

AGRO 429/829 Plant Biotechnology Applications Syllabus

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Class: AGRO 429/829

Recitation: Monday and Wednesday: 10:00 AM-10:50 AM

Labs: Friday: 10:00 AM-12:30 PM

Location: BEADLE N102

Office Hours: by appointment

Credits: 3 cr.

Course Objectives

1. Learn, understand, and apply molecular and biochemical technologies used by plant scientists to better characterize plant molecular mechanisms.
2. Critical reading of the most recent plant biotechnology literature.
3. Understand the benefits when working on biotechnologies to enhance our understanding of plant biology and, ultimately, crop productivity.
4. Integrate the concept of central dogma into your work on plant biology.
5. Solidify the basic common skills used in biotechnology laboratories (lab calculations, sterile technique, bacteria production, setting up reactions, quantifying nucleic acids, handling quantitative data, etc.).
6. Develop bioinformatics skills to analyze large-scale datasets and DNA/protein sequences.
7. Design a molecular experiment including controls.
8. Interpret the results of a molecular biology experiment or procedure.
9. Troubleshoot problems. Raise constructive criticisms of your results.
10. Plan and justify future experiments based on results.
11. Being capable of mining and integrating relevant bibliography to better analyze/discuss your results.
12. Improve reading, writing, and thinking skills with a working knowledge of biotechnology applications and methods.
13. Reinforce the skills and procedures of recording your results through the development of formal lab reporting.

Assessment

Labs may be conducted in groups or pairs but will have individual assessments. Shared write-ups will receive shared grades. Reports will be checked for plagiarism between students and from primary literature sources.

AGRO 429: Problem sets and writing assignments/participation: 90 points (30%)

Formal Lab reports: 105 points (35%)

Short and Long Answer-based final: 105 points (35%)

Total number of points: 300

Points	Percent	Grade
≥ 290	≥ 96.67%	A+
≥ 280	≥ 93.33%	A
≥ 270	≥ 90.00%	A–
≥ 260	≥ 86.67%	B+
≥ 250	≥ 83.33%	B
≥ 240	≥ 80.00%	B–
≥ 230	≥ 76.67%	C+
≥ 220	≥ 73.33%	C
≥ 210	≥ 70.00%	C–
≥ 200	≥ 66.67%	D+
≥ 190	≥ 63.33%	D
≥ 180	≥ 60.00%	D–
< 180	< 60.00%	F

AGRO 829: Problem sets and writing assignments/participation: 90 points (22.5%)
 Formal Lab reports: 105 points (26.25%)
 Short and Long Answer-based final: 105 points (26.25%)
 Formal Review on one aspect of biotechnologies: 100 points (25%)
 Total number of points: 400

Points	Percent	Grade
≥ 586.67	≥ 96.67%	A+
≥ 373.33	≥ 93.33%	A
≥ 360	≥ 90.00%	A–
≥ 346.67	≥ 86.67%	B+
≥ 333.33	≥ 83.33%	B
≥ 320	≥ 80.00%	B–
≥ 306.67	≥ 76.67%	C+
≥ 293.33	≥ 73.33%	C
≥ 280	≥ 70.00%	C–
≥ 266.67	≥ 66.67%	D+
≥ 253.33	≥ 63.33%	D
≥ 240	≥ 60.00%	D–
< 240	< 60.00%	F

Required materials

- Lab coat, long-sleeved
- Safety-glasses
- Abound carbonless or carbon copy laboratory notebook is required. Use of notebooks from other classes is acceptable.
- A basic scientific calculator will be used and should always be available. Sharing of calculators is NOT allowed during exams.
- Access to Canvas to access the material associated with each lab and recitation.

