Spring 2026, 3 credits
AGR 5307: Molecular Genetics for Crop Improvement

95% online – asynchronous lectures, synchronous office hours, paper presentations and in person final exam

Instructor: Fredy Altpeter

e-mail: altpeter@ufl.edu
Office-3085 McCarty B, Phone 273 3418
Teaching assistant: Qasim Ali, PhD. candidate: qasimali@ufl.edu

Meeting Times and Location:

Lectures are online, asynchronous, course review & paper presentation sessions are online synchronous on Wednesday 4th and 5th period via zoom. Additional contact hours (in office or online) by appointment altpeter@ufl.edu.
Teaching Assistant office hours every Thursday 3 PM to 4 PM via zoom

Course Objectives:

Introduce into concepts and applied aspects of plant molecular and cellular biology that enable students to describe, discuss and design strategies for crop improvement through biotechnology.

Learning Outcomes:

After completion of this course the student will be able to:

1. Contrast and compare the organization, structure and control of prokaryote versus eukaryote genes.
2. Compare the details of gene expression control in prokaryotes and eukaryotes.
3. Describe eukaryotic post-transcriptional processing, initiation of translation and posttranslational modifications, subcellular targeting, stability and degradation of RNA and proteins.
4. Explain and apply the fundamental concepts and techniques for the use of recombinant DNA technology, plant tissue culture, genetic engineering, gene expression, molecular characterization of plants.
5. Summarize the mechanisms, design and analysis of experiments, applications, regulatory and commercial issues of current and emerging biotechnologies including targeted regulation of (trans)gene expression, targeted gene silencing/RNAi, viral vectors, targeted genome editing (DNA repair pathways, targeted mutagenesis, gene targeting, base editing prime editing, alternative nucleases), intragenic, cisgenic biotechnologies for crop improvement.
6. Develop skills in critical evaluation of professional literature and scientific presentations of molecular genetics and biotechnology topics.

65 % of the course will be **lectures**
15 % of the course will be **laboratory demonstrations**
20 % of the course will be analysis and discussion of molecular crop improvement **papers**

Lectures:

Introduction into gene expression in prokaryotes and plants (transcription, translation, protein sorting, regulation of gene expression).
Methodology from isolating a gene to its targeted expression in transgenic plants. (Isolation of nucleic acids, traditional and modular cloning, vector construction, PCR, sequencing, database analysis, plant tissue culture, gene transfer, characterization of transgenic plants, expression profiling).
Transgene silencing, viral vectors and application for crop improvement and functional genomics.
Crop Biotechnology: past, current, and future.
Barriers and paths to market for transgenic crops (regulatory and commercial aspects).
New Biotechnologies (intragenic, cisgenic, genome editing with zinc finger nucleases, TALEN, CRISPR/Cas9)
DNA repair pathways, Targeted mutagenesis, Precision nucleotide substitutions, Base editing, Prime editing.
Design and analysis of genome editing experiments
"Superweeds?" When and how to introduce containment factors into crops.

Laboratory Demonstrations of Methodology:

Isolation of nucleic acids, vector construction, preparation of culture media, plant tissue culture, gene transfer, selection and regeneration of transgenic tissues to plants, characterization of transgenic or genome edited plants for presence (PCR) and expression (qRT-PCR) of transgenes or indels/nucleotide substitutions.

Papers: (each student will present one paper)

Recent original research articles describing molecular improvement of crops through biotechnology including transgenic and genome editing approaches. Videos with recorded student presentations of review articles and original research articles discussing or describing molecular improvement of crops through various biotechnology approaches will also be provided.

Prerequisites:

AGR 3303 or PCB 3063
Fundamental knowledge of biology, genetics, and molecular biology. Understanding of plant biology and biotechnology principles. Familiarity with genomics and basic statistical analysis. Awareness of ethical and regulatory considerations in genetic modification.

