

COURSE SYLLABUS

Instructor:	René Malenfant	Lecture Time:	MW: 12:30–13:20
Email:	rene.malenfant@unb.ca	Lab Time:	M: 14:30–17:20
Phone:	458-7462	Locations:	Lecture: C104 Lab: B22
Office Location:	B111	Office Hours:	By appointment (link)

Course Description:

Recent advances in technology allow biologists to generate huge amounts of data in different fields such as genetics, ecology, and neuroscience. For many problems, manual data analysis is no longer possible, and biology is becoming increasingly quantitative and computationally intensive. In this course, you will learn how to approach biological problems using a basic toolkit including text processing, shell scripting, programming, data management, and data display. Previous programming experience is not required.

Course Prerequisites:

BIOL 2018; Recommended: STAT 2264 or equivalent.

Recommended Textbooks:

Beckerman AP, Childs DZ, Petchey OL (2017) *Getting Started with R: An Introduction for Biologists*, 2nd edn. Oxford, UK: Oxford University Press.

Haddock SHD, Dunn CW (2011) *Practical Computing for Biologists*, 1st edn. Sunderland, MA: Sinauer.

Other Course Resources:

Buffalo V (2015) *Bioinformatics Data Skills*, 1st edn. Sebastopol, CA: O’Reilly. [eBook available through UNB libraries.]

Wickham H, Grolemund G (2017) *R for Data Science*, 1st edn. Sebastopol, CA: O’Reilly. [Available for free at: <https://r4ds.had.co.nz/>]

Library Information:

www.lib.unb.ca

UNB Libraries provides access to a vast collection of online and print resources. Use Research by Subject on the library website to find the best resources for this course.

Research help is available by phone, e-mail, chat, and in-person.

The libraries offer quiet and group study space. Book a Group Study Room online at http://www.lib.unb.ca/services/group_study.php

Online Materials:

Online course materials can be found in Desire2Learn (Brightspace), UNB’s online Learning Management System. You can access it through the MyUNB portal for single login to all UNB services (<https://my.unb.ca/Pages/default.aspx>) or directly by pasting lms.unb.ca into your browser address bar.

Course Outcomes:

Upon completion of this course, you should be able to:

- Manage and manipulate data in formats that are common in the biological sciences
- Plot and analyse data using common statistical software
- Use a *nix command-line interface to navigate the file system and execute scientific software
- Write a computer script to automate data analysis
- Use peer-review tools and reference management software to write a research proposal

Students' competency levels on these outcomes may vary. Outcomes achievement requires the meeting of all course expectations, including honouring of all course policies, regular class attendance, and completion of all assigned work in good faith and on time.

Grading Scale:

Letter Grade	Percentage Grade	Grade Points
A+	[93–100]%	4.3
A	[85–93)%	4.0 <i>Excellent</i>
A–	[80–85)%	3.7
B+	[75–80)%	3.3
B	[70–75)%	3.0 <i>Good</i>
B–	[65–70)%	2.7
C+	[60–65)%	2.3
C	[55–60)%	2.0 <i>Satisfactory</i>
D	[50–55)%	1.0
F	[0–50)%	0.0

Course Marking Scheme

Item	Description	Value	Date Due	Details
Labs	Weekly assignments	4% each	See schedule	Best 10 of 11 counted
Assignment	Research proposal (two drafts)	10%	Open-ended	Draft 1 = 7% Draft 2 = 3%
Midterm exam		15%	Nov. 3	Closed-book
Final exam		35%	TBA	Open-book & laptop
Total:		100%		

Course Policies:

- Please note the university's policies on attendance and decorum: <http://go.unb.ca/tls1viWva> and <http://go.unb.ca/tlsmWzKLL>
- All assignments must be received by 11:59 PM of the due date. Assignments should be submitted electronically (i.e., on D2L).
- A student who cannot complete an assignment or attend an examination due to incapacitating illness, severe domestic affliction, or other compelling reasons can apply for a deferral. Without approval, there is a 20% penalty for each day that an assignment is late, where "days" are counted from midnight to midnight including weekends and are judged based on the time submitted to the

instructor. In all cases, the instructor may request adequate documentation to substantiate the reason for the absence. Deferral is a privilege and not a right; there is no guarantee that a deferral will be granted.

