Biostatistics

BIOL/BOT 220

Instructor Info

- Chris Muir (he/him)
- Office Hours: After lab & by appt
- LSB 209
- https://cdmuir.netlify.app
- cdmuir@hawaii.edu

Course Info

- Prereq: BIOL 171, 172 or BOT 101; MATH 134 or MATH assessment exam
- Online asynchronous
- Virtual

Lab Info

- Wednesday
- 1:30-3:30 PM HST
- Virtual

TA Info

- Luke Campillo (he/him)
- Office Hours: After lab & by appt
- campillo@hawaii.edu

Course Description

Introduction to statistical approaches in biology. Students will learn how to formulate hypotheses, test them quantitatively, and present results. Students will analyze biological datasets using the computer language *R*.

Course information, policies, and resources

Attendance policy

Lecture: As this course is online asynchronous this semester, I am not taking attendance during lecture. You can watch recorded lectures at your own pace, however the labs build upon material covered in lecture and assume you are up-to-date.

Lab: Attendance is required to receive full credit on lab assignments. Except in the case of emergencies, you must prearrange an absence with me. If you have a valid reason for being unable to attend the lab, you can make up the assignment in a timely manner to receive full credit.

Statement on Disability: KOKUA Program

If you have a disability and related access needs, please contact the KOKUA program (UH Disabled Student Services Office) at 808-956-7511, KOKUA@hawaii.edu, or go to Room 013 in the Queen Lili‘uokalani Center for Student Services. Please know that I will work with you and KOKUA to meet your access needs based on disability documentation.

Academic Integrity and Ethical Behavior: Office of Judicial Affairs

Cheating, plagiarism, or other forms of academic dishonesty are not permitted within this course and are prohibited within the System-wide Student Conduct Code (EP 7.208). Examples include: fabrication, facilitation, cheating, plagiarism, and use of improper materials. Any incident of suspected academic dishonesty will be reported to the Office of Judicial Affairs for review and possible adjudication. Additionally, the instructor may take action in regards to the grade for the deliverable or course as they see fit.

Office of Title IX (see below)

Department of Public Safety

Website: `https://manoa.hawaii.edu/dps/`

- Emergency: 808-956-6911
- Non-Emergency: 808-956-8211
- Safety Escort: 808-956-SAFE (7233)

Learning Objectives

Know

- Establish foundational knowledge in using statistics to analyze data and answer biological questions.

Do

- Learn to think critically and creatively with about research data
- Enhance numeracy
- Communicate and report data visually, orally, and in writing

Value

- Install good habits of rigorous, quantitative reasoning.
- Individualized projects will allow students to tailor their learning toward areas of personal interest in Biology, such as conservation, sustainability, and health.

FAQs

Can I contact you about the course outside class time?

YES! You *should* contact me and the TA regularly if you have questions, concerns, or want to talk more about biostats. We are not "too busy" to talk with you about class. That said, please read the syllabus first and come prepared so we can an efficient discussion.

How do I contact you about the course?

For all non-urgent matters, use the Contact Form (link). Email is not the best way to reach me. If there is an emergency that requires an immediate response, please email me with the subject URGENT BIOL220.

Can I set up a meeting with you?

YES! You *should* meet with me, especially if you are struggling. Use the Contact Form (link) to request a meeting time.

Can I raise my grade by getting extra points or doing extra credit?

I will regrade an assignment if you think I made a mistake, but I won't give you points or an extra credit assignment. This is because in fairness, I would be obligated to offer the same opportunity to everyone in the course and this is simply not feasible.

Required Texts and Readings

Required Text

Whitlock MC & Schluter D *The Analysis of Biological Data*. 3rd Edition. Macmillan Learning. 2020. ("WS")

Additional readings will be posted on Laulima in the "Resources/readings" folder.

Course Assignments, Assessment, and Grading

Work for this course falls into three broad categories: Lab reports, Assignments, and Group Projects (described below).