Course Goals

Plant Biotechnology is an exciting field that is constantly changing and developing. The study of plant biology at a molecular and cellular level has resulted in fascinating discoveries that influence current research and our lives daily. The goal of this course is to introduce you to plant biotechnologies, and their applications to answer biological questions. In this class, you will also develop improved reading, writing, and thinking skills with a working knowledge of plant biology and biotechnology. Particularly I seek to accomplish the following for course enrollees:

- Reinforce the skills and procedures of keeping a lab notebook and formal lab reporting.
- Develop critical thinking skills through the reading of recent scientific literature, and the ability to apply these to planning experiments and writing about plant biotechnologies.
- Solidify the basic common skills used in plant biology, molecular biology, biochemistry, cell biology, and laboratory techniques (lab calculations, sterile technique, bacteria production, setting up reactions, quantifying nucleic acids, computational data mining, handling quantitative data, etc.).
- Integrate fundamental and applied biological knowledge.

Course Outline

During this semester, you will work on various biotechnological techniques including:

- Cloning of DNA sequences in appropriate vectors
- Quantification and validation of the quality of nucleic acid samples
- Immunodetection of proteins
- Analysis of gene transcriptional activity at the level of plant tissue and single cell
- Protein subcellular localization
- Microscopic observations
- Bioinformatics
- Guided reading of the scientific literature

Attendance and Participation

You are expected to arrive at class and lab on time.

Attendance of all labs and classes is mandatory. Participation is important for your grade. At times, you will be placed into groups of two to three but all students are expected to contribute to all aspects of each set of exercises. **In case of an absence, please inform me in advance, if possible.** You will still be responsible for assignments related to miss class time. For every laboratory and/or recitation class that is missed (unexcused) you will have 10 points deducted from your final grade. You will earn a zero for any missed assignments/quizzes/exams etc. due to your absence.

Your grade will depend less on the results you obtain in each lab and more on your development of an understanding of the tools of plant biotechnology, how you interpret your data, and your ability to convey this, concisely, and thoughtfully in your informal and formal writing. This should be reflected in the lab notebooks and reports. I want to emphasize that improvement of the quality of your writing in the class will be an essential component of your final grade.

Quality work is expected throughout the semester. There will be no extra assignments provided at the end of the semester to increase your grade.

Late Work Policy

Students are allowed to submit late homework as much as 24 hours after the assignment if they can produce valid documentation of their excuse at the time of the submission of their work (e.g., doctor's note). If documentation is provided, late work submission will be fully graded. If no documentation is provided, late work submission will be graded with a 50% penalty. In all cases, late homework work submitted over 24 hours after the assignment will not be graded and the student will automatically receive a "0".

If a student misses an in-class exam and the absence is not excused then there will NOT be an opportunity for a "Make-up" exam and the student will receive a zero for that missed exam. If an exam is missed it is the responsibility of the student to contact the instructor within 24 hours of the missed exam and provide the required supporting documentation within 1 week of the missed exam.

Lab notebook

You will be required to maintain a notebook to record all of your observations. The goal of a laboratory notebook is to document the purpose of the experiment, your exact procedure, any departure from protocol, troubleshooting, and your observations and conclusions. **This notebook will be an essential support to writing your lab reports.** You should have your notebook with you at all class sessions so that you keep a running record of your lab activities. Please note that some recitation time may be used for lab preparation. Do not assume that you will remember all aspects of the lab exercises and try to complete your notebook just before reports are due. Relevant handouts should be included in your lab notebook as well. A well-organized and up-to-date lab notebook will make writing formal reports much easier. You might be asked to show to instructors your lab notebook at any time during the class. Poor notebooks may reduce your participation score.

Below are listed the suggested entries of your notebook.

- 1- Summary/Purpose.** A short (no more than 1 page) synopsis of the experiment that should include: date, title, purpose, and overview of the experiment.
- 2- Flowchart/Procedure.** A flowchart of the overall experiment should be included on a second page and should show in outline form the chronology of the procedures to be followed. Items to be included are reaction conditions, additions, extractions, etc. The flowchart should serve as your immediate and accessible "guideline" of the experiment, such that you can, at a glance, tell what should be done at any given time during the experiment.
- 3- Results and Observations.** Data and any observations should be recorded as they are obtained during the experiment. Make all entries in ink. If an error is made, put a line through it and add the correct entry. Although you should have an outline of the protocol you will follow it will not always be exactly realized during the actual experiment. Thus be sure to record the actual reaction times, temperatures, amounts of reagents, etc. Record everything dealing with the experiment as it occurs. Make records directly in your notebook. Record all calculations in full, and insert any graphs that you have generated from the data.
- 4- Discussion.** Briefly analyze the results you have obtained and make arguments to support any conclusions you believe can be made. Make notes comparing your expected and actual results and observations. Briefly describe what you would do to follow up. Complete any other post-lab exercises as specified.