Week	Module	Title	Topics Covered	Suggested Readings
1 01/12-01/16	1	Genome organization	Genome organization in prokaryotes; genome organization in eukaryotes	iGenetics 15-35; 326-329 Lumenlearninbg.com Structure-and-function-of-cellular-genomes; Brown 2018 Eukaryotic nuclear genomes
	2	Introduction to RNA and RNA polymerase	The new central dogma of molecular biology; basal transcription and RNA polymerase	Tan and Anderson New Central Dogma Dornell 2021 RNA polymerase function Gerecht et al. 2023 The expanded Central Dogma
	3	Prokaryotic promoters and transcription cycle overview	Promoters and DNA binding proteins; prokaryotic transcription initiation, elongation and termination	iGenetics 81-86 Liu et al. 2020 Prediction and analysis of prokaryotic promoters
Bonus Discussion (Polyploidy in Crop Species) available January 14th 8:00am until January 27th 11:59pm **Bonus Quiz 1** available January 20st 6:00am, due January 20st 11:59pm				
2 01/20-01/23	4	Introduction to prokaryotic *transcriptional* regulation and DNA binding proteins	Rationale for transcriptional regulation; DNA binding principles and motifs; transcription factors	Garvie and Wolberger 2001 Recognition of specific DNA sequences
	5	Prokaryotic transcriptional regulation and comparisons with eukaryotes	Examples of regulated transcription; differences between prokaryotes and eukaryotes	iGenetics 491-507; 87-90 Santillan & Mackey 2004 Lac operon Konieczny, L., Roterman-Konieczna, I., Spólnik, P. 2023. Regulation in Biological Systems.
	6	Introduction to eukaryotic gene expression	Eukaryotic RNA polymerases; proteins involved in eukaryotic transcription; chromatin and eukaryotic regulation	iGenetics; 518-531 Benner 2018 Epigenetic regulation of gene activity
	7	The eukaryotic promoter and basal transcription factors	Features of eukaryotic promoters; basal vs. activated transcription; basal transcription factors	Haberle & Stark 2018 Eukaryotic core promoters Jores et al. 2021 Plant core promoter analysis
	8	Sequence-specific DNA binding transcription factors	Transcription factor functional domains; conserved domains, transcription factor families; transcription factor regulation	Hong 2016 Plant TF Families Forbang Peleke, et al. 2023 Deep learning the cis-regulatory code for gene expression in model plants.
Bonus Quiz 2 available January 26th 6:00am, due January 26th 11:59pm				
3 01/26 -01/30	9	Processing of transcripts in eukaryotes – RNA Splicing	Messenger RNA (mRNA) molecular structure; 5' cap addition; biochemical mechanisms of splicing; alternative splicing	iGenetics 90-97 Tognacca et al. 2023 Alternative splicing in plants. Ehrnsberger et al. 2019 mRNA transport in plants: Export factors and their influence on plant development Yang et al. 2021 Co-transcriptional RNA processing & Alternative Polyadenylation
	10	Processing of transcripts in eukaryotes – polyadenylation and export	Polyadenylation; nuclear export of mRNA; RNA stability and degradation	
	11	Eukaryotic translation I	Transfer RNA (tRNA); genetic code; ribosomes; translation initiation	iGenetics 102-117 Castellano and Merchante 2021 Regulation of Translation initiation in plants
	12	Eukaryotic translation II	Elongation and termination of the polypeptide chain; post-translational protein modifications; protein sorting; protein stability and degradation	iGenetics 117-124 Wang et al. 2021 Post-translational modifications: Regulation of nitrogen utilization and signaling Eidenberger et al. 2023 Plant based biopharmaceutical.
Bonus Quiz 3 available February 2nd 6:00am, due February 2nd 11:59pm **Take Home Exam** available January 23rd 8:00am due February 2nd 11:59 pm (14% of grade)				
4 02/02 - 02/06	13 &13LDV	Molecular tools and techniques I	Isolation of nucleic acids	iGenetics 171-183; 248-255; 261-263 Abdel-Lativ &Osman 2017 Comparison of three plant genomic DNA extraction methods Plant Biotechnology and Genetics 181-205 TU Eindhoven - The cloning guide Marillonnet & Gruetzner 2020 Synthetic DNA Assembly Using Golden Gate Cloning Bajpai 2014 High Capacity Vectors
	14 &14LDV	Analysis of transgene integration	Polymerase chain reaction (PCR); agarose gel electrophoresis; Southern blot	
	15 &15LDV	Restriction endonucleases and introduction to molecular cloning	Restriction sites and cleavage patterns; cloning vectors; traditional vs. Golden Gate cloning strategies	
	16	Molecular cloning II	Host organisms and vector DNA; transformation methods; selection and screening methods	
Bonus Quiz 4 available February 9th 6:00am, due February 9th 11:59pm **Homework 1** available February 6th 8:00am due February 16th 11:59 pm (4% of grade)				

