Foundations B: Biostatistics

Course Information

Catalog No GS-GS-6400
Credits: 4
Didactic: Y
Academic Yr: 20-21
Term: 1+2
Room: Online
Schedule: Mondays: Lecture 2:30-3:30
Thursdays: *Either*
     Lecture 2:30-3:30, or
     Lab [12-1:30 or 2-3:30]

Labs: Groups 1-3: Thurs,12:00-1:30pm
Groups 4-6: Thurs, 2:00-3:30pm

Baylor College of Medicine

GRADUATE SCHOOL OF BIOMEDICAL SCIENCES

Course Directors

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CLASSROOM:

Regular Class:

Lectures: Mondays & Thursdays (as scheduled), 2:30-3:30pm
Labs: Thursdays (as scheduled):
     Lab Groups 1-3: 12:00-1:30pm
     Lab Groups 4-6: 2:00-3:30pm

Final Exam:

Thursday, December 10, 1:00-3:00PM

Co-Instructors

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COURSE DESCRIPTION AND OBJECTIVES:

This course will introduce biostatistical principles and technology most likely to be useful to laboratory scientists interested in biomedical and translational research. Topics include ANOVA, linear regression, contingency table analysis, logistic regression, survival analysis, and nonparametric statistics. The course also introduces basic experimental design principles and includes a new module on analysis of RNAseq data, emphasizing statistical underpinnings. The R software environment will be introduced and used for statistical analysis of real-life problem sets. Students will be assigned to either the 12:00-1:30 pm or 2:30-3:30 pm lab time slot and to a specific lab group.

REQUIRED TEXTS AND MATERIALS:

Required:

SG: Primer of Biostatistics, Stanton Glantz, Seventh Edition, McGraw-Hill, 2012. The textbook is readable, and contains good heuristic discussions of statistical concepts with few mathematical formulas. For those who may find that it does not give enough details, see below for more statistics. Amazon ~ $65 (Kindle edition also available)

PD: Introductory Statistics with R, Peter Dalgaard, Second Edition, Springer, 2008. This is a readable R book for elementary statistics and provides a nice introduction to the workings of R. Some may feel a bit disoriented at the beginning, since R is different from the usual point-and-click MS Window applications. R is a very widely used computational tool in biomedical research and worth learning. Amazon ~ $45 (Kindle edition also available and can be rented)

Highly Recommended:

MB: Using R at the Bench: Step-by-Step Data Analytics for Biologists, Martina Bremer and Rebecca W. Doerge, Cold Spring Harbor Laboratory Press, 2015. It is a "bench-side" manual that is designed and intended to be used by people who are in need of a quick refresher or a big picture overview of a statistical procedures. It includes a section on genomic analysis. Amazon ~ $60, Cold Spring Harbor Laboratory Press ~$49 (eBook ~$36)

Additional optional references:

Basic & Clinical Biostatistics, Beth Dawson and Robert G. Trapp, Fourth (or higher) Edition McGraw-Hill, 2004. The textbook is a very readable, clinically oriented introductory textbook for biostatistics. Amazon~$52.

Fundamentals of Biostatistics, Seventh Edition, Bernard Rosner, Duxbury, 2010. This textbook is comprehensive and mathematical. It is filled with lots of good examples that may serve as a reference, but it also has lots of mathematical formulas and notation. Amazon ~ $175

PREREQUISITE(S) or EXCLUSIONS:

None

ATTENDANCE REQUIREMENTS:

Class attendance is required but can be excused with advance notice.

GRADING:

The determination of the overall course grade is based on class attendance and participation (10%), homework assignments (40%), presentation (10%), midterm (10%) and final exam (30%). Attendance and participation are graded together as a proportion of classes attended, excluding excused. Everyone starts with full points for participation and points would be taken off for consistent refusal to participate in lab discussion or to make an effort to answer questions posed to the group. The presentation is graded using a checklist of the items the students are asked to address, plus staying on time, organization and full group engagement. 90% or better of the total grade is an A and 80% or better is a B. Below 80% is not passing, and below 60% is an F.

PROFESSIONAL CONDUCT:

Students are expected to conduct themselves in a professional manner and abide by all policies of Baylor College of Medicine, the Graduate School of Biomedical Sciences and their Programs. Any conduct not in keeping with the ethical or professional standards of BCM is defined as professional misconduct. Academic misconduct is defined as dishonesty (e.g. cheating, plagiarism, etc.) that occurs in conjunction with academic requirements such as coursework including homework and examinations.

