GENES AND CHEMICALS IN AGRICULTURE: VALUE AND RISK

3 credits / MCB 535, FS 435-435H / 535, TOX 435-435H / 535, BI 435-435H / 535
PEAVY 108: T/Th – 9:00-9:50 AM (lecture) / T - 3:00-3:50 PM (recitation)
Students must attend both the lecture and recitation sections
Instructors: Dr. Steve Strauss, steve.strauss@oregonstate.edu
Dr. Dave Stone dave.stone@oregonstate.edu
TA: Elizabeth Axton axtone@oregonstate.edu

Prerequisite: One quarter each of biology and chemistry helpful but not essential

Satisfies **Bac Core** Course in Synthesis category of Science, Technology & Society
(Bac core goals and related procedures listed on last page)

Grading

Student grades will be determined according to the following breakdown: Final grades for undergraduates and graduate student grades will be assessed separately.

- 15% = Participation (5%) / attendance (10%). Attendance will be determined by iclicker responses and/OR sign-up sheets at recitations. Participation will be rated by instructors as low, average, or high (0, 2.5, or 5 pts). Students are responsible for bringing their i-clickers to class each lecture and recitation class meeting. Grades will be withheld (incomplete) until the iclicker is returned at the end of class.
- 20-25% = Essays (two submissions). First essay (self-introduction) is worth 5%; the remaining one is worth 20% (undergrads) or 15% (grad).
- 5% = Grad only: Edit a Wikipedia article.
- 5% = Grad only: 10-15 minute summary, and posing of discussion questions, for a recitation or discussion topic (the questions to help stimulate discussion).
- 5% = Undergrads only: You Tube video contribution and both written (50-100 words) and verbal explanation (in class) of why you chose it and the lesson it provides.
- 5% = Written outline/text/ppt, and associated verbal presentation, for discussion panels in last week of class)
- 25% = Mid-term exam (one page, 8.5 x 11 sheet of paper, with notes on both sides allowed. No calculators needed.)
- 25% = Final exam (one page, 8.5 x 11 sheet of paper, with notes on both sides allowed. No calculators needed.)

COURSE SCHEDULE – SPRING 2016

(Note: Lecture presentations will often not be available until after lectures are completed)

Date	Topic	Instructor
29-Mar	Class organization, rationale, goals. GMO and TOX issues	Strauss/Stone
29-Mar	**REC:** Anti- and pro-GMO worldviews	Strauss/Stone
31-Mar	Toxicology basics	Stone
	(SHORT SELF-INTRO ESSAY WITH PHOTO DUE)	
5-Apr	Natural toxins in food and environment	Stone
5-Apr	**REC**: Interpreting Science	TBA
7-Apr	World of pesticides	Stone
12-Apr	Organic Agriculture	Axton
12-Apr	**REC:** Roundup Ready? Is glyphosate as safe as we thought?	TBA
14-Apr	Risk perception	Stone
19-Apr	Biomonitoring of environmental chemicals	Stone
19-Apr	**REC:** Pesticides and Pollinators	Hooven
21-Apr	Nanotoxicology	Denluck
26-Apr	Risk Assessment	Axton
26-Apr	**REC**: Bt Toxin	TBA
28-Apr	**MIDTERM IN CLASS**	
3-May	Plant domestication and breeding, green revolution	Strauss
3-May	**REC**: Vandana Shiva – Ecogodess or charlatan?	TBA
5-May	Plant genetic engineering: Status and methods	Strauss
	(DEADLINE, ESSAY TOPIC SUBMISSION)	
10-May	Gene flow and herbicide tolerant crops	Mallory-Smith
	(SECOND ESSAY DUE)	
10-May	**REC**: RNAi	TBA
12-May	Tree and forest biotechnology	Strauss
17-May	Golden rice, biofortification, and the developing world	Elorriaga
	(ALL YOUTUBE ENTRIES DUE BY NOON)	
17-May	**REC**: Videos 1 – You Tube (student submissions)	Students
19-May	Regulating GMOs	Strauss

24-May	Patents and intellectual property in biotechnology	Myers
24-May	**REC**: Videos 2 – You Tube (student submissions)	Students
26-May	Ethics and the precautionary principle	Strauss
	(WIKIPEDIA ENTRY, GRAD ONLY)	
31-May	Discussion panel 1: Chemicals to ban? (choose one)	Strauss/Stone
	- Should neonics be banned?	
	- Should stained glass be banned?	
31-May	**REC**: Q and A and review session for final exam / student questions	Strauss/Stone
2-Jun	Discussion panel 2: Ban or label? (choose one)	Strauss/Stone
	- Should GMO foods be labeled, and how?	
	- Should GE salmon be banned?	
	(EXTRA-CREDIT ESSAYS DUE JUNE 3 MIDNIGHT)	
10-Jun	**FINAL EXAM**	Strauss
	9:30 AM Friday – Peavy 104	