Week	Module	Title	Topics Covered	Suggested Reading
5 02/9 - 02/13	17	Sequencing technologies	Sanger dideoxy sequencing; NextGen sequencing platforms; transcriptome analysis with RNA seq; design and analysis of transcriptome experiments	Marudamuthu, et al. 2023 "Next-generation sequencing technology: a boon to agriculture. Van den Berge et al. 2019 RNAseq
	18 &18LDV	Introduction to real-time PCR (qPCR)	qPCR and its applications; basic principles; experimental design, controls and QC; quantification methods	qRT-PCR application guide
Bonus Discussion (Sequencing Technology Comparison) available February 13th 8:00am until February 20th 11:59pm **Bonus Quiz 5** available February 17th 6:00am, due February 17th 11:59pm				
6 02/16 - - 02/20	19	Introduction to droplet digital PCR (ddPCR)	Basic principles and applications of ddPCR	Morcia et al. 2020 Digital PCR: What Relevance to Plant Studies?
	20	Analysis of transgenic protein expression	SDS-PAGE; Western blot; ELISA; chromatography	iGenetics 181-182; 259; 261-263 Galagher 2012 SDS-PAGE; Hornbeck 2015 ELISA; Lough 1998 Western of transgenic plants Caskun 2016 Chromatography
Bonus Quiz 6 available February 23rd 6:00am, due February 23rd 11:59pm				
7 02/23 - 02/27	21 &21LDV	Introduction to plant tissue culture	Tissue culture requirements; plant growth regulators; somatic embryogenesis	Phillips & Garda 2019 Plant tissue culture media and practices: an overview Altpeter et al. 2016 Advancing crop transformation Ghogare et al. 2021 Genome editing reagents delivery in plants Rascon Cruz et al. 2021 Plastid transformation Plant Biotechnology &Genetics 107-125; 262-284
	22	Plant transformation I	Protoplast transformation; molecular steps in gene transfer by *Agrobacterium*	
	23 &23LDV	Plant transformation II	Biolistic transformation; plastid transformation	
Bonus Discussion (Transformation Protocol Comparison) available February 26th 8:00am until March 4th 11:59pm **Bonus Quiz 7** available March 2nd 6:00am, due March 2nd 11:59pm **Exam 2** available March 4th 8:00am due March 4th 6:00pm, online, timed exam (14% of grade)				
8 03/02 - 03/06	24	Gene silencing & RNAi I	Transcriptional gene silencing; post-transcriptional gene silencing; RNA interference (RNAi); micro RNA	Guo et al. 2016 RNAi silencing in plants Samad et al. 2017 MicroRNA and transcription factors in plant regulatory networks Dubrovina $ Kiselev 2019 Exogenous RNAi Zhou et al. 2022 VIGS vectors for plants
	25	Gene silencing & RNAi II	VIGS; applications of RNAi for functional genomics and crop improvement	
	26	DNA repair pathways	non-homologous end joining (NHEJ); homology-directed repair (HDR); microhomology mediated end joining (MMEJ)	Que et al. 2019 Plant DNA repair pathways and their applications in genome engineering Transgenic Plants 237-266
Bonus Discussion (RNA Interference vs CRISPR/Cas9) available March 7th 8:00am until March 11th 11:59pm **Homework 2** available March 6th 8:00am due March 13th 11:59pm **Bonus Quiz 8** available March 9th 6:00am, due March 9th 11:59pm				
9 03/9 - 03/13	27	New breeding technologies I	Cisgenics and intragenics; targeted genome editing	Holme et al. 2013 Intragenesis and cisgenesis Molla et al. 2021 Precise plant genome editing using base editors and prime editors Liu, et al. 2023 Engineered biocontainable RNA virus vectors for non-transgenic genome editing across crop species and genotypes Li et al.2024 Targeted genome-modification tools and their advanced applications in crop breeding Hu & Liu 2025 Unlocking the potential of genome editing in agriculture with tissue culture-free techniques
	28	New breeding technologies II	Alternative & Engineered Cas nucleases; Base editing, Prime editing, Epigenetic Editing.	
	29	New breeding technologies III	Segregation of transgenic and edited loci for production of transgene free events	

Week	Module	Title	Topics Covered	Suggested Reading
Spring Break March 16th to March 20th **Bonus Quiz 9** available March 23rd 6:00am, due March 23rd 11:59pm				
10 03/23 - 03/27	30	Design and Analysis of Gene Editing Experiments	Design considerations and tools for gene editing. Pipeline for analysis of gene editing events	Hassan et al. 2021 Construct design for genome editing in plants Peng et al. 2020 ddPCR for gene editing analysis Germini et al. 2018 Analysis of gene editing events
	31	Commercial Use of Biotech Crops	Commercial use of biotech crops and its importance for sustainable agriculture	ISSSA 2018 Facts about biotech crops Brookes 2020 Environmental impacts of GM crops Caradus 2023 Intended and unintended consequences of genetically modified crops
	32	Risks, Benefits & Risk Management of Biotech Crops	Risks and benefits associated with transgenic crops, Risk management and regulatory approval	Buchholze & Frommer 2023 An increasing number of countries regulate genome editing in crops
Exam 3 available March 27th 8:00am due March 27th 6:00pm, online, timed exam (14% of grade)				

