

Syllabus - BIOL 683 Fall 2025



TEXAS A&M
UNIVERSITY

Course Information

Course Number: BIOL683
Course Title: Experimental Design in Biology
Time: TR 8:00-9:15
Location: ILCB 237
Credit Hours: 3

Instructor Details

Instructor: Heath Blackmon
Office: BSBW425
Phone:
E-Mail: blackmon@tamu.edu
Office Hours: 9:30-10:30, TR; by appointment

Course Description

This course trains PhD students to become fast, rigorous, and AI-savvy scientists. Students will gain a solid foundation in R for data management, visualization, hypothesis testing, regression, model selection, and advanced topics such as GLMs, PCA, and Bayesian methods. At the same time, the course integrates generative AI as a co-scientist: students learn to prompt AI for code, explanations, and workflows—then critically evaluate, refine, and correct its output. Through lectures, live-coding sessions, and structured worksheets, students practice using AI both as an accelerator and as an object of scrutiny. Two exams emphasize judgment over speed by asking students to identify, fix, and/or defend AI-generated analyses. By the end of the semester, students will not only command the statistical and computational tools needed for modern biology but will also be equipped to harness AI responsibly and ethically to maximize their efficiency and scientific impact.

Course Learning Outcomes

AI & Data Science Foundations

- Develop and apply effective strategies for analyzing biological data with R and AI tools.
- Demonstrate proficiency in R for data cleaning, visualization, and statistical modeling.
- Employ AI to generate, explain, and optimize R code, while identifying and correcting errors.
- Evaluate AI outputs for accuracy, reliability, and scientific validity.

Collaboration & Communication

- Collaborate effectively with peers and AI systems in coding, analysis, and interpretation.
- Define key elements of clear communication in scientific contexts (concise writing, constructive feedback, respectful discourse).
- Describe how communication, including the use of AI, impacts professional and research relationships.

- Translate statistical results into biologically meaningful conclusions and share them in written, visual, and oral formats.

Critical Thinking

- Use data-driven reasoning and AI-critiquing strategies to distinguish valid from flawed analyses.
- Compare human-produced and AI-produced outputs, diagnose limitations, and justify methodological choices.
- Apply hypothesis testing, regression, GLMs, PCA, and Bayesian methods appropriately.
- Interpret models and results critically, recognizing when AI accelerates insight versus when it misleads.

Ethics & Responsibility

- Define professional, research, and scientific ethics in the era of AI-assisted analysis.
- Describe responsible and irresponsible uses of AI in research, including impacts on reproducibility.
- Explain personal limits of knowledge and judgment, and how to use AI responsibly without outsourcing critical thinking.
- Describe how misuse of AI tools can impact the integrity of a research community.

Lifelong Learning

- Ask thoughtful scientific questions that deepen comprehension and direct future inquiry.
- Identify next steps required to complete analytical tasks, whether human-driven or AI-assisted.
- Formulate a plan to acquire new skills in data science and AI tools for ongoing professional growth.
- Consider multiple approaches (human, statistical, and AI-generated) when solving complex research problems.

Course Textbook and/or Resource Materials

No textbooks are required but if you have a weak background good references would be:

The Analysis of Biological Data, Second Edition by Michael C. Whitlock and Dolph Schluter

Biostatistical Design and Analysis using R

Course Grading Policy

A total of 300 points are available in the course: 5 worksheet assignments (20 points each), two exams (100 points each). The breakdown of grades will be:

A = 90%-100%

B = 80%-90%

C = 70%-80%

D = 60%-70%

F = 0-60%

Course Late Work Policy

Unexcused absences

- Unexcused absences will result in a zero for any missed work.

Excused absences

- Students with excused absences may miss up to three class periods with proper documentation and **MUST** notify the instructor in advance or within two days of the missed class to plan for missed class work. Students who fail to notify the instructor within two days of the missed class will not receive any make up opportunity or credit. If more than three classes are missed due to extenuating circumstances with a university-approved excuse (as outlined in [Student Rule 7](#)), the instructor will determine how course requirements and grading will be handled on a case-by-case basis.

Course Schedule

We will attempt to adhere to the following schedule as closely as possible. *Please be aware that this schedule is subject to change at the discretion of the instructor.*

Week/Dates	Topics	Assignment due dates
Week 1 Aug 25-29	Orientation & The AI Scientist	
Week 2 Sep 1-5	Foundations of R with AI as a Coding Partner	
Week 3 Sep 8-12	Exploratory Data Analysis	
Week 4 Sep 15-19	Probability & Simulation	
Week 5 Sep 22-26	Hypothesis Testing & AI Critique	
Week 6 Sep 29-Oct 3	Test Week 1 (AI-Critical Thinking Exam)	
Week 7 Oct 6-10	Regression Analysis	
Week 8 Oct 13-17	Generalized Linear & Mixed Models – Part 1	
Week 9 Oct 20-24	Generalized Linear & Mixed Models – Part 2	
Week 10 Oct 27-31	Model Selection	
Week 11 Nov 3-7	Dimensional Reduction	
Week 12 Nov 10-14	Advanced Topics – Bayesian Methods & Simulation	
Week 13 Nov 17-21	Flex week 1	
Week 14 Nov 24-28	Flex week 2	
Week 15 Dec 1-5	Test Week 2 (AI vs. Human Judgment)	