Extra Credit

Option 1: View any one of the full video lectures (generally no shorter than 45 minutes) and associated introductions provided via the OSU Food for Thought Biotech Lecture Series)(also available on Youtube: Food For Thought Lecture Series, Oregon State University Lecture Series) and write up a 2 (minimum) to 4 page (maximum) double-spaced essay (no references needed) following the essay guidelines below, that show you have read and understood the WHOLE lecture, and CRITIQUE it in some way. Each lecture is worth 1.5% and students may review no more than two lectures (maximum extra credit is 3% of course grade). Students may also view other class-related lecture content, from a credible source, of at least 45 minutes in length (excluding any advertisements!) by preapproval from an instructor. Send an email with link and explanation for why you think it qualifies at least three days before deadline.

Submit via Turnitinlike other written assignments, but alert us you have made a submission by email to the TA (axtone@oregonstate.edu). Submit no later than midnight on Friday during the last week of regular class meetings (prior to finals week).

Class Make Ups

Students will be excused from missing one class or recitation, whether for illness, family, or any other reasons. Excused absences beyond this will need to be discussed with a professor or TA and must involve unusual circumstances and documented (e.g., with a letter from a doctor for an illness). A second excused absence can be made up by submission of a 1 page, single-spaced, 11 pt or higher font, well written, and originally drafted (no cut and paste!) summary of the lecture Powerpoint or readings (recitation) for that meeting that shows you have viewed and understood all of it. It must be submitted prior to the last class meeting.

Essays

All essays will be both submitted in print in class, and online via the Turnitin system in Canvas (described below). Essays should be submitted in word (docx) only, not in PDF.

The first short introductory essay is a maximum of one single-spaced page that must include a photo of yourself to help us recognize you in class (the photo will not be posted or otherwise distributed). For this essay, use it as an opportunity to:

1. Introduce yourself as it relates to the class (education, work, home background),
2. State why you have taken this class, and what issues related to the course most interest you most.
3. Summarize your general familiarity with DNA, biotechnology, chemicals, and toxicology, including any courses taken or research experience in these areas.
4. State your hopes/goals for learning-i.e., what questions you have, or what knowledge you most hope to obtain via the class to help in your life, career, etc.
5. No references allowed

To allow you to become familiarized with the sensitive plagiarism checking tool present in Turnitin (described more below), at the bottom of the page in your introductory essay insert one line copied directly from a published source. Perhaps use something you like a lot such as a favorite quote that tells us something about you. Label it “plagiarism test.” This should allow you to see how Turnitin finds and highlights different types of plagiarized (or even quoted) text. This option will not be available to you (but will be to us!) after the first essay.

For the second essay**,** choose any topic of interest to you that is directly related to the class, and submit the tentative title and a short description (1-2 line) of the essay topic on Canvas for approval prior to submission. These essays must be clearly and directly related to the course themes and have not been used for any other courses. The essay should not be too generic (e.g., “GMOs and agriculture,” or “Pesticides and our World,”

are not good topics; better topics would be “Herbicide tolerant crops and biodiversity” or “Is BPA an endocrine disruptor.” For each essay provide:

1. A summary of the general and technical aspects of the issue that cites and summarizes at least 7 (but no more than 15) published, credible references other than the assigned course readings and lectures, including high quality web pages from scholarly institutions, governments, scientifically credible NGOs, or high quality news outlets (blogs and Wikipedia are acceptable if they appear to be rigorous, credible, and/or are hosted by high quality media outlets or institutions). This should be about 2/3rds of the essay.

2. Your own insights/critiques and its justification (not simply your personal opinion) of the issue or reference(s) you have chosen to focus on. This should be about 1/3 of the essay.

3. Use of subheadings to help organize and communicate the logical flow of the essay is highly encouraged.

4. The essay/s should be a minimum of 4, with a maximum of 5, double-spaced pages with 12 pt font and 1 inch margins (excluding references, and figures and tables).

5. If any figures or tables are used, they must be cited and their meaning discussed in the paper. Place them after the text, and include a title and short legend.

6. Use quotations of literature sparingly, only for emphasis. No more than 10% of your text, excluding references, should be quotations.

