chapters Starved for Science: How Biotechnology is being kept out of Africa. Read Chapter 3: Withdrawing Support for Agricultural Science in Africa. Chapter 4: Keeping Genetically Engineered Crops out of Africa.

**Week 9**

**Quiz on Reading**

**Lecture**

- Update on Biochemistry behind Drought-tolerant plants and their applications in places such as Africa with Guest Speaker

**Discussion** Homework Chapters 3 and 4

**Weeks 10-15** will be set aside for 15 minute student presentations.

**Final**: 25% of grade = Turn in final PowerPoint presentation or written paper on your topic of choice.