Week	Paper Presentation & Discussion (20% of grade)	Paper Reference & Presenter	Optional Videos of Paper Presentations & Discussions
11 03/30 - 04/03	04/01; 10:40am -12:35pm	Details will be provided in class	Links to videos will be provided in CANVAS
12 04/06 - 04/10	04/08; 10:40am -12:35pm		
13 04/13 - 04/17	04/15; 10:40am -12:35pm		
14 04/20 - 04/22	04/22; 10:40am -12:35pm		
Exam 4 in class (room tbd), timed exam, date tbd (25% of grade)			

LDV: Lab demonstration video(s), links will be provided in Canvas

Requirement for Learner Interaction:

Learner interaction is required during synchronous paper discussions, during contributions in the online discussion forum, and during synchronous course review sessions.

Paper Presentation and Discussion Overview,

Instructions for paper presentations and discussions:

Papers and presentation dates are assigned randomly to students. Prepare 20 min presentation, 20 slides max, 20 min max, including introduction, main methods, results and discussion and summary. Use font size of at least 22. Send presentation 3 days before presentation to the instructor altpeter@ufl.edu (if you want feedback). Send presentation to all classmates 1 day before presentation as small size ppt or pdf file. You are encouraged to make an appointment with the instructor (altpeter@ufl.edu) for a zoom meeting to go over any questions you may have. If only few questions you can ask them by email. Make sure you can attend all synchronously scheduled paper presentations and come prepared with questions (read paper before presentation) since your contribution to the discussion is a high proportion of the grade.

Grading of paper presentation and discussion:

30% of the grade for this activity is your contribution to the discussion of all presented papers; 30% of the grade for this activity is for presentation at audience level (information flow, correct interpretation of results, correct terminology, including sufficient detail, explain topic and results so that others can follow); 10% of the grade for this activity is for presentation delivery (pace, voice volume, poise and confidence, professionalism);10% of the grade for this activity is for organization of the slides, quality of visual aids, font size (at least 22); 10% of the grade for this activity is for response of the presenting student to questions from others; 10% of the grade for this activity is for staying on time (20 min max, 20 slides max).

Optional Videos of Paper Presentations & Discussions (not part of graded assessments)