7. Give full literature references for all sources cited in a consistent, scholarly format with author, year, title, source, web site URL as hot link. For example: Strauss, S.H., Kershen, D.L., Bouton, J.H., Redick, T.P., Tan, H., and R.A. Sedjo. 2010. Far-reaching deleterious impacts of regulations on research and environmental studies of recombinant DNA-modified perennial biofuel crops in the United States. *BioScience* 60:729-741.

8. Citations in the text should have this form: (LASTNAME or INSTITUTION, YEAR), examples: (Stone 2007, Stone and Strauss 2009, Stone et al. 1955, EPA 2004). Do not put URLs in the text--put them at the back with references, preferably as hot links. Do not list page numbers when making citations in the text.

Essays will be graded based on technical content (70%) and quality/clarity of writing/organization (30%). To do well on the quality/clarity score, carefully check your essay for correct spelling, grammar, sentence structure, formatting, use of subheads, etc before submission. See the lecture schedule for essay due dates. Essays will only be accepted up to one week after the deadline date, but their value for class credit will be reduced by 50% if late. Please alert us via email if you will submit late. All submissions are via both paper and Turnitin.

Online submission of essays

This course uses Turnitin, an online grading and plagiarism detection system within Canvas. Students are required to submit designated written work through it. That system will check for matches between submitted work and internet sources as well as comparing submitted works for significant matches. Turnitin returns reports assessing the percentage of text matching and allows the instructor to view suspected matches in order to judge the likelihood of plagiarism.

A video on how to use Turnitin, and a guide on how to cite and paraphrase correctly can be accessed here:

Wikipedia Article (Grad only)

For this assignment, students will be required to either create a new article or expand upon an existing article. Submit, via email to the TA, the topic and link to the Wikipedia page you propose to edit for approval prior to starting work. Students will make a Wikipedia user account, and join the "Genes and Chemicals in Agriculture" dashboard. Students will be able to draft their articles in the "sandbox" and submit them to Wikipedia when they are ready. As instructors, we will be able to keep track of the changes that you make. At this site, students will complete training, choose a topic, write a new article or expand an existing one, and submit a final reflection paper. This will be an ongoing assignment, and it will greatly benefit you to stay on top of the submission deadlines. Please go to the Dashboard for the timeline and submission process.

We will have meetings outside of class to provide students with hands-on help with navigating Wikipedia. Students should bring their lap tops and come with questions. Please e-mail Lizzy (axtone@oregonstate.edu) if you have any questions.

For full assignment details, please go to: Wikipedia Article Assignment

Videos

For YouTube "videos" days during recitation, please identify one short video clip available on the web, either pro-biotech or anti-biotech (or pro- or anti-chemical). Choose one that is good, perhaps funny, but informative and clearly related to the class themes. Upload the URLs and a ~50 word description (at top state the subject and length) and then say why you think its worth seeing. Upload under assignments in Canvas (see deadline on schedule). Choose one that you can show most of (or a part of) in about 2 minutes. Please avoid any graphic images or language that might offend others. Please team up with two or three other students if possible. After showing it, you will be asked to explain in less than 1 minute why you chose it and its value or lesson. All students will then engage in brief discussion about it. Students will be graded on quality of You-Tube and its explanation for class learning as follows: 3 = adequate, 4 = well done, 5 pts = excellent/insightful.

Discussion panels

For the discussion panels at the end of the class (see schedule), upload to Turnitin either a Powerpoint file or a MS-Word or PDF of a "transcript" with your name on it and what one issue you are addressing (BPA ban, neonics ban, GE salmon, GMO labeling). The write-ups should be 2 to 3 double spaced pages for the transcript, or 8 to 15 ppt slides if you choose to use Powerpoint slides for the presentation. They should take 2-3 minutes to present to the class, and must be uploaded by 4 PM the day before you present. You are encouraged to work with a partner in producing your write-up and making your presentation. As part of your write-up, please state your role as either: 1) neutral, summarizing the science and policy options 2) pro ban or label, or 3) anti ban or label. We will provide you an opportunity to register your preferences for topic and role, from which we will make final assignments the week prior to the panel presentations. Roles can include, for example, an unbiased FDA scientist or bureaucrat, a vehement anti-GMO or anti-pesticide member of an NGO such as Greenpeace, or a pro-GMO or pro-pesticide member of a chemical trade group or biotechnology seed company like Monsanto.

