

BIOL 388/BIOL 488/COMP 381/COMP 488 Bioinformatics

- Days/Times: Mondays and Wednesdays 2:45 – 4:00
- Classroom: Crown Center 103
- Prerequisites: BIOL 282
- Instructor: Dr. Heather Wheeler hwheeler1@luc.edu
- Instructor Office Hours: Mondays 12:30 – 2:30 in LSB 324
- TA: Adelina Voukadinova avoukadinova@luc.edu
- TA Office Hours: Thursdays 4:00 – 6:00 in Doyle Center 303
- Python tutor: Kathleen Delany kdelany@luc.edu
- Python tutor Office Hours: Tuesdays 12:00 – 2:00 in Doyle Center 303

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 required textbook for this course is *Concepts in Bioinformatics and Genomics* by Drs. Jamil Momand and Alison McCurdy (ISBN: 9780199936991). This book 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 materials include course slides, papers from the scientific literature and online tools. Slides, additional readings, and links to online tools 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; we cannot meet with students that just “drop by”. 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 forums where you can post your questions or search for questions. When you encounter a problem, error message, etc., you can always try and **Google it!**

Students with Special Needs: Any student requesting accommodations related to a disability or other condition is required to register with Student Accessibility Center (SAC), located in Sullivan Center, Suite 117. Students will provide professors with an accommodation notification from SAC, preferably within the first two weeks of class. Students are encouraged to meet with their professor 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 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 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 HOMEWORK/TEST. 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 (i.e. Google Docs, Dropbox, OneDrive, SharePoint, sftp, etc.)
- email your assignment to another student to look at, and
- 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. You must enroll here: <http://rosalind.info/classes/enroll/de2221d75a/>
- **Homework Assignments: 50 pts** (10 pts each). Homework assignments will be exercises, many 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.
- **Exams: 30 pts** (10 pts each). Exams will cover the material included in the course materials (slides/textbook/etc.), in-class exercises, assignments, and any assigned supplemental reading. See schedule for material covered in each exam. The final exam is cumulative.
- **Position Paper: 8 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 (based upon provided readings) 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.
- **Program Assessment: 2 pts** This November, the Biology Department will be assessing what you have learned since you started your major. As an incentive to complete the assessment, you will earn 2 points for participating. You will have a one-week window to complete the assessment on your own time. It should take 30-60 minutes. The instructor does not see your performance on the assessment, just whether or not you have completed it.

We will regularly work on in-class exercises that will help prepare you for homework and exams. Individual assignments and in-class exercises may include opportunities to earn bonus points.

The minimum points (pts) needed for each grade are listed in the table below.

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: ALL HOMEWORKS ARE DUE VIA SAKAI BY **12:00PM (noon)** ON THE DUE DATE. ASSIGNMENTS AFTER THIS TIME WILL NOT BE ACCEPTED. MISSING TESTS 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 TEST WILL BE ADMINISTERED. DOCUMENTATION OF THE ABSENCE IS REQUIRED.

Section BIOL 488 or COMP 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. Also, section 488 students do not need to complete the Program Assessment. Instead, their Position Paper will be worth 10 pts.

Course Schedule

Date	Topics	Pre-class Readings	Due at noon
8/26	Introduction to Bioinformatics Biology Basics	Momand Ch. 1	
8/28	Introduction to Python Strings and Lists	https://pythonforbiologists.com/introduction/ , https://pythonforbiologists.com/printing-and-manipulating-text/	
9/2	<i>No class: Labor Day</i>		
9/4	Python Conditions and Loops	https://pythonforbiologists.com/lists-and-loops/ , https://pythonforbiologists.com/conditional-tests/	
9/9	Python Files and Dictionaries	https://pythonforbiologists.com/working-with-files/ , https://pythonforbiologists.com/dictionaries/	
9/11	Python Help Day	https://pythonforbiologists.com/writing-our-own-functions/	
9/16	NCBI ROSALIND 1 Check	Momand Ch. 2	ROSALIND 1
9/18	NCBI and UniProt	Momand Ch. 2	
9/23	Molecular Evolution	Momand Ch. 3, Ch. 4.1-4.4, Ch. 4.11-4.13	
9/25	Algorithms Primer Pairwise Alignment	Momand Ch. 5	
9/30	Biopython Pairwise Alignment Exercises		Homework 1
10/2	BLAST	Momand Ch. 6.1-6.2	
10/7	<i>No class: Mid-Semester Break</i>		
10/9	Multiple Sequence Alignment ROSALIND 2 Check	Momand Ch. 6.3	ROSALIND 2
10/14	Phylogenetics	Momand Ch. 8	Homework 2
10/16	Exam 1 (material 8/26-10/9)		
10/21	Sequencing	Momand Ch. 9.1-9.6	
10/23	Genome Assembly and Annotation	Momand Ch. 9.7-9.8 Reading from Sakai	
10/28	Genome Rearrangements	Reading from Sakai	Homework 3
10/30	Primer Design		
11/4	Transcriptomics	Momand Ch. 10	
11/6	Regulatory Motifs	Reading from Sakai	
11/11	Human Population Genetics	Momand Ch. 9.9-9.13	Homework 4
11/13	Linkage Disequilibrium Pattern Identification	Reading from Sakai	
11/18	Networks/Interactomes		
11/20	Exam 2 (material 10/14-11/13)		
11/25	GWAS Workshop 1	Reading from Sakai	
11/27	<i>No class: Thanksgiving Break</i>		
12/2	GWAS Workshop 2		
12/4	Ethics of Genetic Ancestry	Reading from Sakai	Homework 5
Friday 12/13	FINAL EXAM 4:15-5:30PM (cumulative)		Position Paper

This schedule is subject to change at discretion of the instructor. Changes will be published to Sakai.