Week	Topics	#	Links to the Papers for which Video Presentations & Discussions will be Provided in CANVAS
11	Bottlenecks for efficient plant transformation, genome editing and tissue culture response. Impact of regulatory networks and ectopic expression of morphogenic genes on tissue culture response	1	Advancing Crop Transformation in the Era of Genome Editing https://doi.org/10.1105/tpc.16.00196
		2	Signaling Overview of Plant Somatic Embryogenesis https://doi.org/10.3389/fpls.2019.00077
		3	Use of non-integrating Zm-Wus2 vectors to enhance maize transformation https://doi.org/10.1007/s11627-019-10042-2
	Gene transfer technologies for genetic transformation and genome editing: Protoplast, agrobacterium-mediated, biolistic or viral delivery of transgenes	4	Genome editing reagent delivery in plants https://doi.org/10.1007/s11248-021-00239-w
		5	Agrobacterium tumefaciens: A Bacterium Primed for Synthetic Biology https://doi.org/10.34133/2020/8189219
12		6	An improved ternary vector system for Agrobacterium-mediated rapid maize transformation https://doi.org/10.1007/s11103-018-0732-y
		7	A biolistic method for high-throughput production of transgenic wheat plants with single gene insertions https://doi.org/10.1186/s12870-018-1326-1
		8	A sugarcane mosaic virus vector for gene expression in maize https://doi.org/10.1002/pld3.158
	RNAi mediated gene silencing for crop improvement	9	New wind in the sails: improving the agronomic value of crop plants through RNAi-mediated gene silencing https://doi.org/10.1111/pbi.12226
		10	Ultra-low gossypol cottonseed: generational stability of the seed-specific, RNAi-mediated phenotype and resumption of terpenoid profile following seed germination https://doi.org/10.1111/j.1467-7652.2011.00652.x
13	Genome editing for crop improvement, including targeted mutagenesis, prime editing, base editing chromosome engineering	11	Genome Editing Technologies for Rice Improvement: Progress, Prospects, and Safety Concerns https://doi.org/10.3389/fgeed.2020.00005
		12	Sequence modification on demand: search and replace tools for precise gene editing in plants https://doi.org/10.1007/s11248-021-00253-y
		13	CRISPR/Cas9 directed editing of lycopene epsilon-cyclase modulates metabolic flux for β-carotene biosynthesis in banana fruit https://doi.org/10.1016/j.ymben.2020.01.008
		14	Novel CRISPR/Cas applications in plants: from prime editing to chromosome engineering https://doi.org/10.1007/s11248-021-00238-x
		15	Base-Editing-Mediated Artificial Evolution of OsALS1 In Planta to Develop Novel Herbicide-Tolerant Rice Germplasms https://doi.org/10.1016/j.molp.2020.01.010
14	Gene targeting	16	CRISPR/Cas9-Mediated Multi-Allelic Gene Targeting in Sugarcane Confers Herbicide Tolerance https://www.frontiersin.org/articles/10.3389/fgeed.2021.673566/full
	Prime editing	17	Prime editing efficiently generates W542L and S621I double mutations in two ALS genes in maize https://doi.org/10.1186/s13059-020-02170-5
	Epigenetic editing review	18	Perspectives for epigenetic editing in crops https://doi.org/10.1007/s11248-021-00252-z
	Epigenetic editing: Synthetic transcription activation	19	CRISPR–Act3.0 for highly efficient multiplexed gene activation in plants https://doi.org/10.1038/s41477-021-00953-7
	Improving editing constructs to enhance precision genome editing (targeted nucleotide substitutions) by homology directed repair	20	Improving CRISPR-Cas9 Genome Editing Efficiency by Fusion with Chromatin-Modulating Peptides https://www.liebertpub.com/doi/10.1089/CRISPR.2018.0036
		21	Increasing Cas9-mediated homology-directed repair efficiency through covalent tethering of DNA repair template https://www.nature.com/articles/s42003-018-0054-2

Suggested Text:

Molecular Cell Biology (**MCB**) / H. Lodish et al.
Edition: 9th
Published: New York: Freeman and Company, 2021.
ISBN-10: 1319208525

iGenetics – A Molecular Approach / P.J. Russell
Edition: 3rd
Published: San Francisco: Pearson, Benjamin Cummings, 2010.
ISBN-10: 0-321-56976-8

Plant Biotechnology and Genetics / C.N. Stewart JR.
Edition: 3rd
Published: John Wiley & Sons, 2025.
ISBN: 978-1-394-21723-6

Grading:

Grading will be based on two homework assignments (6 % and 7 % respectively) take home exam 1 (14 %), exam 2 (14 %), exam 3 (14 %), presentation and discussion of assigned paper on transgenic technologies for crop improvement (20 %), and exam 4 (25 %). Rubrics including descriptive criteria for the evaluation of learner's work for the different assignments are provided in CANVAS or at the following links: evaluation of exams or quizzes, evaluation of discussions, evaluation of homework assignment 1, evaluation of homework assignment 2, evaluation of paper presentation and discussion.

% of available marks	Grade
92-100	A
90-91.9	A-
88-89.9	B+
82-87.9	B
80-81.9	B-
78-79.9	C+
72-77.9	C
70-71.9	C-
68-69.9	D+
62-67.9	D
60-61.9	D-

Grades and Grade Points Effective May 11, 2009 - Summer A
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Course website:
E-Learning system, Canvas to http://elearning.ufl.edu is the online source for majority of the course modules. All modules will be uploaded in the "module" section of Canvas. Assignments will also be uploaded in the "module" section of Canvas under the "Assignments" folder.

Announcements regarding general course information will be posted in Canvas throughout the semester. Students need to login with GatorLink username and password for access. If you do not have a GatorLink ID go to http://gatorlink.ufl.edu or to the Help Desk: 392-HELP for assistance. Canvas is a learning management system, that can be accessed from a web browser or one of the Canvas mobile apps. In order to use Canvas, you will need some basic skills to use a computer or mobile device.