COURSE EVALUATIONS:

The Graduate School of Biomedical Sciences seeks student feedback and opinions about the courses and lecturers in the curriculum. After the end of each term, students will receive an email request from gsbs-stars@bcm.edu to complete course evaluations. The email will include a link and unique security PIN that will provide students the opportunity to provide numerical ratings and comments about the lecturers and courses taken during the term. Ratings and comments are fully anonymous and are provided to lecturers, course directors, and GSBS administration. Over time, student input influences and improves the overall quality of the delivery of our curriculum.

GRADE VERIFICATION:

Due process involves providing students with a clear description of course expectations, including grading requirements. Students may have questions about their final grade or the grading process. If students want to verify their final grade, they are first encouraged to meet with the course director informally to discuss those questions. After grade verification and discussion, the student may choose to proceed with a formal grade appeal if they believe they have received a grade unjustly. Grievances are not the same as disagreements. A student cannot file a grievance merely because s/he disagrees with the grade. A student can file a grievance if they believe the grade was unfair, for example, if it is felt to be an act of discrimination. Formal grievances can be filed via the Integrity Hotline portal.

EDUCATIONAL CONFLICTS OF INTEREST

Educators must strive to avoid Conflicts of Interest (COIs) that may arise in relation to academic duties. Possible COIs include: 1) Immediate family or extended family relationship to students; 2) Personal or social relationships with the student or a member of the student's immediate or extended family; 3) Business or financial relationship with the student. Students who have immediate family, extended family or personal relationships with an Educator should not participate in evaluations of that Educator. Students are expected to report an actual or perceived Conflict of Interest to the GSBS Dean or designee. See BCM Policy 23.2.04 for more details.

RESPECTFUL AND PROFESSIONAL LEARNING ENVIRONMENT:

The Baylor College of Medicine (BCM) is committed to the values of integrity, respect, teamwork, innovation, and excellence, and requires all BCM Learners to practice these values consistently during the completion of requirements for educational progression and performance of scholarly and professional duties. Creating and sustaining an environment reflective of BCM values is the responsibility of every individual at BCM. This policy outlines the expectations of academic honesty and integrity; professionalism issues relating to alcohol and substance abuse; expectations for proper management of social media and internet use along with use of BCM resources; options for reporting lapses in professionalism against learners. Learners may report alleged violations of this policy through the Integrity Hotline either by calling the toll-free Hotline number (855-764-7292) or by accessing the Integrity Hotline website (www.bcm.ethicspoint.com).

STUDENT GRIEVANCES POLICY:

https://www.bcm.edu/education/academic-faculty-affairs/student-services/student-grievances

STUDENT DISABILITY SERVICES:

Students with documented disabilities can seek accommodations from Student Disability Services at 713-798-8137 or email to the Student Disability Coordinator at disability@bcm.edu. Information about a student's disability will be kept private. The student is responsible for informing the course director of approved accommodations prior to the first examination.

SEXUAL HARRASSMENT:

Baylor is committed to providing a safe and supportive environment for all community members, guests and visitors. Individuals have the right to be free from all forms of sex and gender-based discrimination, which includes sexual harassment, acts of sexual violence, domestic violence, dating violence and stalking. Sexual Harassment is unwelcomed verbal or physical conduct of a sexual nature that is sufficiently severe, pervasive or persistent that it interferes with, denies or limits a person's ability to participate in or benefit from the College's academic environment, educational programs and/or activities, and is based on power differentials or quid pro quo, results in the creation of a hostile environment, or retaliation. To learn more about BCM policy regarding sexual harassment, discrimination, and reporting options, visit the BCM Title IX Office website or email title-ix@bcm.edu

COURSE SCHEDULE follows on next page:

