Description: This introductory course provides an overview of fundamental concepts in biostatistics. The first half of the course explores fundamental statistical concepts including random variables and probability distributions, sources of variation, experimental design, hypothesis testing and confidence intervals. Both parametric and non-parametric (permutation and rank-based) approaches to inference will be discussed. During the first half of the semester we will introduce the software package R (in Rstudio) and illustrate how to manipulate data in R, explore and graph data, conduct simple tests, create confidence intervals and choose a sample size for a simple two-group comparisons. Approaches to developing reproducible code will be illustrated. During the second half of the course we will explore analysis of variance, regression modeling and categorical data analysis both in class and in lab. The course emphasizes (1) the understanding of statistics through computational approaches rather than mathematical derivations and formulae and (2) the selection, application and interpretation of basic statistical methods appropriate to data arising from the basic biological sciences.

Note: Students with a strong quantitative background may wish to consult their advisors about the possibility of taking a statistics course with more rigorous mathematical underpinnings.

Active Learning: We will carry out activities to help understand fundamental concepts in statistics. Both the lecture and the lab will require a laptop with access to the internet. Some of these activities will use INZIGHT, a free R-based software platform out of the University of New Zealand.

Instructors:

Course Director: Mary Putt, PhD, ScD (621 Blockley), mputt@upenn.edu

Teaching Assistants:
Andrew Smith (andrsm@mail.med.upenn.edu)
Le Wang (wangle@mail.med.upenn.edu)
Jiaqi Li (jiaqili@mail.med.upenn.edu)

Office Hours:
Mary Putt (Tuesdays 12:30 to 2:00 pm)
Andrew Smith (TBD)
Le Wang (TBD)
Jiaqi Li (TBD)

Times/Location:

Lectures: Tuesday 11:00-12:30 pm (Austrian Auditorium)

Labs: Wednesday 3:30 – 5:00 pm (252 BRB II/III)
     Thursday 3:30 – 5:00 pm (202 Anatomy-Chemistry)
     Friday 3:30 – 5:00 pm (252 BRB II/III– exception January 22 will be held in 251 BRB II/III)

Homework Review: Monday 3:30 – 5:00 pm (Austrian Auditorium)

Website: CANVAS through https://upenn.instructure.com/
## Assessment:

<table>
<thead>
<tr>
<th>Component</th>
<th>Contribution to Grade</th>
</tr>
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<tbody>
<tr>
<td>Attendance at Lecture</td>
<td></td>
</tr>
<tr>
<td>• Present at lecture from 11.00 to 12.25 OR</td>
<td>15%</td>
</tr>
<tr>
<td>• Present between 11.05 and 12.20 OR</td>
<td>10%</td>
</tr>
<tr>
<td>• Anything else</td>
<td>0%</td>
</tr>
<tr>
<td>Attendance at Lab</td>
<td>10%</td>
</tr>
<tr>
<td>Coursework</td>
<td></td>
</tr>
<tr>
<td>• Completion</td>
<td>12.5%</td>
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<tr>
<td>• Graded Component</td>
<td>12.5%</td>
</tr>
<tr>
<td>Midterm Examination</td>
<td>15%</td>
</tr>
<tr>
<td>Final Examination</td>
<td>25%</td>
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</tbody>
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A grade of at least 90 guarantees an A- or better; a grade of at least 82 guarantees a B or better.

**Attendance**: Every student is allowed to miss one class and one lab without penalty after the first week. (Attendance begins week 2). You are responsible for completing the coursework even if you miss the lab/lecture. Your TA will take attendance at both lab and lecture---in order to have attendance recorded you must post a picture on CANVAS and check-in (or out) with your TA. If you have a medical or personal issue that extends beyond one week please discuss with me. Appropriate documentation is needed in order to extend the number of labs/lectures missed without penalty.

**Coursework**: Coursework is intended to reinforce lecture and lab material and provide experience applying statistical methods and interpreting results of the analysis. There are two ways of getting help: (1) in-person office hours (gold standard—nothing beats in-person help). (2) discussion boards through CANVAS. Written solutions (e.g. explanations of result) must be typed; calculations and formulae are fine if done by hand and presented neatly. Coursework must be submitted using CANVAS. Late submissions will be deducted 10% for the first 24 hours and 50% for the second 24 hours and is not acceptable after 48 hours.
Each homework assignment will be assessed for completion. Additionally one question will be chosen each week and graded by your TA. Students will be blinded prior to submission as to the question that is chosen.

Please do not hesitate to ask for help with assignments; these are learning experiences not mini-tests. Note that due to the large size of the class neither Dr. Putt nor the teaching assistants will be able to answer individual emails regarding specific questions about coursework. If you have a question please post to the discussion board of the CANVAS website. The teaching assistants will check the discussion boards twice per day. In our experience multiple students usually have similar questions and using the shared discussions boards helps us efficiently answer questions and clarify issues. Please check the announcements before starting your coursework; any errors or corrections will be posted there.

A typical student can expect to devote around 4-6 hours per week for coursework outside of lab and lecture.

Coursework solutions will be reviewed each week on Mondays. The computer component of these sessions will made available on CANVAS.

Midterm and Final Examinations: This course will be successful if students are able to carry out and interpret basic data analyses relevant to biomedical research. Thus the midterm and the final examination will be take-home. You may use any materials that you want for these examinations, but you must work alone. The midterm and the final will be graded in their entirety.

Academic Integrity: Unless specifically indicated in writing, students may work together but must submit individually constructed responses to questions. **Doing otherwise constitutes a violation of the code of academic integrity.** All students enrolled at Penn are responsible for understanding and following the Penn code of academic integrity, which appears at provost.upenn.edu/policies/pennbook/2013/02/13/code-of-academic-integrity