Technology requirements:

Required peripherals include a working webcam, microphone, and speakers attached or built into the computer. Headphones are not permitted during proctored exams.
For video conferencing you will need Zoom.
It is recommended to have a minimum Internet speed of 5 Mbps for video conferencing. You can test your internet speed here https://www.bandwidthplace.com/speed-test
Adobe Acrobat Reader software is the free global standard for viewing and printing PDF documents. It is the only PDF file viewer that can open and interact with all types of PDF content.
The proctoring service Honorlock used during online exams requires the use of the webbrowser Google Chrome and the Chrome extension for Honorlock.
A guide how to use Honorlock can be found here.
A cross-platform multimedia player that plays most multimedia files.
Information how to gain free access to journal articles at the University of Florida is provided here.
Microsoft 365 office for assignments and powerpoint for presentations.
University of Florida students have access to discounted software.
This link provides information regarding technology requirements and skills you may need to use Canvas: https://community.canvaslms.com/t5/Canvas-Basics-Guide/What-tools-and-computer-skills-do-I-need-to-use-Canvas/ta-p/446129. Minimum computer requirements can be found here: https://ufonline.ufl.edu/resources/computer-requirements/

Minimum technical skills required before engaging in this online course include:

Being able to use the learning management system Canvas as explained in the previous section, using email with attachments, creating, editing, formatting and submitting files in commonly used word processing program formats (such as Microsoft Word or Google Docs), downloading and installing software, following tutorials for software use, using presentation and graphics programs like Microsoft PowerPoint to develop and present animated presentation files, using the video conferencing platform zoom including screen sharing and chat functions. Basic computer skills, including understanding fundamental operations like file management, using menus and toolbars, and navigating between different applications. Ability to perform online research using a variety of search engines and library databases.

Assignment objectives:

***Assignment 1 (6 % of grade, due date Feb 16th)*:** In silico recombinant DNA technology exercise, involves retrieval of a genomic DNA sequence from online database, development of a cloning strategy to subclone the promoter from the specific genomic sequence 5' of a reporter gene with terminator for subsequent analysis, analysis of transcription factor binding sites in the promoter with a software tool, design of primers

with a software tool, browsing annotated plasmid DNA sequence files for evaluation of cloning strategies.

***Assignment 2 (7 % of grade, due date March 13th)*:** CRISPR/Cas9 guide RNA (gRNA) design and Illumina next generation sequencing (NGS) analysis exercise, involves using the free online software, CRISPOR, to design gRNAs for CRISPR, followed by analysis of NGS Illumina sequencing outputs (Illumina MiSeq short amplicon paired reads) using Cas Analyzer, a free online software that helps identify CRISPR mutations.

Assignment 3 (20% of grade, between April 1st and April 22nd): Presentation and discussion of recent original research article that will be randomly assigned by instructor describing molecular improvement of crops through transgenic or gene editing approaches. Instructor will be available the week before the presentation to provide feedback on the presentation draft and answer any open questions (due date TBD).

Exam objectives:

***Exam 1 (take home 14 %, of grade, due date Feb. 2nd)*:** 15 to 20 questions with sub-questions, requiring long essay-type answers in covering the following course topics in detail: Gene expression and regulation in prokaryotes and eukaryotes (genome organization, transcription, processing of transcripts, translation, protein folding and sorting, regulation of gene expression, degradation of RNA and proteins).

***Exam 2 (timed and scheduled online exam, 14 % of grade, March 4th)*:** Mix of long essay and short answer questions covering the following course topics: Concepts and techniques for the use of recombinant DNA technology, gene isolation, vector construction, plant tissue culture, and genetic transformation.

***Exam 3 (timed and scheduled online exam, 14 % of grade, March 27t)*:** Mix of long essay and short answer questions covering the following course topics: Mechanisms and applications of gene silencing for crop improvement, DNA repair pathways, new biotechnologies (cisgenics, intragenics, genome editing including targeted mutagenesis, gene targeting, base editing, prime editing, epigenetic editing).

***Exam 4 (timed and scheduled in class exam, 25 % of grade, date tbd)*:** The final exam will evaluate the students' ability to apply the acquired skills in the critical evaluation of professional literature. A scientific article in plant molecular genetics/biotechnology will be handed to students at least 1 week before the exam. During the exam questions will address molecular concepts, molecular techniques, results and conclusions associated with the article.

Bonus Points:

***Bonus quizzes*:** Quizzes will be conducted through canvas and made available on Mondays Week 2 through to Week 10. Nine quizzes will be offered in total, (worth 0.4 to 1.2 points, with a total maximum of 6.5 points) equivalent to an additional 6.5 % of your

grade. Students will be given 20 minutes to answer the questions on each quiz. There is no make-up for missing a bonus quiz.

***Bonus discussions*:** Three instructor-initiated bonus discussions will be conducted on canvas periodically throughout the semester. Discussions will each be available for contributions for one week. Up to one point (equaling an additional 1 % of your grade) will be awarded for contribution per discussion, depending on frequency and detail of contributions. An additional point (equaling an additional 1 % of your grade) can also be earned by starting a new student-led discussion on a different molecular genetics subject of your interest in the general canvas discussion forum of this course.