Incubations and downtime

You will learn quickly that lab work involves a lot of "hurry up and wait", meaning you will work to begin a task that then will require a lengthy incubation period. We will use some of these incubation periods to

discuss course materials. When not otherwise engaged, you should use these periods to maintain your notebook, work on your written lab reports, ask questions related to laboratory activities, etc. **Do not use this time to work on other class' assignments or engage in social media activities.**

General Policies

Safety: Biological experiments often use hazardous chemicals that require certain safety precautions. **Do not wear shorts or open-toed shoes to the lab** or class, if lab activities will be conducted in class.

We might be using chemicals that are caustic and will burn your skin upon contact. I will keep your **lab coat and safety glasses** in the lab so that you have them for use each week. Many exercises will require that you wear your lab coat and safety glasses, others do not. However, I would recommend that you wear your lab coat to protect your clothes from spills and even where hazardous chemicals are not in use. You should also wear **protective eyewear** when instructed to do so. We will also be working with microbes, for which gloves and lab coats should be worn. See protocols for more details.

You should wear gloves throughout the lab exercises in a molecular biology lab for two reasons. At times, the substances we will use are toxic to you. Thus gloves keep you from exposure to these harmful toxic chemicals. In other instances, your skin harbors nucleases, such as RNase and DNase that will destroy many of the reactions that you are attempting to complete. In this case, the gloves prevent you from contaminating your reactions. **Do not leave the lab wearing gloves. Do not touch your items with gloves.** Although you do not want to be wasteful in your use of gloves, you should always remove your gloves when you leave the lab (even for a minute). This is because other people you encounter in the hall do not know what might be on your gloves, and you might forget that you have a harmful substance on your glove exterior. If you open doors using a gloved hand, you will transmit whatever is on the gloves to the handle. Similarly, do not touch things that you touch with bare hands while wearing gloves, such as cell phones, keyboards, or backpacks, when you are wearing gloves.

Food: You won't be permitted to bring food or drinks into the classroom.

Cell phones/Tablets/Laptops: **Use of electronics in the room is NOT permitted** unless the instructor explicitly permits the use of any of these devices. If you are found using any unauthorized electronic devices, they may be confiscated by the instructor and will be returned to you after the class is over. All electronics should be silenced during class. The disruption caused by failure to silence electronics will be noted and may result in the deduction of points from your final grade.

Tardiness/Early Departure: Lab and recitation begin at the scheduled time and you are responsible for being there at that time. You should expect to be in the lab for the entire scheduled period. It is unacceptable to leave the lab early due to other "unexcused" obligations. It is not the responsibility of your fellow lab members to complete your work in your absence. If you leave before the lab has finished for the day this will also be documented as an "unexcused" absence.

Excused Absence: Absences will be excused only if that the appropriate and valid documentation is provided in the appropriate timeframe. Absences are excused if they are "legally-required activities" such as jury duty or military service. Absences may also be excused if a personal illness prevents the student from coming to class (doctor's note required) or if there is a death in the immediate family (documentation also required).

If you are aware that you will be missing class, it is your responsibility to notify the instructor as soon as you are aware of the conflict so that any necessary accommodations can be made.

Religious Observance: It is the policy of the University to excuse the absences of students that result from religious observances and to reschedule examinations and additional required classwork that may fall on religious holidays, without penalty.