15%	Lab reports
45%	Assignments
45%	Group Project

The percentages add up to 105%. Why? I will not accept late Lab reports or Assignments *without prior approval* or unavoidable medical/family emergency. However, I realize that life is complicated and sometimes it's not possible to get assignments in on time. Rather than adjudicate what constitutes a "valid" excuse, I give everyone 5% extra, no questions asked. This means that I will not entertain requests to accept late Lab reports or Assignments or do extra credit to make up for missed points, so don't bother asking. To reiterate, it's OK to request an extension in advance or in the event of unavoidable emergency (e.g. trip to the ER), but don't ask for credit if you turn in an assignment late because you forgot or were too busy, that's what the extra 5% is for.

Letter grades will be assigned based on the rubric. Grades will not be rounded up to the nearest integer (e.g. 89.98 points is a B+).

Grade	Minimum points
A+	100
A	95
A-	90
B+	87
B	83
B-	80
C+	77
C	73
C-	70
D+	67
D	63
D-	60
F	0

Lab reports

15% of your grade will be based on weekly lab reports. There are 15 lab reports, so each is worth 1% of the course grade. Therefore, it is essential you attend labs reguarly to receive full credit. All lab reports are due prior to the following week's lab. For example, the lab report for Week 1 on January 13 is due by January 20 at 1:30 PM HST. Lab reports will not be accepted late without prior approval or in the event of a significant, unforseeable medical/family emergency.

Assignments

45% of your grade will be based on Assignments given out every week. Assignments will take several forms throughout the semester and I will almost certainly make some adjustments as we go. Assignments will come in three broad categories: Problem Sets, Participation in Activities and Discussion, and Surveys.

Problem Sets

In lieu of midterm exams, you complete problem sets to evaluate your understanding of biostatistics. These will be graded for correctness and should be taken seriously. However, unlike exams, each problem set is a relatively small part of your course grade, so don't stress if you do poorly on a few problem sets. These periodic, low-stakes assessments help you learn and retain the material for longer.

Participation in Activities and Discussion

Throughout the semester, I will ask you to participate in class activities and discussion of readings or other topics. Normally, these would be during class time, but since we are online asynchronous, you will be able to complete these Assignments in that format. I will provide specific instructions for each activity/discussion and the format will likely evolve as needed.

Surveys

Surveys will be less regular and more variable than Problem Sets. Sometimes I will merely be getting information (e.g. in the first week, I want everyone to make a short video introducing themselves); other times I will be assessing your understanding of course material. However, unlike Problem Sets, I will be grading on completion rather than correctness. Honest, complete answers will help me evaluate where you are with the material, but I will not take off points if you get a Survey question incorrect.

Grading Assignments

Each Assignment will have an associated point value. I will tally Assignment points at the end of the semester and scale it appropriately. For example, if you receive 82 out of 90 Assignment points in total, then you would get 41% out of the 45% allotted to assignments.

Assignments will not be accepted late without prior approval or in the event of a significant, unforseeable medical/family emergency.

Group Project

In lieu of a final exam, you will work in groups of 4-5 peers on a semester-long project that synthesizes course materials by collecting, analyzing, and communicating data. The project is broken down into five components described below. This will allow your group to keep on track and receive feedback from me at intermediate stages. I have included *tentative* due dates and point values.

Grading Group Projects

For each component of the Group Project, 75% of the grade will the same for all group members (the "group portion") and 25% may be different for group members (the "individual portion") based on peer assessment. We will go through how to do peer assessment fairly in class.

I will tally Group Project points at the end of the semester and scale it appropriately. For example, if you receive 82 out of 90 Group Project points in total, then you would get 41% out of the 45% allotted to the project.

Unlike Lab reports and Assignments, all components of the Group Project, except the class presentation, can be turned in late with a 10% penalty per day. For example, if you got 90% on a component but turned it in a day late, you will receive a grade of 80%.

1. Collect, organize, and validate data [Jan 29; 32 points]
2. Select a question and formulate *scientific* hypotheses [Feb 12; 8 points]

3. Plot your data [March 12; 32 points]
4. Plan your analysis [April 9; TBA points]
5. Present data analysis and conclusions to the class [May 5, TBA points]
6. Explain findings in a scientific blog post [May 10, TBA points]

Class Schedule

Typical Weekly Schedule

Please note that this is intended as a typical weekly schedule, but expect some changes around holidays and when group projects assignments are due. I may also fall behind on posting lectures and slides occassionally, so I appreciate your understanding and I will reciprocate. We may adjust this schedule based on experience later in the semester.

