

AGRN 476
- Crop Improvement and Biotechnology -

INSTRUCTOR: Dr. Win Phippen
KH 310 or lab KH 208
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CLASS: Monday and Wednesday, 1:00-1:50pm KH 207
LABORATORY: Thursday, 1:00-2:50pm KH 208
CREDITS: 3 hours
OFFICE HOURS: Mon. and Wed. 11:00-1:00pm, Thurs. 10-12:00pm or by appointment

SUGGESTED TEXTS:

Stewart, C.N., Jr. (Ed.) 2016. Plant Biotechnology and Genetics: Principles, Techniques and Applications, Wiley and Sons, Hoboken, New Jersey. ISBN:9781118820124

William J. Theiman and Michael A. Palladino. 2012. Introduction to Biotechnology, 3rd edition. Pearson, New York. ISBN: 9780321766113

LAB FEE: To cover the costs of labs and field trips, a mandatory **\$20 fee** must be paid by Jan 26, 2024.

COURSE DESCRIPTION: This is as an upper level course for students with an interest in learning how crop plants can be improved by altering their genetic make-up. The course covers methodology, theory, and applications with particular emphasis on integrating the various molecular techniques to achieve overall crop improvement goals. The course is designed primarily as a hands-on laboratory course where students will actively conduct biotechnology experiments. Students will investigate DNA extraction methods, DNA fingerprinting and profiling techniques using RFLP and PCR technology, PCR based GMO product testing, and tobacco and bacterial transformation techniques using the GUS and GFP genes, along with gene editing techniques with CRISPR Cas9. We will also cover government regulations of field testing, public concerns with genetic engineering, and legal protection of improved crops.

GRADING: There will be a midterm examination after each section, each worth 100 pts and a cumulative final exam worth 200pts. Two quizzes will be given during each section worth 25 pts. Students will also be required to write a 5-page term paper and present their papers in front of the class during the last two days of class (term paper = 100pts; presentation= 50pts). Attendance and participation in class discussions will count for 100 points.

Total points possible = 750 points.

EXAM I	100 pts.	750 - 675 = A
EXAM II	100 pts.	674 - 600 = B
FINAL EXAM	200 pts.	599 - 525 = C
4 Quizzes (25pts. each)	100 pts.	524 - 450 = D
Student paper	100 pts.	< 449 = F
Student presentation	50 pts.	
<u>Attendance and Participation</u>	<u>100 pts.</u>	
Total Points = 750 pts.		

COURSE POLICIES

Your enrollment and attendance in this course automatically subjects you to course policies that have been established by the University. It is the STUDENT'S RESPONSIBILITY to follow the course policies. Brief descriptions of these policies are listed below. The University Handbook will be followed in cases where further clarification is needed. See <http://www.wiu.edu/provost/students.php>

PERSONAL HABITS: Some personal habits are distracting to others in the classroom and are disallowed. They include, but may not be limited to: holding conversations with others during lecture, text messaging, making or receiving phone calls, using personal electronic devices for gaming, using tobacco products, etc. Please respect those around you and limit these practices to personal time. You will be asked to leave the class if these habits are not controlled. See <http://www.wiu.edu/vpas/policies/disrupst.php>.

MAKE-UP EXAMS AND QUIZES: Make-up exams are only available if you are excused due to a university sponsored function (example: required field trip, athletic competition, etc.) or verified illness or death in the family. Advanced notice, when possible is expected, and if applicable, a physician's written verification of illness is required. No make-up quizzes will be offered.

HOMEWORK: Presentations, papers, and homework MUST BE TYPED and handed in at the beginning of the class period on the due date. Anything later will be considered late. Late papers will lose 10% of the grade for each day turned in late (including the day of class if you skip class that day).

ATTENDANCE AND PARTICIPATION: This course is now required for many students to complete their major. Participation from all the students in discussions is critical to the learning process. Attendance will be taken at each class and laboratory meeting. Students are required to sit in their designated seat during all face-to-face class sessions. Absence from class will be considered excused if the absence is (1) due to a required isolation or quarantine based on a (2) documented directive from a public health official or health provider, and (3) if the instructor of record receives notification through WIU Student Services. The student (4) remains responsible for contacting instructors to arrange to complete missed work as soon as possible and is (5) ultimately responsible for material covered in class. If at any time you have a family emergency, funeral, or just not feeling well, please use the OARS system to report your absence (www.wiu.edu/oars).

