Spring 2026 Syllabus: PLSC 454/PLSC 554 Plant Biotechniques (3) Lectures cover recombinant DNA technology, gene cloning, plant transformation methods, and other molecular techniques used for the verification and analysis of genetically engineered plants. Examples illustrate the potential of biotechnology in plants for basic research and applications in crop improvement, along with discussion of associated risks of genetically engineered crops. Labs will include electrophoresis, plant tissue culture, bacterial culture, plasmid preps, genomic DNA preps, PCR, plant transformation, and genomic techniques.

Meeting Times: Spring 2026, Tuesday 9:45-11:00 am; Thursday 9:45-12:35 pm
Location: 321 ANR (Agriculture and Natural Resources Building)

Instructor: Dr. Reggie Millwood, email: rmillwood@utk.edu, phone: 865-806-9684, office: 314 Plant Biotechnology, office hours: 1:00-2:00 pm Wednesdays or by appointment.

Course Texts: All assigned reading materials, primarily lab protocols, will be uploaded to CANVAS or sent via email. Students are required to read and familiarize themselves with each protocol before the corresponding lab session and to copy it into their lab notebook. Lab notebooks will be collected and graded as part of the course evaluation.

Lecture slides will be posted on CANVAS.

Course Format: Lectures are held on Tuesdays (1 hour 15 minutes) to introduce concepts and prepare for lab work. Labs occur on Thursdays (2 hours 50 minutes). Some experiments require advance setup, so select Tuesday sessions may include brief preparatory lab activities for the upcoming Thursday lab. Preparation is essential: students must review protocols (distributed via CANVAS or email) before each lab session. The tentative lab schedule may be adjusted as needed.

Course Objectives: This course introduces critical thinking and hands-on experience in plant molecular biology and genetic engineering. Through lectures and selected laboratory exercises, students will perform key experiments commonly used in the field, including cloning, gene manipulation, and plant transformation using model systems. By the end of the course, students will have practical exposure to the following techniques:

- Nucleic acid isolation (DNA/RNA)
- PCR amplification and gene discovery
- Sequence analysis and primer design
- Bacterial transformation and plasmid preparation
- Restriction digestion and traditional cloning
- Selectable marker use and experimental controls
- Agrobacterium-mediated plant transformation (including Agroinfiltration)
- Transgene verification via PCR and visual screening

Grading: A= 92-100, A- = 90-91, B+ = 88-89, B= 82-87, B-=80-81, etc. – no curve.

PLSC 454 Students

- **Exams (2) = 25% each exam (50% total)** and will include true/false, multiple choice, short answer, essay questions in the format
- *__Presentations – 20% (__5% quality of PowerPoint slides, 15% presentation quality)
- ***__Lab notebooks – 10%__ will be collected and graded three times during the semester.
- **Quizzes – 10%:** Given randomly throughout the semester.
- **Class participation 10%** (5% lectures, 5% student presentations)

PLSC 554 Students

- **Exams (2) = 20% each exam (40% total)** and will include true/false, multiple choice, short answer, essay questions in the format
- *__Presentations – 15% (__5% quality of PowerPoint slides, 10% presentation quality)
- **__Research Paper – 15% (__8% first draft, 7% final draft)
- ***__Lab notebooks – 10%__ will be collected and graded three times during the semester.
- **Quizzes – 10%:** Given randomly throughout the semester.
- **Class participation 10%** (5% lectures, 5% student presentations)

*__Presentations – PLSC 454__ students will deliver a **20-minute presentation** (including Q&A) on a primary research (chosen may be chosen by the student or assigned by the instructor), **PLSC 554** Students will deliver a **30-minute presentation** (including Q&A) on a primary research (chosen by the student with prior approval from the instructor), highlighting the methods used, data collection approaches, results, and interpretations, with emphasis on critical evaluation of the experimental methods. Grading is based on clarity of explanation, depth of critical analysis, effective facilitation of class discussion, and PowerPoint slide quality. Students will submit their PowerPoint slideshow to the instructor one week prior to the assigned presentation date.

**__Research Paper Assignment (PLSC 554 only) –__ PLSC 554 students will submit a scholarly manuscript describing their own proposed or completed research that incorporates biotechnology approaches from this course (e.g., recombinant DNA, gene cloning, plant transformation, molecular verification).

- Format: Short research article or methods report (1500–2000 words, excluding references), with ≥20 peer-reviewed references. Use *Plant Cell Report* **Instructions for authors: Plant Cell Reports**
- Submission schedule: First version: Thursday, April 9, 2026 (start of class)
- Reviewed versions returned: Thursday, April 16, 2026 (on or before)
- Final revised version: Thursday, April 30, 2026 (Any time before the start of class)

***__Lab notebooks__ – Evaluation is based on completeness, detail, and clarity, such that an independent researcher could replicate the experiments from your notes alone. Copying protocols into your notebook before each lab session is strongly recommended as good scientific practice. **Lab notebook checks: Thursday, Feb 19 and Tuesday, Mar 31; Lab notebooks due: Tuesday, May 5.**

Absences:
Attendance is critical as the lab exercises build upon each other. Excused absences will be considered on a case-by-case basis, considering the nature and extent of the missed material.