Structure and goals of panel discussions

The issue of "should we label" comes up time and time again with respect to GE and cloned animal foods. It brings to the fore, and forces us to integrate, many of the science and social issues discussed in this class. People mostly want labels if asked, though most don't read or understand them, and the tracking that goes into labeling (not the printing cost) can be quite high, depending on how strict it is. Thus it can impose significant costs on consumers, for which the poorest will suffer most. Though perhaps intended to inform, labels about esoteric things that are not truly dangerous also can scare and mislead consumers about safety vs. benefit. Thus, many companies will choose not to include ingredients or processes used in food production, even if

beneficial to consumers and economics, if they might scare consumers. Consumer choice can therefore be reduced, not expanded, by labels. On the other hand, to many consumers it is a simple right to know issue, economics and perception notwithstanding.

Likewise, the issue of "should we ban" or strictly regulate a common and unregulated chemical forces us to reckon with all the scientific uncertainties, biases in arguments and viewpoints, and the benefits as well as costs to society for discontinued or greatly restricted use. It also forces us to consider the alternatives that would be used if use is restricted or stopped, for which there may be less knowledge of its effects.

You will make a presentation on a panel that is presenting expert and public testimony on government policy on a GMO or cloned foods issue, or alternatively on whether to ban or regulate a chemicals issue (separate sessions). The issues change each year; see the class meeting schedule.

Whatever your viewpoint, use a logical and science informed argument that shows you understand the key issues (even if in an assumed role you choose to "bend" them). Please aim for two to three minutes for your oral remarks.

You will also be expected to cross-examine other panel members, so have at least one question ready for another panel member, preferably one directed at a member whose views are contrary to yours. Depending on time, there may be a small debate/discussion.

The issues you may wish to consider in your testimony and questions include:

- Is legal and ethical to label, increasing costs and possibly alarming consumers where scientific evidence is weak or still uncertain?
- Is there evidence that labels improve consumer choice, or the opposite?
- If GE and cloned foods are safe, why bother to label?
- If a ban makes sense to you, when and how should it be implemented? Any exceptions for any reason?
- If GE/cloned foods are considered scientifically safe, why NOT label...i.e., what are you hiding?
- Should the chemical be allowed but a warning included on labels?
- If we decide to label, how do we do it? What level of "contamination" warrants labeling? What is the threshold where no labels are needed?
- What do we monitor and what do we print on the label?
- How we verify compliance by companies (i.e., that labels are truthful of what is done)?
- Who/how pays for the tracking and checking system?
- What percentage of GE, cloned food, or chemical in a mixture deserves a label? Does it depend on amount of DNA, protein, chemical, chemical breakdown products, or documents that track the food supply chain?

- How do we harmonize the different systems that might arise in different states and countries?
- How do we deal with processed foods where the GE DNA or derived protein is chemically modified or removed so as not to be readily quantifiable?
- How do we deal with restaurant food where food is often processed, mixed in complex and variable ways, and consumers generally do not want to read technical labels along with their fine wine?
- Is it fair to label on the basis of process used, vs. the new/novel product properties?

Required readings and preparation for exams

There is a rich literature of views and evidence about biotechnology and toxicology issues. Thus, doing the assigned readings is a major part of this course, and keeping up on them during the class is essential for you to understand the materials and lectures, and to take part in the recitation sections (most of which are primarily discussions of readings). You are responsible for the readings assigned for the day of the lecture or recitation.

For exams, it is best to look at old exams to get an idea of the level of preparation is needed. Several will be posted on the Canvas site.

Recitation

For the recitations, we expect students to read the material beforehand and to actively participate in the discussion of the recitation paper. The intent of the recitations is to provoke thoughtful responses and elicit your perspective on complex or controversial issues. Graduate students are required to lead one recitation. At the start of recitation, the student will present a summary of the papers for review, including the scientific underpinning of the article(s). This summary should be 15-20 minutes and can be an oral discussion or powerpoint. If co-leading a presentation, the student is expected to coordinate with their co-presenter in advance of the presentation.

Plagiarism

As defined in the Oregon State University Student Conduct Code, Plagiarism is: “Representing the words or ideas of another person or presenting someone else's words, ideas, artistry or data as one's own, or using one's own previously submitted work. Plagiarism includes but is not limited to copying another person's work (including unpublished material) without appropriate referencing (including use of quotation marks), presenting someone else's opinions and theories as one's own, or working jointly on a project and then submitting it as one's own.”

For more information about plagiarism and how to avoid it, please refer http://www.plagiarism.org/. You are responsible for the content at this web site.

Consistent with the OSU Student Conduct Code, The primary purpose for using a plagiarism detection system is to "maintain and protect an environment conducive to learning, in keeping with the educational objectives of Oregon State University." These educational objectives include proficient and individual effort in academic writing. http://oregonstate.edu/studentconduct/code

You may reduce the likelihood of plagiarism in your work in three ways:
1. Use proper style, quotations, and references.
2. Use the online Plagiarism Resource Site (see your online course site).
3. Consult with the OSU Writing Center (http://writingcenter.oregonstate.edu)

Submitted work in all classes at OSU that use it will be retained as comparison documents in the Turnitin reference database. Works in that database will be retained as source documents in future terms. Works in the Turnitin reference database will be used solely for the purpose of detecting plagiarism.