ACADEMIC HONESTY: You are encouraged to work with your classmates in class and laboratory and study together in groups. However, exams must be completed independently. You are expected to maintain academic honesty as stated by the University. See <http://www.wiu.edu/policies/acintegrity.php>

MILITARY/VETERAN SUPPORT STATEMENT: As a military-friendly institution, and in accordance with federal regulations and Illinois statutes, Western Illinois University has established policies and procedures to accommodate military service students. In addition to the supports available at WIU's Veterans Resource Center (wiu.edu/studentsuccess/veterans / 309-298-3505), veterans, members of the National Guard or Reserves, and active-duty military personnel with military obligations (e.g., deployments, trainings, drill) are encouraged to communicate these, in advance whenever possible, to the instructor. The Military Service Policy can be found at <http://www.wiu.edu/policies/military.php>

STUDENTS WITH DISABILITIES: In accordance with the University values and disability law, students with disabilities may request academic accommodations where there are aspects of a course that result in barriers to inclusion or accurate assessment of achievement. To file an official request for disability-related accommodations, please contact the Disability Resource Center at 309-298-2512, disability@wiu.edu or in 143 Memorial Hall. Please notify the instructor as soon as possible to ensure that this course is accessible to you in a timely manner.

UNIVERSITY VALUES: Title IX, and other federal and state laws prohibit sex discrimination, including sexual assault/misconduct, dating/domestic violence, and stalking. If you, or someone you know, has been the victim of any of these offenses, we encourage you to report this to the Title IX Coordinator at 309-298-1977 or anonymously online at: http://www.wiu.edu/equal_opportunity_and_access/request_form/index.php. If you disclose an incident to a faculty member, the faculty member must notify the Title IX Coordinator. The complete Title IX policy is available at: <http://www.wiu.edu/vpas/policies/titleIX.php>.

Attention Education Majors:

The changes within the state teaching license require all education majors to receive a grade of a "C-" or better in this course in order to meet Illinois teaching license requirements. With the university +/- grading system, receiving a "D+" or below will require you to retake this course or find a substitute course to meet School of Agriculture graduation requirements.

LECTURE, LABORATORY, AND EXAM SCHEDULE

Date	Lecture Topic	Readings
1/17, Wed.	Introduction to Plant Breeding - course outline	Lecture 1
1/18, Thurs.	LAB 1- Aseptic technique, tobacco sterilization	Lab handout
1/22, Mon.	Why Breed Plants?	Lecture 2
1/24, Wed.	Introduction to Biotechnology	Lecture 3, BIO Chp 1
1/25, Thurs.	LAB 2- Carrot callus production	Lab protocol
1/29, Mon.	Quiz 1 – Mendelian genetics	Lecture 4, BIO Chp 2
1/31, Wed.	Central Dogma of Molecular Biology	Lecture 5 handout
2/1, Thurs.	LAB 3- DNA extraction	Lab protocol
2/5, Mon.	Traditional plant breeding	Lecture 6, PB Chp. 3
2/7, Wed.	DNA Fingerprinting	Lab protocol, BIO Chp 3
2/8, Thurs.	LAB 4– RFLP DNA fingerprinting	Lab protocol, BIO Chp 8
2/12, Mon.	Plant tissue culture – carrot callus transfer	
2/14, Wed.	Quiz 2 – PCR reactions and agarose gels	Lab protocol
2/15, Thurs.	LAB 5- Polymerase Chain Reaction	Lab protocol
2/19, Mon.	Plant development and hormones	Lecture 7 handout
2/21, Wed.	PCR reactions	Lab protocol
2/22, Thurs.	LAB 6- DNA profiling and electrophoresis	Lab protocol
2/26, Mon.	Plant tissue culture – Tobacco propagation	Lecture 8, PB Chp. 5
2/28, Wed.	Exam review	
2/29, Thurs.	EXAM I, 1-3pm	
3/4, Mon.	Plant transformation –Particle bombardment	Lecture 9, PB Chp. 10
3/6, Wed.	Plant transformation testing	BIO Chp 6
3/7, Thurs.	LAB 7– PCR based GMO product testing	
3/11-3/15	No Class - Spring Break	
3/18, Mon.	GMO results	
3/20, Wed.	Gene editing	
3/21, Thurs.	LAB 10- CRISPR Cas 9 gene editing	Crop Due date
3/25, Mon.	Library term project	
3/27, Wed.	Library term project	
3/28, Thurs.	Complete Outline	Outline Due date
4/1, Mon.	Plant transformation – Agrobacterium	
4/3, Wed.	Quiz 3 - Vectors and Promoters	
4/4, Thurs.	LAB 8- Tobacco agrobacterium transformation	
4/8, Mon.	Marker assisted selection	PB Chp. 7, 8, 9
4/10, Wed.	Field testing plants	
4/11, Thurs.	Field Trip – Bayer Crop Sci, Budweiser - All Day	
4/15, Mon.	Genomics and genes of interest	PB Chp. 13; BIO Chp 12
4/17, Wed.	Quiz 4 – Marker genes	PB Chp. 15; BIO Chp 13
4/18, Thurs.	Field Trip – Corteva?	
4/22, Mon.	Future	PB Chp. 16
4/24, Wed.	Exam review	
4/25, Thurs.	EXAM II, 1-3pm	
4/29, Mon.	Student Projects	
5/1, Wed.	Student Projects	
5/2, Thurs.	Student Projects and Review	
5/8, Weds.	FINAL EXAM, KH 207, 1:00pm	Cumulative