- Assignments are individual work, and collaboration among students should not exceed the kind of help you would expect from the instructor. For instance, troubleshooting an analysis or helping another student understand concepts are okay, but directly giving/receiving answers or sharing script files (etc.) would obviously be forbidden. If you receive any help from anyone else (including from a site on the Internet, etc.), your assignment must contain an Acknowledgements section in which you thank the person and describe how they assisted you. Any academic offenses will be dealt with strictly according to UNB policy. (See below.)
- I try to answer all email questions as soon as I see them, time permitting. This means that you will usually receive a reply very quickly during the workweek (i.e., Monday–Friday, 9:00 AM to 5:00 PM), and much slower (or perhaps not at all) afterhours or on the weekend. **Note:** I will not answer questions about the content of an examination within 24 hours of the exam. This is a motivation for you to start studying early.
- Mobile devices are to be turned off during lectures and labs.
- Extra-credit assignments will not be considered.

Services for Students with Disabilities

If you are a student with a disability of any type (physical, mental, learning, medical, chronic health, sensory; visible or invisible) you are strongly encouraged to register with the UNBF Student Accessibility Centre (SAC) (<http://www.unb.ca/fredericton/student-services/academics/accessibility/>) so that you may receive appropriate services and accommodations. Once you are registered with SAC, the instructor will be notified via the UNBF SAC Accommodation Letter of your specific accommodations. If you would like to discuss your particular needs with the instructor, please book a time for a confidential appointment.

Privacy Statement for Online Course Recordings

The recordings of your online classes are for your personal use for course purposes only and not to be shared with others.

- Be respectful of your peers and instructors. Sharing of any personal information, including but not limited to personal views and opinions with others, other than for course purposes, is not permitted and may violate UNB's Policy for the Protection of Personal Information and Privacy.
- Personal opinions, views, and commentary provided in the course of online delivery may be considered personal information, which requires the consent of the person who provided it in order to share it ethically and legally.
- The content shared by faculty and instructors is subject to copyright and cannot be shared without the explicit permission of the copyright owner, which may include but not be limited to the course instructor, their colleagues, textbook publishers, and multimedia vendor.

Course Topics

The three major themes covered in the course include the areas of computing where many professional biologists spend much of their time:

1. Microsoft Office (for data and reference management, basic analysis, and graphics)
2. The *nix command line (for fast, easy, and repeatable data manipulation)
3. The R programming language (for reading, processing, analysing, and visualizing data)

Weekly Schedule

Below is the intended schedule. It is subject to change in the event of extenuating circumstances, by mutual agreement, and/or to ensure better student learning. Students will be notified if and when changes are made (Stay up-to-date via D2L Brightspace).

Date	Day	Topics	Items due
Sept. 8	W	Introduction	
Sept. 13	M	Descriptive statistics refresher	
Sept. 15	W	Paper discussion (Noble 2009)	Assigned reading
Sept. 20	M	Random numbers; least-squares fitting	Lab 1 due before midnight (i.e., Sunday Sept. 20 at 11:59 PM)
Sept. 22	W	Proposal writing and reference management	
Sept. 27	M	Text files and regular expressions	Lab 2 due before midnight
Sept. 29	W	<i>Help session</i>	
Oct. 4	M	UNIX and command-line basics	Lab 3 due before midnight
Oct. 6	W	<i>Help session</i>	
Oct. 11	M	<i>Thanksgiving – no class</i>	Lab 4 due before midnight
Oct. 13	W	<i>Help session</i>	
Oct. 18	M	Text and pipelines on the command line	
Oct. 20	W	<i>Help session</i>	
Oct. 25	M	Shell scripting; remote login	Lab 5 due before midnight
Oct. 27	W	<i>Help session</i>	
Nov. 1	M	Introduction to R & RStudio	Lab 6 due before midnight
Nov. 3	W	Midterm exam	
Nov. 8	M	<i>Reading week – no class</i>	Lab 7 due before midnight
Nov. 10	W	<i>Reading week – no class</i>	
Nov. 15	M	Computer graphics	
Nov. 17	W	Inferential statistics review	
Nov. 22	M	Inferential statistics review	Lab 8 due before midnight
Nov. 24	W	Principal component analysis (PCA)	
Nov. 29	M	Clustering	Lab 9 due before midnight
Dec. 1	W	Bootstrapping, permutation tests	
Dec. 6	M	Programming in R	Lab 10 due before midnight
Dec. 8	W	<i>Help/review session</i>	Lab 11 due by 11:59 PM