Final Grades are posted on Monday, Dec. 22nd, 2025, after 5pm on Howdy

Technology Support

Technology Services (IT) - Main Campus

Hours: 24/7
Phone: (979) 845-8300
Email: helpdesk@tamu.edu
Call/Chat/Email/visit: <https://it.tamu.edu/help>

Canvas LMS Technical Support

Hours: 24/7/365
Phone: (877) 354-4821
Email: support@instructure.com
Support is available by clicking the Help button at the far left in the Canvas global navigation menu. Canvas Resources are also linked on the home page of every Canvas course.

University Policies

This section outlines the university-level policies that must be included in each course syllabus. The TAMU Faculty Senate established the wording of these policies.

University Attendance Policy

The university views class attendance and participation as an individual student responsibility. Students are expected to attend class and to complete all assignments.

Please refer to [Student Rule 7](#) in its entirety for information about excused absences, including definitions, and related documentation and timelines.

University Makeup Work Policy

Students will be excused from attending class on the day of a graded activity or when attendance contributes to a student's grade, for the reasons stated in Student Rule 7, or other reason deemed appropriate by the instructor.

Please refer to [Student Rule 7](#) in its entirety for information about makeup work, including definitions, and related documentation and timelines.

Absences related to Title IX of the Education Amendments of 1972 may necessitate a period of more than 30 days for make-up work, and the timeframe for make-up work should be agreed upon by the student and instructor" ([Student Rule 7, Section 7.4.1](#)).

"The instructor is under no obligation to provide an opportunity for the student to make up work missed because of an unexcused absence" ([Student Rule 7, Section 7.4.2](#)).

Students who request an excused absence are expected to uphold the Aggie Honor Code and Student Conduct Code. ([See Student Rule 24.](#))

Academic Integrity Statement and Policy

"An Aggie does not lie, cheat or steal, or tolerate those who do."

“Texas A&M University students are responsible for authenticating all work submitted to an instructor. If asked, students must be able to produce proof that the item submitted is indeed the work of that student. Students must keep appropriate records at all times. The inability to authenticate one’s work, should the instructor request it, may be sufficient grounds to initiate an academic misconduct case” (Section 20.1.2.3, [Student Rule 20](#)).

You can learn more about the Aggie Honor System Office Rules and Procedures, academic integrity, and your rights and responsibilities at aggiehonor.tamu.edu.

Notice of Nondiscrimination

Texas A&M University is committed to providing safe and non-discriminatory learning, living, and work environments for all members of the University community. The University provides equal opportunity to all employees, students, applicants for employment or admission, and the public, regardless of race, color, sex (including pregnancy and related conditions), religion, national origin, age, disability, genetic information, or veteran status.

Texas A&M University will promptly, thoroughly, and fairly investigate and resolve all complaints of discrimination, harassment (including sexual harassment), complicity, and related retaliation based on a protected class in accordance with [System Regulation 08.01.01](#), [University Rule 08.01.01.M1](#), [Standard Administrative Procedure \(SAP\) 08.01.01.M1.01](#), and applicable federal and state laws. In accordance with Title IX and its implementing regulations, Texas A&M does not discriminate on the basis of sex in any educational program or activity, including admissions and employment.

The following person has been designated to handle inquiries and complaints regarding the non-discrimination policies: Jennifer M. Smith, TAMU Associate VP & Title IX Coordinator at YMCA Ste 108, College Station, TX 77843, 979-458-8407, or email civilrights@tamu.edu. For other reporting options, visit the [U.S. Department of Education Office for Civil Rights Complaint Assessment System](#) to locate the address and phone number of the office that serves your area, or call 1-800-421-3481.

Civil Rights, Free Speech, and Title IX Policies

Texas A&M University is committed to fostering a learning environment that is safe and productive for all. University policies and federal and state laws prohibit discrimination and harassment based on an individual’s race, color, sex, (including pregnancy and related conditions), religion, national origin, age, disability, genetic information, veteran status, or any other legally protected characteristic. This includes forms of sex-based violence, such as sexual assault, sexual harassment, sexual exploitation, dating/domestic violence, and stalking.

Students can report discrimination/harassment, access supportive resources, or learn more about their options for resolving complaints on the [University’s Civil Rights & Title IX webpage](#). Students should be aware that all university employees (except medical or mental health providers) are mandatory reporters, which means that if they observe, experience or become aware of an incident that they reasonably believe to be discrimination/harassment alleged to have been committed by or against a person who was a student or employee at the time of the incident, the employee must report the incident to the university.