LABORATORY ACTIVITIES SCHEDULE:

Date	Lecture Topic	To do
1/17, Wed.		Unpack all materials
1/18, Thurs.	LAB 1- Aseptic technique, tob. sterile	AM: pour plates
1/22, Mon.		
1/24, Wed.		Buy carrots, pour plates, autoclave materials
1/25, Thurs.	LAB 2- Carrot callus production	Prepare lab
1/29, Mon.	Quiz 1	
1/31, Wed.		
2/1, Thurs.	LAB 3- DNA extraction	AM: water bath, ethanol -20F
2/5, Mon.		Conduct digests, pour gel
2/7, Wed.		
2/8, Thurs.	LAB 4- RFLP DNA fingerprinting	Run gel, stain, analyze
2/12, Mon.		Check carrot callus
2/14, Wed.	Quiz 2 –	Setup PCR reactions, pour gels, PCR o/n
2/15, Thurs.	LAB 5- Polymerase Chain Reaction	Run gel, stain, analyze
2/19, Mon.		Extract DNA, Setup PCR reactions, pour gels, PCR o/n
2/21, Wed.	PCR reactions	
2/22, Thurs.	LAB 6- DNA profiling and electro	Run gel, stain, analyze. Pour plates for transfer
2/26, Mon.		Transfer carrot and tobacco cultures
2/28, Wed.	Exam review	
2/29, Thurs.	EXAM I, 1-3pm	
3/4, Mon.		
3/6, Wed.		Extract DNA, Setup PCR reactions, pour gels, PCR o/n
3/7, Thurs.	LAB 7- PCR GMO product testing	Run gel, stain, analyze
3/11-3/15	No Class - Spring Break	
3/18, Mon.	Library – term project Biotechnology tools in plant breeding	
3/20, Wed.	Gene editing	
3/21, Thurs.	LAB 10- CRISPR Cas 9	Term Project Due Date
3/25, Mon.		Prepare Agro cultures, pour plates, make media
3/27, Wed.	Quiz 3 -	Prep lab
3/28, Thurs.	LAB 8- Tobacco agrobacterium trans	Prepare explants, transform tobacco
4/1, Mon.		
4/3, Wed.		Pour agar plates for GFP
4/4, Thurs.	Field Trip – Bayer & Bud - All Day	
4/8, Mon.	Genomics and genes of interest	Prepare starter plates
4/10, Wed.	Quiz 4 – Marker genes	
4/11, Thurs.	LAB 9 – GFP bacterial transformation	Streak plates, incubate, analyze results
4/15, Mon.	Field testing transgenic plants	
4/17, Wed.	Controversies	
4/18, Thurs.	Field Trip – Corteva?	
4/22, Mon.	Future	Gus assay for tobacco
4/24, Wed.	Exam review	
4/25, Thurs.	EXAM II, 1-3pm	
4/29, Mon.	Student Projects	
5/1, Wed.	Student Projects	
5/2, Thurs.	Student Projects and Review	