Lab Schedule

The schedule is subject to change – watch for e-mails; announcements in class on days of the tutorial or via Desire2Learn).

Week #	Date	Topic
1	Sept. 13	Microsoft Excel 1: Data management, descriptive statistics, and graphing
2	Sept. 20	Microsoft Excel 2: Least-squares fitting and random-number generation
3	Sept. 27	Text files and regular expressions
4	Oct. 4	Shell 1: The UNIX command-line environment
	Oct. 11	<i>Thanksgiving – no lab</i>
5	Oct. 18	Shell 2: Manipulating text using the command line
6	Oct. 25	Shell 3: Shell scripting (and working with remote machines)
7	Nov. 1	R 1: The R environment, data types, and data management
	Nov. 8	<i>Reading week – no lab</i>
8	Nov. 15	R 2: Data exploration and visualization (and RMarkdown)
9	Nov. 22	R 3: Inferential statistics (e.g., chi-square test, <i>t</i> -test, general linear models)
10	Nov. 29	R 4: Unsupervised methods (e.g., PCA, clustering)
11	Dec. 6	R 5: Writing R functions; bootstrapping and permutation tests

Lab Safety Procedures and Conduct:

Food and drink are not permitted in the computer lab.

Writing and Study Skills Support:

UNB's Student Services provides many coaching and mentoring services to assist with writing papers, effective study methods, and other skills development related to student success:

<http://www.unb.ca/fredericton/studentservices/academics/writing-centre/index.html>

Math Skills Support:

UNB's Math Learning Centre offers math help drop-in times and opportunity to book appointments:

<http://www.math.unb.ca/~mathhelp/>

Technical Support:

Information Technology Services (ITS) Help Desk can be reached by phone at 457-2222, by email at its servicedesk@unb.ca, or visited in person at the Harriet Irving Library Learning Commons.

<http://www.unb.ca/its/get-it-help.html>

Academic Advising:

For academic advising information and assistance, see: www.unb.ca/student-toolkit

Academic Offences

Academic offences include, but are not limited to, the following:

Plagiarism

Plagiarism includes:

1. quoting verbatim or almost verbatim from any source, regardless of format, without acknowledgement;
2. adopting someone else's line of thought, argument, arrangement, or supporting evidence (such as, statistics, bibliographies, etc.) without indicating such dependence;
3. submitting someone else's work, in whatever form (essay, film, workbook, artwork, computer materials, etc.) without acknowledgement;
4. knowingly representing as one's own work any idea of another.

NOTE: In courses which include group work, a penalty may be imposed on all members of the group unless an act of plagiarism is identified clearly with an individual student or students.

Examples of other academic offences include: cheating on exams, tests, assignments or reports; impersonating somebody at a test or exam; obtaining an exam, test or other course materials through theft, collusion, purchase or other improper manner, submitting course work that is identical or substantially similar to work that has been submitted for another course; and more as set out in the academic regulations found in the Undergraduate Calendar.

Penalties for plagiarism and other academic offences range from a minimum of F (zero) in the assignment, exam or test to a maximum of suspension or expulsion from the University, plus a notation of the academic offence on the student's transcript.

For more information, please see the Undergraduate Calendar, University Wide Academic Regulations, Regulation VIII.A, or visit: <http://go.unb.ca/tlsPb0XX5>. It is the student's responsibility to know the regulations.