

BIOL 388/BIOL 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: Jeff Ng jng2@luc.edu
- TA Office Hours: Tuesdays 1:00 - 3:00 in Doyle Center 303

Objectives:

- Gain a familiarity with current areas of research, data repositories and tools 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 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 with special needs or difficulties in learning and completing course assignments is strongly encouraged to contact the instructor as soon as possible. Please refer to the Student Handbook for student rights and available resources pertaining to assistance with special needs or disabilities.

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 Mac OS, 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, 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:

- **Homework: 50 pts** (10 pts each). Homework assignments will be exercises, many using software and web resources; these tools can include those discussed in class materials and challenges to find new tools.
- **Exams: 35 pts** (10 pts Exam 1, 10 pts Exam 2, 15 pts Final Exam). Exams will cover the material included in the course materials (slides/textbook/etc.), homework assignments, and any assigned supplemental reading. See syllabus for material covered in each exam. The final exam is cumulative.
- **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 (based upon provided readings) and a discussion (opinion) of the ethical issues surrounding the topic. Grades will not be based on the opinion taken; instead, grades will be based on your ability to summarize the ethical issues and convey your opinion.
- **Class Participation: 5 pts.** We will regularly work on in-class exercises that will help prepare you for homework and exams. Your attendance and participation will be documented. Excessive absences and/or lack of active participation when present could result in lost points.

Note: Individual assignments and in-class exercises may include opportunities to earn bonus points.

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

A ≥ 93 pts	B+ ≥ 87 pts	B- ≥ 80pts	C ≥ 73pts	D+ ≥ 67pts	D- ≥ 60pts
A- ≥ 90 pts	B ≥ 83 pts	C+ ≥ 77pts	C- ≥ 70pts	D ≥ 63pts	F < 60pts

Late/Missed Assignment Policy: ALL HOMEWORKS ARE DUE VIA SAKAI BY **2:45PM ON THE DUE DATE** (the start of class). 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 488 Students: Students enrolled in section 488 (graduate level credit) will have an additional component to their first homework assignment worth 5 additional points. They will turn in their Homework 1 assignment earlier than those in section 388 and subsequently assist in grading and identifying additional solutions and/or common errors made in the undergraduates' Homework 1. Thus, for graduate students, Homework 1 will be worth 15 pts and the Final Exam worth 10 pts.

Homework 1 is like a treasure hunt and requires you to thoroughly explore NCBI databases to familiarize yourself with the types of information available. **Yes, this means Homework 1 is time consuming and should be started ASAP!**

Course Schedule

Date	Topics	Pre-class Readings	Due via Sakai at 2:45PM
8/27	Introduction to Bioinformatics Biology Basics	Momand Ch. 1	
8/29	NCBI UniProt	Momand Ch. 2	
9/3	<i>No class: Labor Day</i>		
9/5	Molecular Evolution Substitution Matrices	Momand Ch. 3 (all), Ch. 4.1-4.4, Ch. 4.11-4.13	Homework 1 (Sec. 488)
9/10	Computational Primer Pairwise Sequence Alignment	Momand Ch. 5	Homework 1 (Sec. 388)
9/12	Pairwise Alignment Exercises		
9/17	BLAST	Momand Ch. 6.1-6.2	Homework 1 Grading (Sec. 488)
9/19	Multiple Sequence Alignment	Momand Ch. 6.3	
9/24	Phylogenetics	Momand Ch. 8	
9/26	Sequencing	Momand Ch. 9.1-9.6	Homework 2
10/1	Exam 1 (material 8/27-9/26)		
10/3	Introduction to Python Strings and Lists	https://pythonforbiologists.com/introduction/ , https://pythonforbiologists.com/printing-and-manipulating-text/	
10/8	<i>No class: Mid-Semester Break</i>		
10/10	Python Files and Loops Introduction to Biopython	https://pythonforbiologists.com/working-with-files/ , https://pythonforbiologists.com/lists-and-loops/	
10/15	Python Conditional Tests and Dictionaries	https://pythonforbiologists.com/conditional-tests/ , https://pythonforbiologists.com/dictionaries/	
10/17	Python Help Day	https://pythonforbiologists.com/writing-our-own-functions/	
10/22	Genome Assembly	Momand Ch. 9.7-9.8 Reading from Sakai	
10/24	Genome Annotation Python Check		Homework 3
10/29	Human Population Genetics	Momand Ch. 9.9-9.13	
10/31	Linkage Disequilibrium Pattern Identification	Reading from Sakai	
11/5	GWAS Workshop 1	Reading from Sakai	
11/7	GWAS Workshop 2		
11/12	Genome Rearrangements	Reading from Sakai	Homework 4
11/14	Primer Design		
11/19	Exam 2 (material 10/3-11/14)		
11/21	<i>No class: Thanksgiving Break</i>		
11/26	Transcriptomics	Momand Ch. 10	
11/28	Regulatory Motifs	Reading from Sakai	
12/3	Interactome		
12/5	Ethics of Genetic Ancestry	Reading from Sakai	Homework 5
Friday 12/14	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.