BIOL 388/488 Bioinformatics

- Instructor: Dr. Heather Wheeler (she/her/hers)
- Email: hwheeler1@luc.edu
- Prerequisites: BIOL 282
- Days/Times: MWF 2:50 – 3:40 PM
- Classroom: Cuneo Hall 311
- Mode: Synchronous
- Instructor Office Hours: Mondays 1:00 – 2:30 PM in LSB 324

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. 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 to schedule a day and time in advance. Another, usually faster, route to get assistance is to ask questions via email. I will do my 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 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 laptop both during and outside of class time 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. 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/photograph 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. Homework will be administered through the "Tests & Quizzes" function of Sakai.
• **Quizzes: 20 pts** (5 pts each). Quizzes will be given during class time and cover the material included in lectures, in-class exercises, assignments, and readings. See Course Schedule for quiz dates. Reviews outlining the material covered in each quiz will be provided prior to each quiz. Quizzes will be administered through the "Tests & Quizzes" function of Sakai.
• **Final Exam: 10 pts**. The final exam is cumulative, will comprise similar questions as the four quizzes, and will be administered through the "Tests & Quizzes" function of Sakai.
• **Position Paper: 10 pts**. This course will also include some of the ethical issues in bioinformatics, specifically in relation to genetic ancestry testing. Each student will 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 that will help prepare you for homework and quizzes. Your attendance and participation will be documented. Excessive absences and/or lack of active participation when present could result in lost points.

Note that 105 points are available. Your final grade will simply be the sum of all the points you have earned over the course of the semester. 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	

Late/Missed Assignment Policy: Due dates and times for each assignment will be posted on ROSALIND or Sakai. LATE ASSIGNMENTS ARE TYPICALLY NOT ACCEPTED. Extra points are built into the course for this reason. Exceptions may be made at the discretion of the instructor. 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.

Diversity, Equity, and Inclusion Statement: Science strives to be objective. However, science is historically built on a small subset of privileged voices and thus includes both explicit and implicit biases. My goal is that students from all backgrounds and perspectives are well served by this course. The diversity students bring to bioinformatics should be viewed as a resource, strength, and benefit as we pursue knowledge in the service of humanity and nature. I intend to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, religion or no religion, and culture. Your suggestions for improving inclusion are encouraged and appreciated.

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 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 will be recorded and available for students to view in Panopto or Zoom (linked and/or embedded in Sakai) after class. 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.

Section BIOL 488 Students: Students enrolled in section 488 (graduate level credit) will be required to solve additional programming problems to receive full credit for the ROSALIND Python Assignments.

Course Schedule

Week	Date	Due at Noon	In-class Topics	Readings To Do This Week
1	M 8/30		Course Intro, Biology Review	Momand & McCurdy Ch. 1 https://pythonforbiologists.com/tutorial/introduction.html, https://pythonforbiologists.com/tutorial/text.html, https://pythonforbiologists.com/tutorial/lists.html
	W 9/1		Install Python, Strings, Lists	
	F 9/3		ROSALIND Intro, Example Problems	
2	M 9/6		***No class: Labor Day***	https://pythonforbiologists.com/tutorial/files.html, https://pythonforbiologists.com/tutorial/conditions.html
	W 9/8		Python Loops, Conditions, Files	
	F 9/10		ROSALIND Example Problems	
3	M 9/13		Python Dictionaries/Functions	https://pythonforbiologists.com/tutorial/dictionaries.html, https://pythonforbiologists.com/tutorial/functions.html
	W 9/15		Python Help Day	
	F 9/17	ROSALIND 1	Python Code Review	
4	M 9/20		**Quiz 1**	Momand & McCurdy Ch. 2
	W 9/22		NCBI/UniProt	
	F 9/24		NCBI Exercises, Biopython	
5	M 9/27		Python Help Day	Momand & McCurdy Ch. 3, Ch. 4.1-4.4, Ch. 4.11-4.13
	W 9/29	ROSALIND 2	Python Code Review	
	F 10/1		Molecular Evolution	
6	M 10/4	Homework 1	Algorithms Primer, Pairwise Alignment	Momand & McCurdy Ch. 5
	W 10/6		Pairwise Alignment Exercises	
	F 10/8		BLAST	
7	M 10/11		***No class: Mid-Semester Break***	Momand & McCurdy Ch. 6
	W 10/13		Multiple Sequence Alignment, BLAST Exercises	
	F 10/15	Homework 2	More BLAST Exercises	
8	M 10/18		**Quiz 2**	Momand & McCurdy Ch. 8
	W 10/20		Phylogenetics	
	F 10/22		Phylogenetic Tree Exercises	
9	M 10/25		Sequencing	Momand & McCurdy Ch. 9.1-9.8 Langmead et al. article (Sakai)
	W 10/27	Homework 3	Genome Mapping & Assembly	
	F 10/29		Genome Mapping & Assembly Exercises	
10	M 11/1		Genome Annotation	Heber & Howard article (Sakai)
	W 11/3		**Quiz 3**	
	F 11/5		Genome Rearrangements	
11	M 11/8		Primer Design	Momand & McCurdy Ch. 10
	W 11/10		Primer Design Exercises	
	F 11/12		Transcriptomics	
12	M 11/15		Interactomes	Hannenhalli article (Sakai) Przulj article (Sakai) Momand & McCurdy Ch. 9.9-9.13
	W 11/17		Omics Review	
	F 11/19	Homework 4	Human Population Genetics	
13	M 11/22		Pattern Identification	Chao article (Sakai)
	W 11/24		***No class: Thanksgiving Break***	
	F 11/26		***No class: Thanksgiving Break***	
14	M 11/29		LD/Pattern ID Review	Bush & Moore article (Sakai)
	W 12/1		**Quiz 4**	
	F 12/3		GWAS Workshop	
15	M 12/6		GWAS Help Day	Garrison & Bardill article (Sakai)
	W 12/8	Homework 5	"The Science of Family Ties: It's All Relatives"	
	F 12/10		Ethics of genetic ancestry testing	
	Thurs 12/16	Position Paper	**FINAL EXAM 1:00-2:15PM CST (cumulative)**	

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

Fall 2021