ADA Statement: The University strives to make all learning experiences as accessible as possible. If you anticipate or experience barriers based on your disability (including mental health, chronic or temporary medical conditions), please let me know immediately so that we can discuss options privately. To establish reasonable accommodations, I may request that you register with Services for Students with Disabilities (SSD). If you are eligible for services and register with their office, make arrangements with me as soon as possible to discuss your accommodations so they can be implemented promptly. SSD contact information: 232 Canfield Admin. Bldg.; [402-472-3787](tel:402-472-3787)

Policy Regarding Academic Dishonesty: Cheating and/or plagiarism will not be tolerated as per the UNL Student Code of Conduct. The Department of Agronomy and Horticulture Academic Integrity Statement reads as follows:

“Academic integrity is an essential indicator of the student’s ethical standards. For this reason, students are expected to adhere to guidelines concerning academic honesty outlined in Section 4.2 of University’s Student Code of Conduct, which can be found at <http://stuafs.unl.edu/ja/code/three.shtml>. Students are encouraged to contact the instructor to seek clarification of these guidelines whenever they have questions and/or potential concerns.”

The following procedures outline the general operations involved with enforcing and appealing academic integrity (e.g. cheating, plagiarism) violations in courses.

- Breaches of academic integrity and their consequences vary considerably, so it is not possible to outline a single chain of consequences for every situation.
- Each instructor may impose a consequence(s) for a breach of academic integrity in his/her course, consistent with the magnitude of the breach. The consequences may range from reduced credit for a test or assignment to failure in the course.
- If the student feels that the consequence (s) imposed are inappropriate, the student should discuss the matter first with the instructor within 7 days of the incident.
- If the student is still dissatisfied with the consequences imposed, he/she may appeal to the Department Head or his/her designee within 14 days of the incident.
- If the student is dissatisfied with the results of his/her appeal to the Department Head, then he/she may appeal to the Dean of the College of Agricultural Sciences and Natural Resources within 21 days of the incident.
- Further appeal may be pursued with the University Judicial Officer as described in <http://stuafs.unl.edu/ja/code/three.shtml>.
- The course instructor will inform the student's academic advisor of the final disposition of the breach of academic integrity within 7 days after the final decision.

Classroom Emergency Preparedness and Response Information

Fire Alarm (or other evacuation): In the event of a fire alarm: Gather belongings (Purse, keys, cellphone, N-Card, etc.) and use the nearest exit to leave the building. Do not use the elevators. After exiting notify emergency personnel of the location of persons unable to exit the building. Do not return to the building unless told to do so by emergency personnel.

Tornado Warning: When sirens sound, move to the lowest interior area of the building or designated shelter. Stay away from windows and stay near an inside wall when possible.

Active Shooter: *Evacuate!* If there is a safe escape path, leave belongings behind, keep hands visible and follow police officer instructions. *Hideout:* If evacuation is impossible secure yourself in your space by turning out lights, closing blinds, and barricading doors if possible. *Take action:* As a last resort, and only when your life is in imminent danger, attempt to disrupt and/or incapacitate the active shooter.

UNL Alert: Notifications about serious incidents on campus are sent via text message, email, unl.edu website, and social media. For more information go to:

<https://emergency.unl.edu/unlalert/>

Additional Emergency Procedures can be found here:

<https://emergency.unl.edu/>

AGRO 429/829 Plant Biotechnology Applications Lab Schedule; Friday: 12:00 PM-2:30 PM

Week 1	Bioinformatics, data mining; development of research hypotheses, questions and strategies
Week 2	Extraction of nucleic acids
Week 3	DNA recombinant technology/Promoter cloning using <i>Agrobacterium rhizogenes</i>
Week 4	DNA recombinant technology/Bacterial colony PCR
Week 5	DNA recombinant technology/Validation of positive bacterial clones/bacterial culture
Week 6	DNA recombinant technology/Plant transformation
Week 7	Extraction of RNAs/Synthesis of complementary DNA
Week 8	Quantitative RT-PCR
Week 9	Extraction of proteins from plant samples
Week 10	Detection of recombinant proteins (Western blot; Part I)
Week 11	Detection of recombinant proteins (Western blot; Part II)
Week 12	DNA recombinant technology /Protein localization in plants using <i>Agrobacterium tumefaciens</i>
Week 13	Bright field and epifluorescent microscopy/Subcellular localization of proteins; Plant gene promoter activity
Week 14	Final Review Session