Essays with plagiarism will either have their value reduced by up to 25% if only moderate instances are noted. Essays with multiple instances of plagiarism will not be graded but will be returned to students who will have one week to revise and resubmit the essay for credit; the maximum essay value will be reduced by 50%. Instances of repeated plagiarism will be referred to the OSU Office of Student Conduct and may result in failure of the class or more serious actions by OSU.

OSU has plagiarism prevention tools as well that are available at: http://ica.library.oregonstate.edu/subject-guide/1776-Academic-Integrity-for-Instructors?tab=519731

Students with Disabilities

"Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098."

Measurable Student Learning Outcomes

At the end of the class, students should be able to describe and critically analyze:

- Relationships among science, technology, and society with relation to GMO crops and pesticides using critical perspectives or examples from historical, political, or economic disciplines
- The role of science and technology in shaping breeding, and gene and chemical regulation, over time.
- How organisms have been domesticated, cultivated, and genetically manipulated via conventional breeding, and how biotechnology is similar and different
- The basic methods used to isolate and manipulate genes, and transfer them into plants, animals, and microbes
- The kinds of GE organisms in commercial use, and on the horizon for use in the near to mid-term, including insect-resistant corn, herbicide-resistant crops, medicine-producing livestock, and growth-enhanced fish
- How genetic engineering has modified agricultural practices with respect to pesticide use, soil conservation, water quality, and other environmental measures
- How environmental and health impacts of chemical use are studied and analyzed
- How chemical uses have led to unintended consequences, and how these lessons have informed subsequent laws and regulations
- How the toxicity of synthetic and natural chemicals compares and is regulated by governments
- How GE organisms are tested for food and environmental safety, the government regulatory bodies involved, and their requirement
- How ethical values and perspectives affect social and personal acceptance of GM crops and chemicals
- How the interests and values of populations in the poor and developing world differ from those in the developed world with respect to GM crops
- The reasons for ideological as well as legal and ecological concerns by organic farmers and some activist groups about GM crops
- Ability to critically analyze claims made by companies, scientists, and government agencies about food and environmental safety of new agricultural technologies
- Students should also be able to articulate in writing a critical perspective on issues involving gene and chemical science, technology, and society using evidence as support.

Graduate Student Work and Learning Outcomes

As outlined above, graduate students must lead a recitation session and submit an additional analytical essay. In addition to the BAC core learning outcomes described above that apply to all students, graduate students will:

- Understand the relevant biology, food safety, legal, and environmental issues with suitable depth and capacity to integrate among the various issues.
- Be able to propose solutions, in the form of biological innovations and regulatory modifications, that might help to resolve important pesticide and GMO crop issues.
- Critically evaluate the biases inherent to information from various sources, including to identify the ideologies and information frames adopted by various interest groups and citizens.

Bacc Core Learning Outcomes

This class qualifies for the Bacc Core in the Synthesis category of Science, Technology, and Society. The student learning outcomes for courses in this area are for students to be able to:

1. Analyze relationships among science, technology, and society using critical perspectives or examples from historical, political, or economic disciplines.
2. Analyze the role of science and technology in shaping diverse fields of study over time.
3. Articulate in writing a critical perspective on issues involving science, technology, and society using evidence as support.

Evaluation of Bacc Core learning outcomes with respect to class content

- *Criterion 1:* Many lectures and readings in class explicitly include historical, political, or economic perspectives and information. Students will be evaluated for their understanding of this information by their participation in relevant class discussions, and by evaluations of exams, essays, and presentations. For example, students will be expected to understand regulation of GMO crops and pesticides in relation to historical practices in plant breeding, patents, and chemical development, and the economic and political forces and consequences pertaining to these developments.
- *Criterion 2:* Many lectures and readings in class explicitly include consideration of how related fields of study have been affected by genetic and chemical technology. Examples include how recombinant DNA methods gave rise to the discipline and business of genetic engineering, and how advances in basic chemistry have given rise to pest management/fertilizer businesses and fields of study.

- *Criterion 3:* All students must write, and are graded, essays on gene/chemical topics related to course content that include 2/3 on data and evidence related to the topic, at least 1/3 on a critical analysis of the core issues pertaining to the technology and/or social acceptance. It is an essay requirement that they cite literature and facts as evidence for positions they take.