Week	Date	Start Time	Lecture	Readings (do before class)	Lecturer	Homework - due on Tues
1	Mon Aug 3	2:30 PM	L1. Introduction and overview	SG Chapter 1; PD Appendix A, Chapter 1.1; *MB Chapter 1, 2.1-2.4*	Hilsenbeck	
	Thu Aug 6	12:00 PM 2:00 PM	Computer Lab 1: Install and introduce R, data management	PD Appendix A, Chapter 1.1, 4; *MB Chapter 2.7-2.8.*	All	
2	Mon Aug 10	2:30 PM	L2. Summarizing numerical data	SG Chapter 2; PD Chapter 4; *MB Chapter 3*	Wang	
	Thu Aug 13	12:00 PM 2:00 PM	Computer Lab 2: Summarize data (statistics and graphs)	PD Chapter 4; *MB Chapter 3.*	All	
3	Mon Aug 17	2:30 PM	L3. Differences between groups	SG Chapter 3; PD Chapter 7.1; *MB Chapter 4.1, 6.1, 7.2.1*	Hilsenbeck	HW1
	Thu Aug 20	2:30 PM	L4. Differences between two groups	SG Chapter 4 (p 49-62); PD Chapter 5.1, 5.3, 5.4; *MB Chapter 6.2.1, 6.2.3*	Minard	
4	Mon Aug 24	2:30 PM	L5. Multiple Comparisons	SG Chapter 4 (p 62-72); *MB Chapter 6.2.4, 8.4.6*	Hilsenbeck	
	Thu Aug 27	12:00PM 2:00PM	Computer Lab 3: ANOVA, t-test, multiple comparison	PD: Chapter 3, 7.1	All	
5	Mon Aug 31	2:30 PM	L6. Rates and proportions	SG Chapter 5 (p 73-91); PD Chapter 8	Minard	HW2
	Thu Sep 3	12:00 PM 2:00 PM	Computer Lab 4: Rates and proportion		All	
6	Mon Sep 7		Labor Day			
	Thu Sep 10	2:30 PM	L7. Power and sample size;	SG Chapter 6; PD Chapter 9; *MB Chapter 4.5, 5.3*	Wang	
7	Mon Sep 14	2:30 PM	L8. Confidence intervals	SG Chapter 7 (p 125-133); PD Chapter 3.5.3, 5.1	Minard	
	Thu Sep 17	12:00 PM 2:00 PM	Computer Lab 5: Power and sample sizes, confidence intervals	PD Chapter 9; *MB Chapter 5*	All	
8	Mon Sep 21	2:30 PM	L9. Linear regression	SG Chapter 8 (p 143-164); PD Chapter 6 (p 109-120); *MB Chapter 7.1*	Wang	HW3
	Thu Sep 24	2:30PM	L10. Regression, correlation	SG Chapter 8 (p 164-183); PD Chapter 6 (p 120-125); *MB Chapter 3.8*	Wang	
	Thu Sep 24	To be announced	TA Help Session			
	Fri Sep 25	To be announced	TA Help Session			
9	Mon Sep 28	2:30PM	MIDTERM EXAM			
	Thu Oct 1	12:00PM 2:00PM	Computer Lab 6: Linear regression, correlation	PD Chapter 6: *MB Chapter 7.1*	All	
10	Mon Oct 5		AUTUMN			
	Thu Oct 8		BREAK			

11	Mon Oct 12	2:30 PM	L11. Multiple measurements per subject	SG Chapter 9; PD Chapter 7.3	Hilsenbeck	
	Thu Oct 15	12:00 PM 2:00 PM	Computer Lab 7: Paired t-test, repeated measurements	PD Chapter 5.6, 6.4, 7.3	All	
12	Mon Oct 19	2:30 PM	L12. Survival analysis	SG Chapter 11; PD Chapter 14	Hilsenbeck	HW4
	Thu Oct 22	12:00 PM 2:00 PM	Computer Lab 8: Survival	PD Chapter 14	All	
13	Mon Oct 26	2:30 PM	L13. Rank tests for comparison	SG Chapter 10; PD Chapter 5.2, 5.5, 5.7, 7.2, 7.4; *MB Chapter 6.3.1*	Minard	
	Thu Oct 29	12:00 PM 2:00 PM	Computer Lab 9: Rank tests	PD Chapter 5.2, 5.5, 5.7, 7.2, 7.4	All	
14	Mon Nov 2	2:30 PM	L14. Genomic -- Intro to RNAseq and data prep	*RNAseq-1-2-3.pdf: p3-11, natureprotocol.pdf*	Li	HW5
	Thu Nov 5	12:00 PM 2:00 PM	Computer Lab 10: Low level processing		All	
15	Mon Nov 9	2:30 PM	L15. Genomic -- linear model basis for DE	*limma_usersguide.pdf: Chapters 8, 9, 13, 15, 18.1*	Robertson	
	Thu Nov 12	12:00 PM 2:00 PM	Computer Lab 11: Differential expression		All	
16	Mon Nov 16	2:30 PM	L16. Genomic -- statistical basis for gene set analysis	*GSEA.pdf*	Coarfa	
	Thu Nov 19	12:00 PM 2:00 PM	Computer Lab 12: Functional analysis, visualization		All	
17	Mon Nov 23	2:30 PM	L17. More ANOVA and t-test;	PD Chapter 7.3; *MB Chapter 7.2*	Minard	HW6
	Thu Nov 26		Thanksgiving			
18	Mon Nov 30	2:30 PM	L18. Reproducible research, experimental design	SG chapter 12	Hilsenbeck	
	Thu Dec 3	12:00 PM 2:00 PM	Student Presentations: Discussion of studies			
	Thu Dec 3	To be announced	TA Help Session			
	Fri Dec 4	To be announced	TA Help Session			
19	Thu Dec 10	1:00 PM	Final Exam			