

SYLLABUS

Course Name: Genetic Engineering in Plants
Course Number: 40035
Term Offered: Winter 2020
Credits: 3

Instructor:

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Prerequisites: (BI311 and BOT 331) or (CSS430 or CSS530) or (HORT 430 or HORT 530) or
(PBG 430 or PBG 530)

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Class Schedule

Date	Topic	Instructor
6-January	Class organization and Introduction (LEC)	Deluc
8-January	Plant Genetic Engineering: Concept and Objectives (LEC)	Deluc
10-January	Where are the Drought Tolerant Crops? (REC-1)	Class Discussion
13-January	Overview of the different techniques (LEC)	Deluc
15-January	<i>Agrobacterium</i> : A Remarkable Organism (LEC)	Deluc
17-January	" <i>Agrobacterium</i> : Nature's genetic engineer (REC-2)"	Class Discussion
20-January	Developing the Essay (LEC)	Class Discussion
22-January	"Integration of T-DNA into the Plant Genome" (REC-3)	Class Discussion
24-January	"Integration of T-DNA into the Plant Genome" (REC-3)	Class Discussion
27-January	The "Era of Gene Editing" (LEC)	Deluc
29-January	"CRISPR-Cas9: Structures and Mechanism" (REC-4)	Class Discussion
31-January	"CRISPR-Cas9: Structures and Mechanism" (REC-4)	Class Discussion
3-February	The Application of Gene Editing in plants (LEC)	Deluc
5- February	Mid-Term in Class	Exam
7- February	"Plant Genome Engineering for Targeted Improvement of Crop Traits" (REC-5)	Class Discussion
10-February	Physical and chemical DNA and Protein Delivery - Chloroplast Engineering (LEC)	Deluc
12-February	"Nanoparticle-Mediated delivery Towards Advancing Plant Genetic Engineering" (REC-6)	Class Discussion
14-February	HIGS and SIGS: Perspective and Potential (LEC)	Deluc
17-February	GMO-free RNAi: Exogenous application (REC-7)	Class Discussion
19-February	DNA-Free Genome Editing and In vivo Promoter Editing (LEC)	Deluc
21-February	"In vivo promoter editing: Are we Ready?" (REC-8)	Class Discussion
25-February	Presentation of the outlines of the Essay for each study group	Class Discussion
26-February	"DNA-Free Genome Editing" - Satyanarayana Gouthu	Seminar
28-February	Progress Report on the Essay	Study Group
2-March	Genome Editing: How to use it wisely in crop improvement? (LEC)	Deluc
4-March	"Genetic Engineering: Applications for Seed Crops" - Hiro Nonogaki	Seminar
6-March	Discussion Panel: Genetically Engineered? What is really wrong and what is really true?	Study Group
9-March	"Pollinator Health and GMOs" - Ramesh Sagili	Seminar
11-March	Oral presentation of the Essays	Study Group
13-March	No Class	
Finals Week	Final in Class	Exam

Grading:

Student grades will be assessed according to the following breakdown:

Attendance	5
Pre-class write ups (Canvas)	10
Participation in class	10
Midterm	10
Final	10
Essay	50
Oral presentation of the essay	5
Total:	100

- Attendance (5 pt): will be validated by a sign-up sheet at the beginning of the class. Students are expected to arrive on time not 10 minutes later unless valid reasons.
- Pre-Class write ups (10 pt): Students will review readings (Research articles) posted on Canvas at the beginning of the Term. They upload the answers to questions in Canvas **by 8 AM** before the day of the course. **No late entries or last minute connection problems will be accepted as an excuse.** All the research articles related to the pre-class write up exercise are on Canvas. The objective of this exercise is to demonstrate that you have done the assigned readings and that you have been able to understand the content of the research articles in order to stimulate discussion during the follow up class. All responses on Canvas will be graded as 0 (inadequate), 1 (adequate, 50%), or 2 (high quality, 100%). Please find a guideline on how to summarize a research article [here](#). The PDF will be downloaded on Canvas as well.