CLASS POLICIES

Instructor response plan:

The instructor strives to provide frequent feedback and short response times. Same day response to emails and discussion postings can be expected, feedback on assignments, and exam grades will typically be provided within three business days of the submission. Grading of the take home exam will take 5-8 business days from submission due to the time required for reviewing the long essay answers in this exam.

Attendance and Participation:

Students are expected to log on in on time to scheduled synchronous paper discussion and review sessions have cell phones turned off and camera turned on. Students are expected to be prepared (have completed modules and read papers prior discussion) and participate in class discussions during synchronous online sessions, ask questions and push for clarity. Bonus points are available for initiation of a student led discussion on a molecular genetics topic in the online discussion forum in Canvas.

Consent and Release of Recordings:

With registration to this class students agree that the University of Florida, College of Life and Agricultural Sciences (the "University") may record presentation, participation, appearance, likeness, and voice during the AGR 5307 Molecular Genetics for Crop Improvement course on any digital, analogue, or other device or storage medium (the "Materials"). Students unconditionally and irrevocably consent to the University's use of the Materials for educational purpose (e.g. placing the link to the video on the course website). Students consent to this, knowing that videos placed on the course website may potentially also be accessed by other individuals not registered for the course, causing loss of control of the potential subsequent distribution. Students will not hold University or the instructor liable for any of the recorded contents and its distribution. Students waive any right to be paid for use of the Materials or to object to the use of the Materials for educational purpose. All intellectual property rights that are associated with the Materials are the sole property of the University.

Makeup Exams:

Make-up exams will be accepted only by special permission of the course instructor. Permission to make up work will be granted on a case by case basis and not all requests will be approved.

Requirements for class attendance and make-up exams, assignments, and other work in this course are consistent with university policies that can be found at: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx"

Online Course Evaluation Process:

Student assessment of instruction is an important part of efforts to improve teaching and learning. At the end of the semester, students are expected to provide feedback on the quality of instruction in this course using a standard set of university and college criteria. Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at: https://gatorevals.aa.ufl.edu/students/. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via https://ufl.bluera.com/ufl/. Summaries of course evaluation results are available to students at: https://gatorevals.aa.ufl.edu/public-results/.

Academic Honesty:

As a student at the University of Florida, you have committed yourself to uphold the Honor Code, which includes the following pledge: "*We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honesty and integrity*." You are expected to exhibit behavior consistent with this commitment to the UF academic community, and on all work submitted for credit at the University of Florida, the following pledge is either required or implied: "*On my honor, I have neither given nor received unauthorized aid in doing this assignment*."

The two greatest threats to the academic integrity of the University of Florida are cheating and plagiarism. Definitions of activities that constitute plagiarism and/or academic misconduct and consequences of committing such behavior are described here: https://policy.ufl.edu/wp-content/uploads/2018/06/4.040-1.pdf

It is assumed that you will complete all work independently in each course unless the instructor provides explicit permission for you to collaborate on course tasks (e.g. assignments, papers, quizzes, exams). Furthermore, as part of your obligation to uphold the Honor Code, you should report any condition that facilitates academic misconduct to appropriate personnel. It is your individual responsibility to know and comply with all university policies and procedures regarding academic integrity and the Student Honor Code. Violations of the Honor Code at the University of Florida will not be tolerated. Violations will be reported to the Dean of Students Office for consideration of disciplinary action. For more information regarding the Student Honor Code, please see:

http://www.dso.ufl.edu/sccr/process/student-conduct-honor-code. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Netiquette:

is a set of rules for behaving properly online. Something about cyberspace makes it easy for people to forget that they are interacting with other real people. The following bullet points cover some basic expectations to communicating online:

Be sensitive to the fact that there will be cultural and linguistic backgrounds, as well as different political and religious beliefs, plus just differences in general.

Use good taste when composing your responses in Discussion Forums. For example, swearing and profanity must be avoided. Also consider that slang can be misunderstood or misinterpreted.
Don't use all capital letters when composing your responses as this is considered "shouting" on the Internet and is regarded as impolite or aggressive. It can also be stressful on the eye when trying to read your message. Be respectful of others' views and opinions. Avoid "flaming" (publicly attacking or insulting) as this can cause hurt feelings and decrease the chances of getting all different types of points of view.

