BioStatistics
BIOL322 | Fall | 2022

Instructor: Dr. Pedro Peres-Neto, Professor, Department of Biology

syllabus updated on October 24, 2022 (last update – small changes in the lecture structure)

Please contact me via Moodle (using its messaging system). But, if Moodle is down and you have an emergency, then contact me at pedro.peres-neto@concordia.ca with BIOL-322 in the subject. For contacting TAs, see below.

Teaching strategy and access to course material and information

Format: Lectures and tutorials are in person.

Access to material: Information on how to access course material (lecture pdf, lecture notes, etc) is available in Moodle. We will use an online WebBook structuring the entire course.

🌐.info = SUCCESS

CHECK MOODLE, OUR WebBook AND EMAILS ROUTINELY PAY DETAILED ATTENTION TO INFORMATION

Lectures: Tuesday & Thursday 10:15am-11:30am	Pedro Peres-Neto (Instructor) - room HU 125 (Loyola)
Lab tutorials (they start in the week of Sept. 12)	TAs - room: CC-203 (Loyola)
Lab section 101: Wednesday 10:15-13:00	John Williams (j.p.w@outlook.com)
Lab section 102: Wednesday 13:15-16:00	Hammed Akande (hammed.akande@mail.mcgill.ca)
Lab section 103: Friday 10:15-13:00	Michael Paulauskas (michael.paulauskas@mail.mcgill.ca)
Lab section 104: Friday 13:15-16:00	Alexandra Engler (alexandra.engler@hotmail.fr)

Questions related to course material & assessment components: contact the instructor (Dr. Peres-Neto) via Moodle
Questions related to tutorials: post is Moodle Forums or contact your TA via email

[Moodle FORUM]: We expect that you ask general questions first to all students via the appropriate Moodle Forum. This will generate an environment for exchange and cooperation.
[Instructor]: Drop-in hours Tuesdays & Thursdays 9:30AM to 10:30AM (L-SP-437.13); please try to send a message via Moodle to know if you are stopping by (see end of the course outline for why drop-in hours are relevant.
[TA]: TAs don't have office hours but can be contacted via their email.

Course Description: This course is designed to present, explain and practice basic and commonly used statistical techniques applied to biological sciences for data exploration and hypotheses testing. Examples and applications will be drawn from a wide range of fields including cell biology, ecology, epidemiology, genetics, molecular biology and genomics. Lectures will present and explain technical concepts within an applied context and tutorials will provide hands-on data analysis using the statistical software R.

Objectives: Upon successful completion of the course, students will be able to: express scientific questions in a statistical manner; decide which techniques are better suited for different types of biological problems; report statistical results in an effective manner; adapt the knowledge and practice they learned to new biological questions. Formulas (formulae) are presented so that students gain intuition about their nature, but their memorization is not required in exams and in tutorials.

Lectures: The teaching strategy in lectures is to use multiple examples from different fields of biology so that students can gain experience on the technical and application aspects of a multitude of commonly used statistical methods.

Computer-based labs (tutorials): The application and concepts underlying the statistical methods covered in lectures will be practiced using data extracted from real studies covered in class. Applications will be based on the software environment R for statistical computing and graphics.

Statistical software: We will use R, which is a free software environment for statistical computing and graphics. R has become the de facto standard platform for performing statistical analyses in biology. Knowledge of R has now become a skill required in the job markets of many disciplines, including Biology.

Assessment calendar in a glance (details are provided in the next pages) days indicate deadlines for Quizzes and reports, and exam days (not for tutorials)

September	October	November
23 Quiz 1	04 **REPORT 1**	04 Quiz 6
30 Quiz 2	07 Quiz 3	08 **REPORT 2**
	No lectures labs and quizzes in week of October 10th	11 Quiz 7
		18 Quiz 8
	18 **MIDTERM EXAM**	22 **MIDTERM EXAM**
		25 Quiz 9
	21 Quiz 4	29 **REPORT 3**
	28 Quiz 5	**December**
		02 Quiz 10 (Bonus)

10 QUIZZES (0.8% each): posted in Moodle 72h prior to their deadline (see next pages for details); total 8%.

3 REPORTS (5% each) posted in Moodle 2 weeks prior to their deadline (see next pages for details); total 15%.

2 MIDTERM Exams (16% each); total 32% - If you miss either midterm (or both), they will be accumulated over the final exam (the grade, not the questions).