You can watch lectures and complete readings on your own schedule, but the Problem Sets assume you have watched all lectures and completed all readings.

Other activities, discussion, and surveys will not be on a set schedule.

Day	Student	Instructor
Monday	Turn in Problem Set	Post some lectures & slides, post readings
Wednesday	Turn in Lab Report	Post Lab Assignment
Thursday		Post Problem Set and remaining lectures & slides

Topic Schedule

Week 1	Introduction to Biostatistics	WS Chapter 1
	Collecting data: Experiments	Broman KW & Woo KH (2018) Data organization in spreadsheets. *The American Statistician* 78:2–10.
	Collecting data: Sampling	
Week 2	Data visualization	WS Chapter 2
		Chapter 7 from Bergstrom CT & West JD (2020) *Calling Bullshit*. Random House
Week 3	Describing data	WS Chapter 3
Week 4	Estimating with uncertainty	WS Chapter 4
	Biased samples	Chapter 3 from Bergstrom CT & West JD (2020) *Calling Bullshit*. Random House
Week 5	Probability	WS Chapter 5
Week 6	Hypothesis testing	WS Chapter 6
	Statistical significance	McShane KW, *et al.* (2019) Abandon Statistical Significance. *The American Statistician* 73:235-245.
Week 7	Proportions	WS Chapter 7
Week 8	Frequency data	WS Chapter 8

Week 9	Contingency analysis	WS Chapter 9
	Contingency analysis in molecular evolution	McDonald JH & Kreitman M (1991) Adaptive protein evolution at the *Adh* locus in *Drosophila*. *Nature* 351:652-654.
Week 10	Spring Recess	
Week 11	Normal distribution	WS Chapter 10
Week 12	Comparing means with t-tests	WS Chapter 11
Week 13	Analysis of Variance (ANOVA)	WS Chapter 15
	ANOVA in Hawaiian forests	Craven JH *et al.* (1991) Dissecting macroecological and macroevolutionary patterns of forest biodiversity across the Hawaiian archipelago. *PNAS* 116:16436-16441.
Week 14	Correlation	WS Chapter 16
	Causality	Chapter 4 from Bergstrom CT & West JD (2020) *Calling Bullshit*. Random House
Week 15	Regression	WS Chapter 17
	Regression and molecular clock	Wray GA *et al.* (1996) Molecular Evidence for Deep Precambrian Divergences Among Metazoan Phyla. *Science* 274:568-573.
Week 16	Multiple regression	WS Chapter 18
Week 17	Project presentations	

Lab Schedule

Week 1	Jan 13	Introduction to *R*
Week 2	Jan 20	One and two variable summaries
Week 3	Jan 27	Two variable summaries
Week 4	Feb 3	Confidence intervals
Week 5	Feb 10	Writing with descriptive statistics
Week 6	Feb 17	Hypothesis testing I
Week 7	Feb 24	Sampling distributions
Week 8	Mar 3	Visualizing discrete variables using ggplot2
Week 9	Mar 10	Multiple groups and the χ^2 test
Week 10	Mar 17	No class (Spring Recess)
Week 11	Mar 24	The Central Limit Theorem

Week 12	Mar 31	t-tests
Week 13	Apr 7	ANOVA
Week 14	Apr 14	Correlation
Week 15	Apr 21	Regression
Week 16	Apr 28	Visualizing continuous variables using ggplot2
Week 17	May 5	Work on projects

Title IX Information

The University of Hawai'i is committed to providing a learning, working and living environment that promotes personal integrity, civility, and mutual respect and is free of all forms of sex discrimination and gender-based violence, including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence, and stalking. If you or someone you know experiences any of these, UHM has staff and resources on campus to support and assist you. Staff also can direct you to resources in the community. Here are some of your options:

If you wish to remain ANONYMOUS, speak with someone CONFIDENTIALLY, or would like to receive information and support in a CONFIDENTIAL setting, contact:

Office of Gender Equity
The Office of Gender Equity offers direct services to victims and survivors of sexual harassment and sexual assault. Services offered include crisis screening and assessment, case referral, safety planning and risk assessment.

