BIOL 388 Bioinformatics

- Instructor: Dr. Heather Wheeler hwheeler1@luc.edu
- Prerequisites: BIOL 282
- Classroom: Online, see Sakai for Zoom links (Zoom Pro tab)
- Synchronous Sessions: Mondays and Wednesdays 2:50 – 3:40 PM CDT/CST via Zoom
- Instructor Office Hours: Fridays 2:50 – 5:00 PM CDT/CST via Zoom
- TA: Katie Delany kdelany@luc.edu
- Python Tutor: Elyse Geoffroy egeoffroy@luc.edu
- TA/Python Tutor Office Hours: Tuesdays 2:00 – 4:00 PM CDT/CST via Zoom

Objectives:
- Gain a familiarity with current areas of research, data repositories, computational tools, and scripting languages used in the field
- Develop the ability to master new analysis tools and critique their utility
- Cultivate the facility to understand multidisciplinary questions and identify solutions
- Increase familiarity with reading and presenting primary scientific literature

Course Materials: The recommended textbook for this course is *Concepts in Bioinformatics and Genomics* by Drs. Jamil Momand and Alison McCurdy (ISBN: 9780199936991). While not required, this textbook is the starting material for many topics covered in class and is thus recommended background reading. This book can be rented and is available in print and as an e-book. The required Python tutorial is *Python for Biologists* by Dr. Martin Jones and is freely available online (https://pythonforbiologists.com/introduction/) Other required materials include lecture videos, course slides, papers from the scientific literature, and online tools, which will be made available through Sakai.

Discussions, Office Hours & Seeking Help: To meet at a time other than scheduled office hours, you must email the instructor or TA to schedule a day and time in advance. Another route to get assistance is to ask questions via email, **please cc: instructor and TA**. We will do our best to respond to emails within 24 hours. There are many online forums where you can post your questions or search for questions and answers. When you encounter a problem, error message, etc., you can always try and **Google it!**

Student Accommodations: Any student requesting accommodations is required to register with Student Accessibility Center (SAC). Students will provide the instructor with an accommodation notification from SAC, preferably within the first two weeks of class. Students are encouraged to meet with the instructor individually in order to discuss their accommodations. All information will remain confidential. For more information or further assistance, please call 773.508.3700 or visit https://www.luc.edu/sac/.

System Requirements: Students must have access to their own computer (laptop or desktop) with administrative rights. This means that the student can download and install software on the machine. In addition, the student must have access to a reliable internet source. For synchronous sessions, the student needs a device with a microphone and a large enough screen to view shared Python code. A webcam is helpful for interacting with classmates, instructor, and TA, but not required. The software presented in the course will be cross-platform, i.e. able to work on MacOS, Windows, and Linux.

Academic Integrity: While you are encouraged to interact with fellow students and use outside resources (the web, journal papers, etc.), **your assignments, quizzes, and exams are to be your own work**. Plagiarism and cheating will not be tolerated (see University policy: http://www.luc.edu/academics/catalog/undergrad/reg_academicintegrity.shtml) and will be reported to the college. *STUDENTS FOUND TO PRESENT SOMEONE ELSE'S WORK AS THEIR OWN WILL* **RECEIVE A ZERO FOR THE ASSIGNMENT**. *ANY STUDENT WHO REPEATS SUCH AN ACTION WILL RECEIVE A FAILING GRADE (F) FOR THE COURSE.* THIS MEANS IT IS NOT ACCEPTABLE TO:
• photocopy or copy/paste others' work,
• share files via file transfer (e.g. Google Drive, Dropbox, OneDrive, sftp, etc.)
• email your assignment to another student to look at,
• collaborate on quizzes and exams,
• allow or pay someone else to write code or a paper for your own benefit, or
• any other action that is deemed unethical by Loyola University Chicago or the instructor.

Grading:
• **ROSALIND Python Assignments: 10 pts** (5 pts each). We will use the ROSALIND web platform to introduce you to Python and to solve assigned Python programming problems. Details for how to enroll will be provided the first week of class.
• **Homework Assignments: 50 pts** (10 pts each). Homework assignments will be exercises using software and web resources; these tools can include those discussed in class and challenges to find new tools. All should be turned in via Sakai.
• **Quizzes: 20 pts** (5 pts each). Quizzes will cover the material included in the video lectures, in-class exercises, assignments, and readings. See Course Schedule for quiz dates and the material covered in each quiz. Quizzes will be given during synchronous Zoom sessions via Sakai.
• **Final Exam: 10 pts**. The final exam is cumulative and will comprise similar questions as the four quizzes.
• **Position Paper: 10 pts**. We will expand our discussion of bioinformatics to also include some of the ethical issues in the field, specifically in relation to genetic ancestry testing. Students will be required to submit a 2-3 page, single-spaced paper that includes a concise scientific review and a discussion (opinion) of the ethical issues surrounding the topic. Grades will be based on your ability to summarize the ethical issues and support your opinion, not the opinion taken. More details will be provided.
• **Class Participation: 5 pts**. We will regularly work on in-class exercises during synchronous Zoom sessions (Mondays and Wednesdays) that will help prepare you for homework and quizzes. You are expected to come prepared to synchronous Zoom sessions, having watched the required videos in the "**To Do Before Class Zoom**" column in the Course Schedule below. Your attendance and participation will be documented. Excessive absences and/or lack of active participation when present could result in lost points.

Note that more than 100 points are available. In addition, individual assignments and in-class exercises may include opportunities to earn bonus points, so come prepared to synchronous Zoom sessions.

The minimum points (pts) needed for each grade are listed in the table below. Points are rounded to the nearest tenth.