10 TUTORIALS lab reports (Tutorial 2 through 11): one report each week starting in the 2nd week of classes (1% each report). Deadline for tutorials are at their end (see instructions in the next page). Tutorial 1 is simply the instructions for installing R and RStudio and you can do it by yourself.

1 FINAL exam is cumulative and covers the entire course (35%; in person booked by the exam's office)

You should also become familiar with the general Concordia calendar:
https://www.concordia.ca/students/undergraduate/undergraduate-academic-dates.html

(Ten) QUIZZES (total 8%; 0.8% each x 10 = 8%). Quiz deadlines are at 10:15AM of the day indicated in the calendar (see previous page). Deadlines always fall on a Friday. They will be posted on Moodle the Tuesday prior to the deadline at 10:15AM. You have then 72h in total to complete each Quiz. Quizzes cover previous material including the lecture of the day in which they are released. No excuse for delays other than medical or the new Concordia academic accommodation request is accepted (see below). One single quiz can be missed without an excuse; in this case, its grade will be the average of the other quizzes at the end of the semester. The last quiz (#10) replaces the lowest grade you had in one of your quizzes (including zero if you missed one). If you don't take, then your grade is not affected for the quizzes you already took.

(Ten) TUTORIALS (Tutorial 2 through 11; total 10%; 1% each x 10). Practicing R and working on tutorial exercises are key to acquire strong skills in biostatistics. R tutorials will be conducted during the lab sections. One report each week starting in the 2nd week of classes (1% each report). It is not mandatory that you attend the tutorials in person, but you are always required to complete their respective reports according to their deadline (i.e., either at 13h or 16h depending on the lab section). One single tutorial can be missed without an excuse; in this case, its grade will be the average of the other quizzes at the end of the semester. **The tutorials are key to your success in this course, particularly in completing reports.**

(Three) REPORTS (total 15%; 5% each x 3). Reports are due on report 1) Oct. 4; report 2) Nov. 8 and report 3) Nov. 29. Reports will be posted in Moodle two weeks prior to their deadlines. They should be submitted via Moodle on the day of their deadline by 10:15AM. Reports will be produced using R (the statistical software used in BIOL322 and learned during lab tutorials). If an excused issue is incurred (e.g., medical or the new Concordia academic accommodation request), an extension for the report should be granted by the instructor (Dr. Peres-Neto, not your TA). If no excuse is provided, the following grading penalties will be applied to late reports: 1 day or less - 10%; 1-2 days - 20%; 2-3 days - 35%; 3-4 days - 50%; 4-5 days - 70%; more than 5 days - 90%.
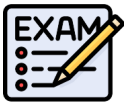
(Two) MIDTERM EXAMS (total 32%; 16% each x 2). Exam 1 is on October 18 and Exam 2 is on November 22. Students will be informed of the exam room (Loyola campus) a few days before the midterm exam. Students have a total of 75 minutes to complete (from 10:15 AM until 11:30 AM). NOTE: Midterms are not cumulative, but the final exam is cumulative. Exams contain questions related to lectures, lab computer tutorials and additional material distributed during the term. If you miss any of the midterms (or both), they will be accumulated over the final exam (the grade, not the questions).

(ONE) FINAL CUMULATIVE EXAM (total 35%). The exam contain questions related to lectures, computer tutorials and additional material distributed during the term.

SHORT-TERM ABSENCE FORM - The short-term absence form lets you submit your request for short-term accommodation without documentation.

https://www.concordia.ca/students/absence-form.html

EXAMS ARE NOT OPEN BOOK
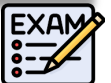
GRADING SCHEME: A+=91-100, A=85-90, A-=80-84, B+=77-79, B=73-76, B-=70-72, C+=67-69, C=63-66, C-=60-62, D+=57-59, D=53-56, D-=50-52, F<50.

MATERIAL USED in the COURSE and for STUDYING for ASSESSMENTS

MANDATORY: Lectures, slides from lectures (may contain more material then the videos), external resources made available to you (e.g., videos, papers, etc), tutorials, reading material produced in our WebBook.