Paxon Chang (available Tuesdays, Wednesdays, and Fridays)
Telephone: (808) 956-9499
Email: geneq@hawaii.edu
Queen Lili'uokalani Center for Student Services 210
2600 Campus Road
Honolulu, HI 96822
Website: `https://blog.hawaii.edu/genderequity/`

UH Confidential Advocacy
The UH Confidential Advocates provide confidential advocacy services and case management to victims* of sex discrimination and gender-based violence (including sexual harassment, gender-based harassment, dating and domestic violence, stalking, sexual exploitation, and sexual assault) who are involved in the University system on O'ahu.

Natalia Villegas
Telephone: (808) 341-4952
Email: nataliat@hawaii.edu
Pop in/Walk in Services:
Join Zoom Meeting: `https://hawaii.zoom.us/my/hccmanoaadvocate`

Mondays: 1PM – 3:30 PM
Tuesdays: 9:30 AM – 12 PM
Wednesdays 9:00AM – 11:00AM
Thursdays 4:30PM – 6:30PM

Student Parents At Mānoa (SPAM)
Student Parents At Mānoa (SPAM) seeks to increase the visibility of and resources for student parents at UH Mānoa as they pursue education while parenting. SPAM staff provide advocacy, support, and referrals for pregnant and parenting students to help them succeed in their educational goals.

Teresa Bill
2600 Campus Road
Queen Lili'uokalani Center for Student Services 211
Honolulu, HI 96822

Telephone: (808) 956-8059
Email: gotkids@hawaii.edu
Website: http://manoa.hawaii.edu/studentparents/

Counseling and Student Development Center (CSDC)
The Counseling and Student Development Center (CSDC) offers support to UHM students, staff, and faculty to assist with personal, academic, and career concerns. All services are confidential and most are free of charge for Mānoa students. They also offer free consultation to faculty and staff on personal and student-related issues as well. CSDC office hours are from 8:00 a.m. to 4:30 p.m., Monday through Friday. They also offer immediate walk in appointments for urgent or emergency/crisis services during their regular daily hours.

Queen Liliʻuokalani Center for Student Services 312
2600 Campus Road
Honolulu, HI 96822
Telephone: (808) 956-7927
Email: uhmcsdc@hawaii.edu
Website: www.manoa.hawaii.edu/counseling

University Health Services Mānoa (UHSM) The University Health Services Mānoa (UHSM) is staffed by physicians, nurse clinicians, nurses, and other support staff, and offers a wide range of medical services and programs to UH Mānoa students, with many of the services also available to UH Mānoa faculty and staff and students from other UH campuses. Services include general medical care on a walk-in basis; women's health, sports medicine, psychiatry, and dermatology clinics by appointment; pharmacy and clinical laboratory; and student training, employment and volunteer opportunities.

1710 East West Road
Honolulu, Hawaii 96822
Honolulu, HI 96822
Telephone: (808) 956- 8965
Website: www.hawaii.edu/shs/

If you wish to REPORT an incident of sex discrimination or gender-based violence including sexual assault, sexual harassment, gender-based harassment, domestic violence, dating violence or stalking as well as receive information and support, contact:

Dee Uwono
Director and Title IX Coordinator
Hawaiʻi Hall 124
2500 Campus Road
Honolulu, HI 96822
Telephine: (808) 956-2299
Email: t9uhm@hawaii.edu

As a member of the University faculty, I am required to immediately report any incident of sex discrimination or gender-based violence to the campus Title IX Coordinator. Although the Title IX Coordinator and I cannot guarantee confidentiality, you will still have options about how your case will be handled. My goal is to make sure you are aware of the range of options available to you and have access to the resources and support you need. For more information regarding sex discrimination and gender-based violence, the University's Title IX resources and the University's Policy, EP 1.204, go to: http://www.manoa.hawaii.edu/titleix/