Guidelines for the write up exercise:

Vague and broad answers to the questions will be graded 0. Detailed and concise answers will be graded 2. Copy and paste of the sentences from the abstract or paraphrasing it is not acceptable and will be graded 0. The students must use their own words to summarize their thoughts and address the question.

Here is an example of what the type of answers that may be expected:

Question: In the article “In vivo promoter editing: Are we ready?” by Pandiarajan and Grover (2018), what is the importance of a minimal promoter sequence when one designs a synthetic promoter?

Grade 0: The Minimal Promoter is important for designing synthetic promoter.

Grade 1: The presence of the minimal promoter facilitates the transcription of the inducible genetic cassette in a synthetic promoter.

Grade 2: Eukaryotic promoters generally consist of a core promoter near the site of transcription initiation and one or more enhancer elements that may be located more distantly. In *cis*-engineering (genetic engineering of promoter region), having a minimal promoter within the core region of the transcriptional initiation will be critical and will be part of the synthetic transcriptional module to be designed along a pre-defined cis-regulatory elements (CREs) upstream the minimal promoter sequence. This will ensure a fine tunable landing of the transcriptional machinery to control its expression of the targeted transgene.

- Participation in class (10 pt): The students have to keep in mind that the grading of the participation in class will be related to the papers you have been assigned to read. So, reading the paper will be essential to stimulate discussion points during the class.

Writeup exercise 1 (until 8AM January 10): Where are the Drought Tolerant crops? An assessment of more than two decades of plant biotechnology effort in crop improvement (2018) - Plant Science 273: 110-119.

Writeup exercise 2 (until 8AM January 17): *Agrobacterium*: nature's genetic engineer (2015) - Eugene Nester - *Frontiers in Plant Science* - 10.3389/fpls.2014.00730.

Writeup exercise 3 (until 8AM January 22): Integration of *Agrobacterium* T-DNA into the plant Genome (2017) - Stanton B Gelvin - *Annual reviews of Genetics* - 10.3389/fpls.2014.00730.

Writeup exercise 4 (until 8AM January 29): CRISPR-Cas9 Structures and Mechanisms (2017) F Jiang and J. Doudna - *Annual reviews of Genetics* - doi.org/10.1146/annurev-genet-120215-035320.

Writeup exercise 5 (until 8AM February 7): Plant Genome Engineering for Targeted Improvement of Crop Traits (2019) - *Frontiers in Plant Science* - Sedeek KEM., Mahas, A., and M Mahfouz. -

Writeup exercise 6 (until 8AM February 12): Nanoparticle-Mediated Delivery towards Advancing Plant Genetic Engineering (2018) Cunnighanm et al. - *Trends in Biotechnology* 36(9): 882-897.

Writeup exercise 7 (until 8AM February 17): Induction of Silencing in Plants by High-Pressure Spraying of In vitro-Synthesized Small RNAs (2016) Dalakouras et al. - *Frontiers in Plant Science* - doi: 10.3389/fpls.2016.01327.

Writeup exercise 8 (until 8 AM February 21): *In vivo* promoter editing: Are we Ready? (2018) - Pandiarajan and Glover - *Plant Science* 277:132-138.

- Mid-Term and Final Exam (20 pt): Hard copy notes (both sides) are allowed. Calculators are not needed so not accepted.
- Essay (50pt):

Each student is tasked for developing a personal written 6-page document essay (references not included) to the instructor one week before defending the essay before the class (March 11th). A hard copy of a progress report of the essay will be provided to the classmates send online via Canvas to the instructor as well two days before the discussion in class. Essays must be submitted **as a word document only**.

Guideline for the written Essay: Two types of format are proposed to the students. The content for both essay types with detailed explanation of the different sections that must in the essay is uploaded on Canvas. One class will be dedicated to discussing how to write the essay and the timeline for developing a scientifically relevant essay. Scheduled meetings of individuals with the instructor **are also strongly recommended** to discuss concerns, questions and progress on the Essay.

