**BIOS 6606: Statistics for Basic Sciences**

Fall Semester 2019

CSPH Department of Biostatistics and Bioinformatics

3 Credits

**Prerequisites:** None

**Course Summary:** This course is designed for those wishing to obtain a basic understanding of statistics and its applications in biological research, excluding analyses of big data (e.g., proteomics, genomics) which are covered in other courses. The material is focused at a level that is considered appropriate for basic science graduate students and is a required course for several Graduate Programs at the University of Colorado Anschutz Medical Campus. In this course, the students should develop statistical literacy and an ability to perform basic statistical analyses, basic graphical statistics, data summarizations, and estimation and inference using statistical software (GraphPad Prism 7). Example topics include: making and interpreting histograms and scatter plots, means, standard deviations and proportions, confidence intervals, the correct use and interpretation of p-values, t-tests, ANOVA, Kaplan-Meier curves, correlation and simple linear regression. Whenever possible, data from a variety of basic science experiments will be used as examples in the class and for assignments. Many examples will be taken from *Nature*, a journal that is at the forefront of promoting scientific rigor and reproducibility by including datasets and more extensive methods sections in its publications. Classes consist of didactic lectures (questions encouraged) and sessions of practical reviews that will include discussions of good and poor data analyses and data presentations from papers in *Nature*.

**Class Time and Location:**

Monday/Wednesday 10:30-11:50 am, Room: P28-2307 in Ed2 North

Starting August 26, 2019 through December 11, 2019

**Instructor(s):** Course Director: Kathleen C. Torkko, PhD, MSPH, MS

Office: RC1 South, 5th floor, Room L18-5113

Office Hours Location: RC1 South, 5th floor, Room L18-5113

Time: TBA

kathleen.torkko@cuanschutz.edu

TA: TBA

TBA

Office Hours: TBA

**Course Website:** Canvas: https://ucdenver.instructure.com/

**Class Materials:** Class materials including lecture slides, datasets, supplementary reading, and homework assignments will be placed online using Canvas (https://ucdenver.instructure.com/login). We will use either the email feature of Canvas or our own university e-mails to communicate with you. Please make sure that you check the email account associated with your student account on Canvas.

**Statistical Computing:** The required statistical software package for this course is Graphpad Prism (Ver 8). Prism is a useful program to learn as it is used extensively to produce figures in the basic sciences literature. The Department of Biostatistics and Bioinformatics will provide Prism licenses that cover the duration of the semester to students who do not already have a copy of Prism. Information on accessing the program will be discussed during the first class session. Statistical assistance may not be available from the instructors or TA’s on software other than Prism. Please note that there are separate computing courses in SAS (BIOS 6603), SPSS (BIOS 6604) and R (BIOS 6605), which may be of interest to students continuing into courses that use one of those languages.

**Learning Objectives:**  At the end of the course, you should be able to exhibit the following competencies:

1. Describe the roles that biostatistics serves in basic biological research, including the importance of planning research from scientific to statistical hypotheses.
2. Learn to properly use and interpret a p-value and to distinguish between statistical and biological significance.
3. Distinguish among the different data types and the implications for selection of statistical methods to be used.
4. Learn and understand the importance of meeting test assumptions.
5. Learn to transpose data to meet test assumptions or to apply alternative statistical methods when assumptions are not met completely or when working with small research data sets.
6. Understand how sampling can bias conclusions.
7. Apply descriptive statistics and related techniques for expressing levels of confidence in estimators that are commonly used to summarize biological data.
8. Apply statistical methods to commonly used statistical analyses in biological sciences.
9. Understand the role bias plays in research and ways to limit it.
10. Understand the role statistics plays in improving reproducibility.
11. Learn appropriate data presentation and graphing techniques for biological data.
12. Learn to communicate the results of statistical analyses commonly done in biological sciences in language and terms appropriate for other basic scientists, funding agencies, and journal reviewers.