Americans with Disabilities Act (ADA) Policy

Texas A&M University is committed to providing equitable access to learning opportunities for all students. If you experience barriers to your education due to a disability or think you may have a disability, please contact the Disability Resources office on your campus (resources listed below). Disabilities may include, but are not limited to, attentional, learning, mental health, sensory, physical, or chronic health conditions. All students are encouraged to discuss their disability-related needs with Disability Resources and their instructors as soon as possible.

To request academic accommodations, contact the designated ADA office based on your location:

- Texas A&M University, College of Nursing, College of Dentistry, Irma Lerma Rangel College of Pharmacy College Station, College of Medicine, School of Public Health, Institute of Biosciences and Technology, EnMed Program, Bush School in Washington DC, Mays Business School – CityCentre, TAMU Engineering Academies, Texas A&M University Higher Education Center at McAllen and Texas A&M University at Galveston should contact Disability Resources at (979) 845-1637 or disability@tamu.edu.
- Texas A&M University School of Law should contact the Office of Student Affairs at (817) 212-4111 or law-disability@law.tamu.edu to request accommodations.
- Irma Lerma Rangel College of Pharmacy in Kingsville should contact the Disability Resource Center at Texas A&M University-Kingsville at (361) 593-3024 or drc.center@tamuk.edu to request accommodations.
- Texas A&M University College of Veterinary Medicine & Biomedical Sciences in Canyon should contact the Office of Student Accessibility at West Texas A&M University – Canyon at (806) 651-2335 or osa@wtamu.edu.

If you are experiencing difficulties with your approved accommodations, contact the office responsible for approving your accommodations or the Texas A&M ADA Coordinator Julie Kuder at ADA.Coordinator@tamu.edu or (979) 458-8407.

Pregnancy Accommodations

Texas A&M provides reasonable accommodations to students due to pregnancy and/or related conditions, such as childbirth, recovery, and lactation. Students should contact the University's [Pregnancy Coordinator](#) as soon as they become aware of the need for accommodation. Depending on the circumstances, accommodations could include extended time to complete assignments or exams, changes in course sequence, or modifications to the physical classroom environment.

Texas A&M will also allow a voluntary leave of absence, ensure the availability of lactation space, and maintain grievance procedures to provide for the prompt and equitable resolution of complaints of sex discrimination. For information regarding pregnancy accommodations, email TIX.Pregnancy@tamu.edu.

Statement on Mental Health and Wellness

Texas A&M University recognizes that mental health and wellness are critical factors influencing a student's academic success and overall wellbeing. Students are encouraged to engage in healthy self-care practices by utilizing the resources and services available through [University Health Services](#). The [TELUS Health Student Support app](#) provides access to professional counseling in multiple languages anytime, anywhere by phone or chat, and the 988 Suicide & Crisis Lifeline offers 24-hour emergency support at 988 or 988lifeline.org.

Texas A&M College Station

Students needing a listening ear can contact University Health Services at 979.458.4584. Call 911 or visit your nearest emergency room if you are currently experiencing a life-threatening situation or if your safety is at risk. 24-hour emergency help is also available through the 988 Suicide & Crisis Lifeline (988) or at 988lifeline.org.

Statement on the Family Educational Rights and Privacy Act (FERPA)

FERPA is a federal law designed to protect the privacy of educational records by limiting access to these records, to establish the right of students to inspect and review their educational records, and to provide guidelines for the correction of inaccurate and misleading data through informal and formal hearings.

Currently enrolled students wishing to withhold any or all directory information items may do so by going to howdy.tamu.edu and clicking on the “Directory Hold Information” link in the Student Records channel on the MyRecord tab. The complete [FERPA Notice to Students](#) and the student records policy is available on the Office of the Registrar webpage.

Items that can never be identified as public information are a student’s social security number, citizenship, gender, grades, GPR, or class schedule. All efforts will be made in this class to protect your privacy and to ensure confidential treatment of information associated with or generated by your participation in the class.

Directory items include name, UIN, local address, permanent address, email address, local telephone number, permanent telephone number, dates of attendance, program of study (college, major, campus), classification, previous institutions attended, degrees, honors and awards received, participation in officially recognized activities and sports, medical residence location, and medical residence specialization.

Free Speech and Civil Disclosure

Texas A&M recognizes that the pursuit of truth through open and robust discourse is critical to academic inquiry. However, as a community of scholars, the university has an aspirational expectation that such discourse will be conducted in accordance with Aggie Core Values. In this “marketplace of ideas,” we encourage civil dialogue creating an environment that allows individuals to express their ideas and to have their ideas challenged in respectful and responsible ways. Students can learn more about Freedom of Expression and Free Speech on the [University's website](#) about the [First Amendment](#).