Essay 1:

The format of the Essay 1 is **a research proposal format** related to your research scope and for which you are willing to address your scientific question via genetic engineering. A template document with the different sections that should be covered in the document will be provided to the students through Canvas and will be discussed in class January 20.

Essay 2:

The format of the Essay 2 is a general review on a precise GE topic (technique/methodology/scientific question, etc.). A broad review on GMOs **will not be accepted as material**. Rather, “*in vivo promoter editing*” for improved performance traits will be focused enough to be relevant to the instructor’s expectation. A template document with the different sections that should be covered in the document will be provided to the students through Canvas and will be discussed in class January 20. The instructor the students who are opting for the review format to read “Ten simple rules for writing a literature review” (<https://journals.plos.org/ploscompbiol/article?id=10.1371/journal.pcbi.1003149>).

Important: This Essay and the oral presentation of the Essay represent more than **half of your grade**. It should not therefore be neglected, and the students should begin to work on it **at Day 1** of your course. Meeting and interaction as much as possible with the instructor to discuss your ideas and strategies is strongly recommended. The writing process of both essays will require a pre-reading phase by the students with reviews and other research articles before starting the writing. These essays **must be clearly and directly related to the course themes** and have not been used for any other courses.

Based on the number of students present in the class, the development of the Essay might be managed as a study group with a common frame for the essay **BUT** each student will provide its own narrative to the instructor as final document for grading. Detection of plagiarism (from

classmate or from primary literature) for the Essay will be sanctioned by a 0 on the Essay and the Oral presentation. Turnitin software will be used for plagiarism detection.

Essay 1 (Research proposal-type essay):

There is no need for a long introduction. Rather, the intellectual effort for the writing process must emphasize on the scientific question(s), the rationale, the significance of the work, the approach to address the question(s), and finally the scientific and societal impacts of the expected research outcomes.

Essay 2 (Review-type essay): Even more than the essay 1, the literature review essay needs substantial readings upfront in order to define a topic based on the audience that is going to read. The review needs to be focused but broad enough to 1) gain traction in terms of significant impacts, and 2) be critical enough to provide a neutral position on the topic. The “ten simple rules for writing a literature review” can be found [here](#).

- Oral presentation of the Essay: A 3 min Flash-Talk for each group will be uploaded to Canvas by 8:00 AM the day of the presentation. A template of the PowerPoint is proposed on Canvas and the instructor strongly recommends you using this template to your oral presentation. However, the instructor is giving plenty of liberty to the students to come up with a “personal touch”.

Courses Policies and Expectations:

Class absence (LEC and REC): Students may be excused from missing one lecture or recitation for other relevant reasons as long as the instructor is informed by email. Repeated absences will be discussed with an instructor and any unusual circumstances must be justified with proper documentation.

Recitations (REC): For the recitations, the instructor expects the students to read ***the material beforehand*** in order to actively participate to the discussion. The main objective of the recitations is **to stimulate thoughts and ideas**, which that will structure **your mind for developing the essay assignment**.

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.” This course uses Turnitin, a plagiarism detection system enabled with Canvas. This system will identify word and sentences’ matches from works submitted by the students to any internet sources. A guide on how to cite and paraphrase correctly can be accessed [here](#).

Essays with some plagiarism instances will be penalized with an upfront **25% reduction** of the credit. Essays with numerous instances of plagiarism will be returned to students with still the possibility of returning the essay within a week **but with a 50% reduction in the credits**.

Students with Disabilities: "Accommodations for students with disabilities are determined and approved by Disability Access Services (DAS). If the student believes to be eligible for accommodations but has not obtained approval please contact DAS immediately at 541-737-4098 or at [the Disability Access Services](#). DAS notifies students and faculty members of approved academic accommodations and coordinates the implementation of any accommodations. While not required, students and faculty members are encouraged to discuss details of the implementation of individual accommodations."

