

STATISTICAL TECHNIQUES FOR THE BIOMEDICAL SCIENCES
BMR 617
SPRING 2026

SYLLABUS

Course Director:

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Additional Course Instructors:

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Required Text:

There is no required text for this course. Online teaching materials will be provided by the instructors.

Class Policy:

This is a 3 credit hour course which will primarily be conducted by directed self-study. We will meet at three times per week on Mondays, Wednesdays, and Fridays from 10:00-10:50 in BBSC 102.

Course Content:

This course is an application-oriented course in statistical concepts and techniques aimed at prospective researchers in biomedical sciences. Discussion of the underlying statistical theory will be limited to contexts in which this enhances the intuitive understanding.

Class time will include presentations by students on the sections covered in the previous week, with discussion from other class attendees and the instructor, as well as material presented by the instructor.

Students will use the statistical environment R for hands-on work; additional resources will be given and presented in class for using R.

Objectives and Outcomes:

Upon successful completion of this course, students will be able to:

- Formulate a data analysis plan as part of an experimental design in biomedical sciences
- Be able to present data in a form suitable for publication in peer reviewed journals and in a manner which is accessible to the reader
- Understand the role and uses of statistical modeling in biomedical research
- Critically read data analysis presentations and methodological descriptions in biomedical research journals
- Perform day-to-day statistical analyses required of a biomedical science researcher
- Understand and use a sufficient level of statistical jargon to communicate with experts in the field of statistics when more sophisticated analyses are required
- Select and perform appropriate statistical tests for hypothesis testing
 - Understand the extent to which deviations from statistical and mathematical ideals occur in real-world biomedical research and discuss the extent to which these may be tolerated.

Grading, Assessment and Examinations:

Grades will be assigned on a standard percentage scale:

A	At least 90%
B	At least 80% and less than 90%
C	At least 70% and less than 80%
D	At least 60% and less than 70%
F	Less than 60%

Percentages will be based on performance in three take-home exams, one comprehensive take-home final exam, and class participation and assignments during the semester. Overall percentages will be computed as follows:

Exam 1	15%
Exam 2	15%
Exam 3	15%
Class assignments	15%
Final Exam	40%

All exams may contain any of essay questions, short answer questions, or multiple-choice questions.

Only under exceptional circumstances will a student be permitted to submit an exam at a time later than the scheduled time. Exceptional circumstances include: death or serious illness in the immediate family, childbirth, illness requiring hospitalization and illness serious enough to warrant a written dispensation from a physician. Minor illnesses are **NOT** exceptional circumstances. A written doctor's excuse stating the nature of the illness will be required. In the event of any exceptional circumstances, students must make every possible attempt to contact the instructor before the scheduled exam. If arrangements have not been made beforehand, the student **MUST** contact the course director within 24 hours after the scheduled exam period to discuss rescheduling the exam.

Course Schedule: The exam dates in this schedule are fixed, but the exact timing of the material may vary according to the interests and needs of the class. Exams 1, 2, and 3 will be on the material covered since the previous exam (or the beginning of the course in the case of exam 1); the final exam will be comprehensive and will be on all material covered in the course.

Week	
1: 1/12-1/16	Introduction to R and RStudio Types of Variable
2: 1/21-1/23	Examining distributions The normal distribution
3: 1/26-1/30	Presenting data: One categorical variable Presenting data: One quantitative variable Presenting data: Two variables C/C
4: 2/2-2/6	Presenting data: Two variables Q/Q Presenting data: Two variables C/Q Exam 1
5: 2/9-2/11	Probability: Random variables Sampling distributions
6: 2/16-2/20	Point estimation and estimation of population mean Confidence Intervals Estimation of population proportion
7: 2/23-2/27	Hypothesis testing Hypothesis testing for population proportion Inference: Chi-squared and Fisher exact tests
8: 3/2-3/6	Hypothesis testing for population mean Inference: Two class t-tests Inference: Matched pairs t-test
9: 3/9-3/13	Exam 2 Inference: One Way ANOVA Inference: Two Way ANOVA
3/16-3/20 Spring break	

10: 3/23-3/27	Interactions Inference: Linear regression Linear models
11: 3/30-4/3	Multiple linear regression Sample size and power analysis
12: 4/6-4/10	Exam 3 Writing Journal Articles R notebooks
13: 4/13-4/17	Analysis of RT-PCR data: normalizing to a housekeeping gene and the $2^{-\Delta\Delta C_T}$ method. Analysis of protein expression data
14: 4/20-4/24	Multiple hypothesis testing Introduction to the analysis of high-throughput differential expression data
15: 4/27-5/1	Review
5/4-5/8	Exam week

Exam **due** dates:

Exam 1: February 11th

Exam 2: March 13th

Exam 3: April 10th

Final Exam: May 8th.

Health and Safety Information

All members of the Marshall University community are expected to always observe health and safety protocols. This includes general health and safety protocols as well as specific protocols that might emerge in response to community and campus health conditions.

Campus Carry Policy

University Policy, UPGA-12 (Campus Carry Policy) derives its authority from West Virginia State law, including the Campus Self-defense Act (W. Va. Code § 18B-4-5b). It pertains to the exercise of Concealed Carry on Marshall University's campus, except in designated areas, by individuals with a valid permit to Conceal Carry.

Individuals who choose to Conceal Carry are responsible for knowing and understanding all applicable federal, state, and local laws and Marshall University Board of Governors Rules, University Policies, and Administrative Procedures. University Policy, UPGA-12 applies to areas of campus and buildings that are directly under the possession or control of Marshall University.

Concealed Handguns are not observable to others and must be holstered and concealed on the body of the permit holder or in a personal carrier, such as a backpack,

purse, or other bag that remains under the exclusive and uninterrupted control of the permit holder. This includes wearing the personal carrier with a strap, carrying or holding the personal carrier, or setting the personal carrier next to or within your immediate reach at all times. If your participation in class activities impedes your ability to maintain constant control of your Handgun, please make alternate arrangements prior to coming to class.

Faculty Office

NOTICE: University Policy, UPGA-12 (Campus Carry Policy) defines Sole Occupancy Offices as areas that may restrict Concealed Carry. Please be aware that my office is a Sole Occupancy Office which is located in an area designated to be weapons-free, and this statement serves as notice that concealed weapons or handguns are not permitted in my office. If you plan to attend a meeting in my office or to drop by my office, secure your weapon or handgun appropriately before you arrive.