Group Study: Modern Statistics for Modern Biology

Spring 2020

Instructors:	Fosdick, Anderson, and Lyons	**Time:**	Th 3:00–5:00 PM
Website:	kind-neumann-789611.netlify.com	**Place:**	Weber 223H

Course Description: To fully understand and interpret the increasingly complex and sophisticated laboratory data of contemporary life sciences requires quantitative skills beyond the traditional statistical analyses of biological research based on, for example, descriptive statistics and hypothesis testing. This course aims to extend the conventional biological data analysis skill set to include computational methods and tools that provide a for modeling, simulation, visualization, and the integration of complex data sets such as those needed to quantify gene and protein expression profiles from -omics type measurements, the numbers and type of cells and the chemical composition of a biological sample from flow-cytometry, and to categorize and quantify the geometric features in high resolution histopathology image data. The R programming language and environment will be used to explore basic concepts in probability and statistics, clustering, networks and trees, image data, high-throughput count data, and supervised learning. Additionally, reproducible research and collaborative science tools will be employed with git version control and R Markdown-based tools.

References:

The main reference for this course is:

- Susan Holmes and Wolfgang Huber, *Modern Statistics for Modern Biology*, Cambridge University Press, 2019. https://www.huber.embl.de/msmb/#book-supplements

Other references that might be useful are:

- Garrett Grolemund and Hadley Wickham, *R for Data Science*, O'Reilly, 2017. https://r4ds.had.co.nz/
- Yihui Xie, Amber Thomas, and Alison Presmanes Hill, *blogdown: Creating Websites with R Markdown*, CRC Press, 2018. https://bookdown.org/yihui/blogdown/
- Rob Phillips, Jane Kondev, Julie Theriot, Hernam Garcia, *Physical Biology of the Cell*, 2nd Edition, Garland Science, 2012.
- Phillip Nelson, *Biological Physics: with New Art by David Goodsell*, Macmillan Higher Education, 2013.
- Phillip Nelson, *Physical Models of Living Systems*, W. H. Freeman and Company, 2015.
- Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Toberts, Peter Walter, *Molecular Biology of the Cell*, Garland Science, 2017.

Objectives: This course is primarily designed for graduate students ...

Prerequisites: An undergraduate-level understanding of probability, statistics, graph theory, algorithms, and linear algebra is assumed.

Tentative Course Outline:

- A little of probability theory and graph theory

Grading Policy: Homework and quizzes (30%), Midterm 1 (20%), Midterm 2 (20%), Final (30%).

Important Dates:

Midterm #1	Ābān 16, 1393
Midterm #2	Āzar 21, 1393
Final Exam	Dey 18, 1393

Course Policy:

- Please sign up for AeLP. I will confirm your enrollment for the course, then you will be able to see the course page.

Class Policy:

- Regular attendance is essential and expected.

Academic Honesty: Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. For more on Colorado State University's policies on Academic Integrity / Misconduct.