A ≥ 93 pts	B+ ≥ 87 pts	B- ≥ 80pts	C ≥ 73pts	D+ ≥ 67pts	F < 63pts
A- ≥ 90 pts	B ≥ 83 pts	C+ ≥ 77pts	C- ≥ 70pts	D ≥ 63pts	

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Late/Missed Assignment Policy: *ALL ASSIGNMENTS ARE DUE VIA SAKAI BY **12:00PM (noon) CDT/CST** ON THE DUE DATE. ASSIGNMENTS AFTER THIS TIME WILL NOT BE ACCEPTED. MISSING QUIZZES/EXAMS WILL ONLY BE PERMITTED UNDER SPECIAL CIRCUMSTANCES (e.g., medical emergencies, educational events, court dates, religious holidays, etc.); ARRANGEMENTS MUST BE MADE IN ADVANCE WHEN APPLICABLE AND A NEW QUIZ/EXAM WILL BE ADMINISTERED.*

Class Conduct: One important aspect of your education is learning to respect the rights of others. Please respect others by (1) allowing all classmates the right to voice their questions or opinions without fear of ridicule and (2) not making objectionable (gendered, racial, or ethnic) comments.

Privacy Statement: Assuring privacy among faculty and students engaged in online instructional activities helps promote open and robust conversations and mitigates concerns that comments made within the context of the class will be shared beyond the classroom. As such, recordings of instructional activities occurring during synchronous Zoom sessions will be used solely for internal class purposes by the faculty member and students registered for the course, and only during the period in which the course is offered.

Intellectual Property: All lectures, videos, PowerPoints and other instructional materials in this course are the intellectual property of the instructor. As a result, they may not be distributed or shared in any manner, either on paper or virtually without the instructor's written permission. Lectures may not be recorded without the instructor's written consent; all lectures and synchronous Zoom sessions will be available for students to view in Panopto (linked and/or embedded in Sakai). Note that Zoom Breakout Rooms and Office Hours will not be recorded. Recognizing that your work, too, is your intellectual property, the instructor will not share or distribute your work in any form without your written permission.

Statement of Intent: By remaining in this course, students are agreeing to accept this syllabus as a contract and to abide by the guidelines outlined in the document.

Course Schedule

Week	Date	Due at Noon CDT/CST	To Do <u>Before</u> Class Zoom	Other Videos/Readings To Do This Week
1	M 8/24		Read Syllabus	Watch Biology Review Video Read Momand & McCurdy Ch. 1 Read https://pythonforbiologists.com/introduction/, https://pythonforbiologists.com/printing-and-manipulating-text/, https://pythonforbiologists.com/lists-and-loops/
	W 8/26		Watch Python Install and Strings/Lists Videos	
2	M 8/31		Watch Python Loops/Conditions/Files Video	Read https://pythonforbiologists.com/conditional-tests/, https://pythonforbiologists.com/working-with-files/, https://pythonforbiologists.com/dictionaries/, https://pythonforbiologists.com/writing-our-own-functions/
	W 9/2		Watch Python Dictionaries/Functions Video	
3	M 9/7		*No class: Labor Day*	Watch NCBI/UniProt Video Read Momand & McCurdy Ch. 2 Watch Biopython Video
	W 9/9	ROSALIND 1	During class: Python Code Review	
4	M 9/14		During class: **Quiz 1 (Python)**	Read Momand & McCurdy Ch. 3, Ch. 4.1-4.4, Ch. 4.11-4.13
	W 9/16		Watch Molecular Evolution Video	
5	M 9/21	ROSALIND 2	During class: Python Code Review	Read Momand & McCurdy Ch. 5
	W 9/23		Watch Algorithms Primer Video Watch Pairwise Alignment Video	
6	M 9/28	Homework 1	Watch BLAST Video	Read Momand & McCurdy Ch. 6
	W 9/30		Watch Multiple Sequence Alignment Video	
7	M 10/5	Homework 2	During class: **Quiz 2 (Week 3-6 material, no Python)**	Read Momand & McCurdy Ch. 8
	W 10/7		Watch Phylogenetics Video	
8	M 10/12		Watch Sequencing Video	Read Momand & McCurdy Ch. 9.1-9.8 Read Langmead et al. (Sakai)
	W 10/14		Watch Genome Assembly Video	
9	M 10/19	Homework 3	Watch Genome Annotation Video	Catch Up on Readings
	W 10/21		During class: **Quiz 3 (Week 7-9 material)**	
10	M 10/26		Watch Genome Rearrangements Video	Read Heber & Howard (Sakai)
	W 10/28		Watch Primer Design Video	
11	M 11/2		Watch Transcriptomics Video	Read Momand & McCurdy Ch. 10 Read Hannenhalli (Sakai) Read Przulj (Sakai)
	W 11/4		Watch Interactomes Video	
12	M 11/9	Homework 4	Watch Human Population Genetics Video	Read Momand & McCurdy Ch. 9.9-9.13 Read Chao (Sakai)
	W 11/11		Watch Pattern Identification Video	
13	M 11/16		During class: **Quiz 4 (Week 10-12 material)**	Read Garrison & Bardill (Sakai) Reflect on the ethics of genetic ancestry testing, start Position Paper
	W 11/18		Watch "The Science of Family Ties: It's All Relatives" Video	
14	M 11/23		*No class: Thanksgiving Break*	
	W 11/25		*No class: Thanksgiving Break*	
15	M 11/30		Watch GWAS Workshop Video	Read Bush & Moore (Sakai)
	W 12/2	Position Paper	Bring Questions re: Final Exam and/or Homework 5	
	Thursday 12/10	Homework 5	**FINAL EXAM 1:00-2:15PM CST (cumulative)**	

Schedule is subject to change at discretion of the instructor; changes will be published to Sakai.

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