**CSPH Competencies:**  BIOS 6606 is a service course taken by students in basic sciences programs in the School of Medicine and the Graduate School and is not used for any degrees or concentrations in the Colorado School of Public Health (CSPH), therefore CSPH competencies are not included or mapped.

**Assignments:** There are assignments for most lecture topics and review sessions. Homework will be assigned once each week (usually on a Wednesday) and will cover the topics for that week. It will be due the following week before the start of the lecture on Wednesday, or at other times as indicated. Total points for each homework assignment may differ. Homework submitted to Canvas after the required time will have 25% deducted from the total points earned. It is expected that the students will have completed any assigned reading prior to the beginning of the lecture.

**Evaluations:** The course evaluation is divided into homework (35%), quizzes (15%), a mid-term exam (25%), and a final exam (25%). Students are encouraged to work collaboratively on homework but ensure they do more than just copy answers from other students. Quizzes, the midterm and the final exam will be done in class with potentially an out-of-class analysis which is expected to be an individual effort.

**Grading:** Letter grades will be assigned according to the following scale: A(100-93%), A- (92-90%), B+ (89-88%),B (87-83%),B-(82-80%), C+(79-78%),C(77-73%),C-(72-70%),F(69% and below). The scale will be normalized to the highest total points earned by the best scores earned by fellow students. Extra credit points may be available on homework and exams. After the midterm exam, the grading scheme will be available on request so that a student may judge his or her performance up to that point.

**E-mail policy:** The TA and instructors will check e-mail once a day and will try to respond to questions within 24-hours on the next business day (i.e., if a student posts a question on Friday or over the weekend, the response may not come until Monday). Thus e-mails sent less than 24 hours before homework due dates/times may not be answered prior to the class period when the homework is due. The students should plan their work accordingly. Office hours are the preferred method of communication.

**Academic Conduct Policy**

All students are expected to abide by the Honor Code of the Colorado School of Public Health.

Unless otherwise instructed, all of your work in this course should represent completely independent work. Students are expected to familiarize themselves with the Student Honor Code that can be found at

http://www.ucdenver.edu/academics/colleges/PublicHealth/Academics/academics/Documents/P

oliciesHandbooks/CSPH\_Honor\_Code.pdf or the Student Resources Section of the CSPH website.

Any student found to have committed acts of misconduct (including, but not limited to cheating, plagiarism, misconduct of research, breach of confidentiality, or illegal or unlawful acts) will be subject to the procedures outlined in the CSPH Honor Code.

**Accommodations for Disabilities**

Students requesting accommodations for a disability must contact one of the following:

***Sherry Holden | Coordinator***

University of Colorado Anschutz Medical Campus Disability Resources & Services

Bldg. 500, Room Q20-EG 305A; Part-time: Monday, Tuesday and Thursday

Phone: (303) 724-5640, Fax (303) 724-5641

[sherry.holden@ucdenver.edu](mailto:sherry.holden@ucdenver.edu)

***Selim Özi | Assistive Technology Specialist, Accommodation Coordinator***

University of Colorado Anschutz Medical Campus Disability Resources & Services

Mail Stop A010, Building 500, Room Q20-EG 306

Phone: (303) 724 8428, Fax: (303) 724 5641

[selim.ozi@ucdenver.edu](mailto:selim.ozi@ucdenver.edu)

Be aware that the determination of accommodations can take a long period of time. No accommodations will be made for the course until written documentation is provided by the Disability resources and services office to the course directors.  It is the student’s responsibility to coordinate approved accommodations with the Disability resources and services office in advance.

Further general Information regarding disability resources and services can be found at:

<http://www.ucdenver.edu/student-services/resources/disability-resources-services/accommodations/Pages/accommodations.aspx> Students can set up an appointment at:

<http://www.ucdenver.edu/student-services/resources/disability-resources-services/about-office/contact-us-CUAnschutz/Pages/form.aspx>