OPTIONAL (but highly recommended) - textbook - The Analysis of Biological Data by Whitlock & Schluter, 3rd edition, W.H. Freeman & Company. Data & resources by chapter:
https://whitlockschluter3e.zoology.ubc.ca

DETAILED SCHEDULE (Lectures and Tutorials)

Date	Activity	Subject	Week
Sept. 6	Lecture 1	Introduction to the course - This is BioStatistics!	
lab section	Tutorial 1	Install R and RStudio (solo activity - see WebBook)	1
Sept. 8	Lecture 2	Key Jargon used in BioStatistics	
Sept. 13	Lecture 3	Displaying data - Graphs: The art of designing information	
lab section	Tutorial 2	The R and RStudio environments	2
Sept. 15	Lecture 4	Frequency distributions	
Sept. 20	Lecture 5	Describing data via summary statistics (part 1)	
lab section	Tutorial 3	Graphs: The art of designing information	3
Sept. 22	Lecture 6	Describing data via summary statistics (part 2)	
Sept. 27	Lecture 7	Estimating and making inferences with uncertainty	
lab section	Tutorial 4	Describing data via summary statistics	4
Sept. 29	Lecture 8	Sampling distributions	
Oct. 4	Lecture 9	Confidence intervals (part 1)	
lab section	Tutorial 5	Estimating and making inferences with uncertainty	5
Oct. 6	Lecture 10	Confidence intervals (part 2)	
		No lectures BUT don't forget to complete Quiz 4	
Oct. 18	Midterm 1	All subjects covered so far	
lab section	Tutorial 6	Sample estimators - biases and adjustments	6
Oct. 20	Lecture 11	Properties of estimators	
Oct. 25	Lecture 12	Statistical hypothesis testing	
lab section	Tutorial 7	Statistical hypothesis	7
Oct. 27	Lecture 13	One-sample testing	
Nov. 1	Lecture 14	Two-sample testing, F-test for heteroscedasticity	
lab section	Tutorial 8	The t-distribution and its use in stat. hypothesis testing	8
Nov. 3	Lecture 15	Two-sample testing under heteroscedasticity	
Nov. 8	Lecture 16	The side of a test (one-sided *versus* two-sided tests)	
lab section	Tutorial 9	Two-sample t-tests (homoscedastic and heteroscedastic)	9
Nov. 10	Lecture 17	Analysis of variance (ANOVA designs)	
Nov. 15	Lecture 18	Post-hoc tests for ANOVA	
lab section	Tutorial 10	Analysis of variance (ANOVA designs)	10
Nov. 17	Lecture 19	Simple linear regression (part 1)	

Date	Activity	Subject	Week
Nov. 22	Midterm 2	Subjects covered between Midterm 1 and Midterm 2	
lab section	Tutorial 11	Regression	11
Nov. 24	Lecture 20	Simple linear regression (part 2)	
Nov. 29	Lecture 21	Correlation and normality	
lab section	Tutorial 12	Correlation and normality (non-mandatory)	12
Dec. 1	Lecture 22	Computational Methods	
Dec. 6	Lecture 23	End of lectures - Questions from students (review)	
			13

Why drop-in hours? (tips for any course)

- Get clarification on topics that weren't clear in lecture or the readings.

- Ask clarification on assignments.

- Exchange ideas on how to improve the course for you and others.

- Interact with the instructor - This can help you finding an honors thesis advisor or letters of recommendation.

RIGHTS AND RESPONSABILITIES – PLAGIARISM & ACADEMIC INTEGRITY

PLAGIARISM: I take this issue very seriously. The most common offense under the Academic Code of Conduct is plagiarism which the Code defines as "the presentation of the work of another person as one's own or without proper acknowledgement." This could be material copied word for word from books, journals, internet sites, professor's course notes, etc. It could be material that is paraphrased but closely resembles the original source. It could be the work of a fellow student, for example, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased through one of the many available sources. Plagiarism does not refer to words alone - it also refers to copying images, graphs, tables, and ideas. "Presentation" is not limited to written work. It also includes oral presentations, computer assignments and artistic works. Finally, if you translate the work of another person into French or English and do not cite the source, this is also plagiarism. In simple words: DO NOT COPY, PARAPHRASE OR TRANSLATE ANYTHING FROM ANYWHERE WITHOUT SAYING FROM WHERE YOU OBTAINED IT! And instructors have software to detect plagiarism.
Source: https://www.concordia.ca/students/academic-integrity.html

ACADEMIC INTEGRITY: What you can and can't do on assignments and exams? You should watch this Concordia video: https://www.concordia.ca/cunews/main/stories/back-to-school/video-what-is-academic-integrity.html