In enrolling in this class student promises to abide by the UT Honor Statement "An essential feature of the University of Tennessee is a commitment to maintaining an atmosphere of intellectual integrity and academic honesty. As a student of the University, I pledge that I will neither knowingly give nor receive any inappropriate assistance in academic work, thus affirming my own personal commitment to honor and integrity."

Tentative lab schedule:

Week	Date	Lab tasks
Week 1	Tuesday, Jan 20	**Lecture 1 – Class introduction**
Week 1	Thursday, Jan 22	*Lab – Introduction:* Lab safety, sterile technique, tissue culture
Week 2	Tuesday, Jan 27	**Lecture 2 – Tissue Culture,** *Lab – Start Agrobacterium cultures*
Week 2	Thursday, Jan 29	*Lab – Plant Transformation 1:* tobacco, transfer explants (weekly)
Week 3	Tuesday, Feb 3	**Lecture 3 – Plant Transformation I,** *Lab – Start Agrobacterium cultures*
Week 3	Thursday, Feb 5	*Lab – Plant Transformation 2:* canola, weekly tissue culture
Week 4	Tuesday, Feb 10	**Lecture 4 – Plant Transformation II,** *Lab – Start Agrobacterium cultures*
Week 4	Thursday, Feb 12	*Lab – Plant Transformation 3:* switchgrass, tissue culture
Week 5	Tuesday, Feb 17	**Lecture 5 – Molecular Genetics of Gene Expression** *Lab – Start Argo.*
Week 5	Thursday, Feb 19	*Lab – Plant Transformation 4:* Arabidopsis floral dip & tobacco infiltration, tissue culture, **LAB NOTEBOOK CHECK**
Week 6	Tuesday, Feb 24	**Lecture 6 – Recombinant DNA & vectors I**, Lab: Vector construction – start *E. coli* cultures with plasmid backbone for cloning
Week 6	Thursday, Feb 26	*Lab – Vector construction:* Plasmid preparation, DNA quantification, restriction enzyme digestions, cast and run gels, cut bands, tissue culture
Week 7	Tuesday, Mar 3	**Lecture 7 – Recombinant DNA & vectors II**
Week 7	Thursday, Mar 5	*Lab – Vector construction:* Gel cleanup, perform ligation with cloning components, tissue culture
Week 8	Tuesday, Mar 10	**NO CLASS**
Week 8	Thursday, Mar 12	**NO CLASS**
Week 9	Tuesday, Mar 17	**EXAM 1**
Week 9	Thursday, Mar 19	*Lab – Vector construction:* transform *E. coli* with cloning construct, plate *E. coli* cells, tissue culture
Week 10	Tuesday, Mar 24	**Lecture 8 – Genes and Traits of Interest,** *Lab – Cloning Construct Verification:* prepare liquid cultures from *E. coli* colonies on plates
Week 10	Thursday, Mar 26	*Lab – Cloning Construct Verification:* Plasmid prep from *E. coli* cultures, DNA quantification, prep samples for sequencing, tissue culture
Week 11	Tuesday, Mar 31	**Lecture 9 – Promoters and Markers Genes, LAB NOTEBOOK CHECK**
Week 11	Thursday, Apr 2*	**NO CLASS**
Week 12	Tuesday, Apr 7	*Lab – Cloning Construct Verification & Agrobacterium transformation:* Review sequencing, transform *Agro., plate bacteria*
Week 12	Thursday, Apr 9	*Lab – Verify Agrobacterium transformation via* colony PCR, cast & run gels with PCR product, *plate Arabidopsis seeds*
Week 13	Tuesday, Apr 14	**Lecture 10 – Analysis of Transgenic Plants I**
Week 13	Thursday, Apr 16	*Lab – Screen for transgene via PCR:* Plant genomic DNA isolation, DNA quantification, PCR, *plate Arabidopsis seeds*
Week 14	Tuesday, Apr 21	**Lecture 11 – Analysis of Transgenic Plants II**
Week 14	Thursday, Apr 23	*Lab – PCR confirmation and screen for visual marker gene expression:* cast & run gels with PCR product, perform visual screen of plants & seeds
Week 15	Tuesday, Apr 28	**Lecture 12 – Genetically engineered plants regulation and biosafety *or additional Lab if needed***
Week 15	Thursday, Apr 30	Student Presentations: PLSC 554
Week 16	Tuesday, May 5**	Student Presentations, PLSC 454 ****LAB NOTEBOOKS DUE****
Final Exam	Wednesday, May 13	**EXAM 2, Time 10:30 am–12:45 pm, Location AGNR 321**

*Spring Recess – No Classes Thursday-Friday April 2-3; **Full Session Ends Wednesday May 6