

# BAYESIAN ANALYSIS OF BIOLOGICAL DATA

## FALL 2016

Class meetings: Tu. & Th. 1:30–2:45 pm in Lillywhite 003

Website: Log-in to Canvas

Instructor: Zach Gompert

Email: zach.gompert@usu.edu

Office: BNR 355

Office Hours: Tu. 10:00–11:00 am

## 1 DESCRIPTION OF THE COURSE AND LEARNING OBJECTIVES

This course examines the theory and conceptual foundations of Bayesian statistics and provides instruction and experience conducting Bayesian data analysis using computer-based procedures. The course emphasizes practical applications of Bayesian statistical procedures for problems in the biological sciences. By the end of the course students will (1) understand the conceptual framework for Bayesian data analysis, (2) be able to construct Bayesian models and derive posterior probability distributions, (3) be able to implement computer-based methods for Bayesian inference, and (4) have the vocabulary and skills to understand scientific papers that use Bayesian methods.

## 2 SUGGESTED TEXTS

A text book is not required for this course, but I will use material from the following texts, which you are encouraged to use as references.

- Krushke, J. 2015. *Doing Bayesian Data Analysis: A Tutorial with R, JAGS and Stan*. Second Edition. Academic Press.
- Gelman, A., Carlin, J., Stern, S., and Rubin, D. 2013. *Bayesian Data Analysis*. Third Edition. Chapman and Hall/CRC Press, Florida.
- Lunn, D., Jackson, C., and Best, N. 2012. *The BUGS Book: A Practical Introduction to Bayesian Analysis*. Chapman and Hall/CRC Press, Florida.

## 3 ASSESSMENT

Your performance will be evaluated based on a series of problem sets and a final report. Each problem set will require problem solving, data analysis, use of computer software, and a mixture of creative and quantitative reasoning. Your final report will document your analysis of a data set of your choosing. Details on this report will be provided later in the semester. Letter grades will be calculated on the standard USU scale with the problem sets accounting for 75% of your grade and the final report accounting for 25% of your grade.

## 4 LIST OF TOPICS

1. Fundamentals of Bayesian data analysis
2. Markov chain Monte Carlo methods
3. Hierarchical models
4. Model comparison and model averaging
5. Generalized linear models
6. Advanced topics

## 5 ADDITIONAL ITEMS

- The schedule of topics, assignments, and all other details in this syllabus are subject to change with fair warning.
- ADA compliance: Students with physical, sensory, emotional or medical impairments may be eligible for reasonable accommodations in accordance with the Americans with Disabilities Act and Section 504 of the Rehabilitation Act of 1973. All accommodations are coordinated through the Disability Resource Center in Room 101 of the University Inn, 797-2444 voice, 797-0740 TTY, or toll free at 1-800-259-2966. Please contact the DRC as early in the semester as possible. Alternate format materials (Braille, large print or digital) are available with advance notice.
- Sexual harassment is defined by the Affirmative Action/Equal Employment Opportunity Commission as any “unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature.” If you feel you are a victim of sexual harassment, you may talk to or file a complaint with the Affirmative Action/Equal Employment Opportunity Office located in Old Main, Room 161, or call the AA/EEO Office at 797-1266.
- Students whose religious activities conflict with the class schedule should contact me at the beginning of the semester to make alternative arrangements.
- Cheating and other forms of academic dishonesty are listed in The Code of Policies and Procedures for Students at Utah State University (revised September 2009), Article VI, Section 1. If you are found to be engaged in academic misconduct, at a minimum you will receive no credit for that exam or assignment. Repeat or serious offenders can expect more serious consequences.