Family/Health Emergency: If you are late **for an assignment or exam due to a family or health emergency and wish to be excused or have it rescheduled for full or partial credit**, please first provide the documentation to demonstrate its verity. Examples might be notes from a doctor or clinic, an obituary for a funeral of a family member, or a signed letter from another OSU student (including full name, emails, ID number) who witnessed the event (e.g., injury, illness, death of friend). Upon appropriate documentation, other plans for make-up of full or partial credit will be considered.

Expectations for Student Conduct: Student conduct is governed by the university's policies, as explained in the [Office of Student Conduct and Community Standards](#).

Academic Integrity: Students are expected to comply with all regulations pertaining to academic honesty. For further information, visit [Academic Misconduct](#), or contact the office of Student Conduct and Mediation at 541-737-3656.

OAR 576-015-0020 (2) [Academic or Scholarly Dishonesty](#):

a) Academic or Scholarly Dishonesty is defined as an act of deception in which a student seeks to claim credit for the work or effort of another person, uses unauthorized materials or fabricated information in any academic work or research, either through the Student's own efforts or the efforts of another.

b) It includes:

(i) CHEATING - use or attempted use of unauthorized materials, information or study aids, or an act of deceit by which a Student attempts to misrepresent mastery of academic effort or information. This includes but is not limited to unauthorized copying or collaboration on a test or assignment, using prohibited materials and texts, any misuse of an electronic device, or using any deceptive means to gain academic credit.

(ii) FABRICATION - falsification or invention of any information including but not limited to falsifying research, inventing or exaggerating data, or listing incorrect or fictitious references.

(iii) ASSISTING - helping another commit an act of academic dishonesty. This includes but is not limited to paying or bribing someone to acquire a test or assignment, changing someone's grades or academic records, taking a test/doing an assignment for someone else by any means, including misuse of an electronic device. It is a violation of Oregon state law to create and offer to sell part or all of an educational assignment to another person (ORS 165.114).

c) Academic Dishonesty cases are handled initially by the academic units, following the process outlined in the University's Academic Dishonesty Report Form, and will also be referred to SCCS for action under these rules.

Resources and reading tips:

All the writeup exercises of this class will require students to be familiar with electronic information sources and read a substantial amount of research articles. Various sources Online Journal and Research Databases can be found [here](#). In most cases, the students will be using BiomedCentral (<https://www.biomedcentral.com>), PubMed (<https://www.ncbi.nlm.nih.gov/pubmed/>), and CORE (<https://core.ac.uk>). All three will cover more than 50 million research articles, which I believe should be enough...

Online research can take minutes if properly done or hours. Most of them work as search engine and the use of perfectly identified key words is important to maximize your search. Once you have your paper, the reading step is always a challenge. Please find some advices on how to manage your reading [here](#) in order to extract the most relevant information from them.

1. **Determine why you need to summarize a given article.** You are going to read a lot but you might not need to go in depth for each of them. Only the ones that consider worth to include in your essay should go to a full pro. Usually for an essay, 5 to 10 papers will be necessary in your collection for structuring the narrative of the essay. This means a pre-phase of screening article to identify those papers that will consider essential to your essay.
2. **Reading the article:** It is advised first to scan the article before making the decision to read more in depth
3. **Taking notes:** It is crucial here to use your own words. This will force you to rewrite the ideas later and will prevent plagiarism.
4. **Summarize and write a draft:** The draft should state the research question, the hypothesis tested, the methods (briefly) to address the scientific questions(s), the main results and their interpretation related to the original hypothesis.

Learning outcomes:

At the end of the class, students should be able to:

- List the different methodologies used by genetic engineers to modify DNA.
- Critically assess the advantages of one given technique versus another.
- Analyze the benefits and drawbacks of manipulating an organism's DNA.
- Discuss recent advances on gene editing technology and how it may or may not surpass the first generation of GE technology.
- Compare objectively accelerated breeding through genetic manipulation versus conventional breeding.