Be careful when using acronyms. If you use an acronym it is best to spell out its meaning first, then put the acronym in parentheses afterward, for example: Frequently Asked Questions (FAQs). After that you can use the acronym freely throughout your message. Use good grammar and spelling, and avoid using text messaging shortcuts. Test your microphone and camera before synchronous online meetings, to provide for an enjoyable interaction during the meeting.

Software Use:

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate.

Accessibility Policy:

The University of Florida is committed to providing everyone a welcoming and accessible campus. The institutional accessibility policy can be found here: https://accessibility.ufl.edu/. If you have a disability and experience difficulty accessing this or other course related content please email accommodations@ufsa.ufl.edu or call 352.392.8565 for assistance.

Accessibility Statements for Technologies Required in the Course Can be Found Here:

Zoom: https://www.zoom.com/en/accessibility/
Canvas: https://www.instructure.com/accessibility

Microsoft office: https://www.microsoft.com/en-us/accessibility/microsoft-365?activetab=pivot_1%3aprimaryr2
You Tube and Google products: https://about.google/belonging/disability-inclusion/
Mediasite: https://mediasite.com/wp-content/uploads/Mediasite-7-Content-Accessibility.pdf
NCBI: https://report.nih.gov/accessibility-statement
Phytozome: https://jgi.doe.gov/accessibility-section-508-statement/

Technologies Used in the Course without Accessibility Statements:
https://www.snapgene.com/snapgene-viewer; http://plantregmap.gao-lab.org/; https://www.idtdna.com/calc/analyzer; http://crispor.tefor.net/; http://www.unafold.org/; http://www.rgenome.net/cas-analyzer/#!

Privacy Policies for Technologies Required in the Course:

Canvas Privacy Policy: https://www.instructure.com/policies/product-privacy-policy
Zoom Privacy Policy: https://explore.zoom.us/en/privacy/
Microsoft Privacy Policy: https://privacy.microsoft.com/en-us/privacystatement
Google Privacy Policy: https://policies.google.com/privacy?hl=en-US
YouTube Privacy Policy: https://www.youtube.com/howyoutubeworks/our-commitments/protecting-user-data/
Honorlock Privacy Policy: https://honorlock.com/wp-content/uploads/2023/01/Honorlock-Exam-Taker-Privacy-Notice-092322.docx.pdf
Mediasite.com Privacy Policy: https://sonicfoundry.com/privacy-policy/
NCBI Privacy Policy: https://www.ncbi.nlm.nih.gov/home/about/policies/
Phytozome.com Privacy Policy: https://jgi.doe.gov/user-programs/pmo-overview/policies/
Snapgene.com Privacy Policy: https://www.snapgene.com/privacy-policy

Services for Students with Disabilities:

The Disability Resource Center coordinates the needed accommodations of students with disabilities. This includes registering disabilities, recommending academic accommodations within the classroom, accessing special adaptive computer equipment, providing interpretation services and mediating faculty-student disability related issues. Students requesting classroom accommodation must first register with the Dean of Students Office. The Dean of Students Office will provide documentation to the student who must then provide this documentation to the Instructor when requesting accommodation 0001 Reid Hall, 352-392-8565, https://disability.ufl.edu/

Campus Helping Resources:

Students experiencing crises or personal problems that interfere with their general wellbeing are encouraged to utilize the university's counseling resources. The Counseling & Wellness Center provides confidential counseling services at no cost for currently enrolled students. Resources are available on campus for students having personal problems or lacking clear career or academic goals, which interfere with their academic performance.

- ***U Matter, We Care*:**
  If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.
- ***Counseling and Wellness Center*:** http://www.counseling.ufl.edu/cwc, and 392-1575; and
- ***University Police Department***: 392-1111 (or 911 for emergencies).

Academic Resources:

- ***E-learning technical support***, including problems with CANVAS or technology failure 352-392-4357 (select option 2) or e-mail to Learning- support@ufl.edu. https://lss.at.ufl.edu/help.shtml.
- ***Career Connections Center***, Reitz Union, 392-1601. Career assistance and counseling. https://career.ufl.edu/
- ***Library Support***, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.
- ***Teaching Center***, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/
- ***Writing Studio*,** 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/
- ***Student Complaints On-Campus****:* Visit the Student Honor Code and Student Conduct Code webpage for more information. https://sccr.dso.ufl.edu/policies/student-honor-%20code-student-conduct-code/
- ***On-Line Students Complaints*:** View the Distance Learning Student Complaint Process. https://distance.ufl.edu/getting-help/student-complaint-process/.

NOTE: The instructor reserves the right to change any information contained in this and other handouts in this course.