Syllabus

Spring 2022

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1. COURSE DESCRIPTION:

The methods, applications, and implications of genomics–the analysis of whole genomes. Microbial, plant and animal genomics are addressed, as well asmedical, ethical and legal implications. The lab provides exposure and experience on a range of bioinformatics approaches–the computer applications used in genome analysis. Much of this course content was written by Professor Matthew MacManes

2. CONTACT INFORMATION:

Instructor: Jeffrey Miller Email: jeffrey.miller@unh.edu Office: Rudman 312 Office hours: 11-12pm or by appointment

TA: Hannah Pare Office: Gregg Email: Hannah.Pare@unh.edu Office hours: Apptmt

3. ZOOM LINK:

Check the canvas zoom link

4. LECTURE:

MWF 10:10-11:00PM NESM 140

5. LAB:

Friday 3:10-5:00PM in HORT 207

6. COVID19:

Without a doubt, learning and teaching during global pandemic is going to come with significant challenges! What I want you all to know at the very beginning is that I amright there with you, trying to figure out what it means to live and regain some normalcy in these exceptionally strange times, while still being safe. I hope we can all figure this out ASAP.

In terms of classroom instruction, it is very likely that we operate using some hybrid model for the entire semester. If conditions permit to continue in-person instruction, I will be the strongest advocate for that! I would like nothing more than to be in-person with you all.

Full disclosure, I'm not an expert in online class delivery, so I do expect some challenges. These are likely to be small but annoying (like internet, video, audio issues). What I want from you, is your commitment to tell me what I can do better or different in real time. I promise to not be offended if you tell me something I'm doing is not working for you! We're all figuring this out together in very real sense, so open communication will be critical!

There are very likely to be changes to the class because of COVID, including some that are unanticipated. For instance, how will I administer exams. The university has invested in a remote proctoring system, but no one is quite sure how well this will work. What this means is that we will have to make decisions and changes as we go along. I run the class more like a democracy than dictatorship, so we will vote on issues whenever possible. Please be flexible with me, and I promise I will be flexible with you all.

7. WEB RESOURCES:

Canvas: I will use this for grades Website: https://jthmiller.github.io/GEN711_S21/ Google: All of the computational tools you'll learn this semester has been discussed by the world-wide bioinformatics community. A huge part of applied bioinformatics is a matter of learning how to ask the question in way that someone else has. stackoverflow.com is where it's at! SummerWorkshops: https://angus.readthedocs.io/en/2019/

8. ASSIGNMENTS AND EXAMS:

Lab Assignments: These are assigned in lab, and typically involve some sort of sequence analysis, short answer questions, and the notes that you took during lab. You may work in groups, but you must submit your own report. These will be due in lab, unless otherwise instructed. NO late assignments accepted. 9 labs, lowest dropped. 80/200 lab and discussion points

Lab Practicals: One lab practical exam (50 pts, 50/150 of the lab points).

Paper Discussion Participation Points: We will discuss genomics and bioinformatics papers over the semester. Groups will be tasked with summarizing the paper to get discussion rolling. Participation in this discussion will earn 20 points (20/100)

On presentation day: Each group will lead class through discussion of the chosen paper. Groups should email me their slides no later than 9am of their presentation day. At least 1 slide by the grad student in each group to introduce the topic, their research and larger questions addressed by the paper. The intro should addess questions such as "What is the goal of the study and why is the study important enough to be published?" Students should present 1-2 Methods slides (Use methods figure from paper or from web and cite it!) to answer: 'What is the experimental design?', 'Was something sequenced and how?'. 1 Results slide (at least) should be presented per figure (Interpret each), and answer: 'What was measured and/or tested?' and 'What observation/conclusion does the figure support?' For discussion, one slide (more as needed so that everyone has at least one slide) should address 'What did they do well? What could have been done differently? What is next?' Each group needs to answer questions to clarify answers to the questions above.

Exams: There will be 2 exams covering both lecture and lab material. Each will be worth 100 points. The dates for these will be March 4 and April 22. Makeup exams will be permitted only under extreme documented circumstances, or by prior approval (>1week) from the instructor.

Final Project: The final project will consist of an oral presentation and written report of a topic related to genomics and bioinformatics. Projects must incorporate an implementation of the computational techniques we've learned about. The final project will be worth 200 points (150 written/50 oral). Oral presentations will occur during the last week of class. Written reports will be due on the last day of class. You may work in groups (<6 members - mix of grad and undergrad), with the understanding that expectations increase with group size, given division of labor. More details will be provided later in the semester.

9. MATERIALS NEEDED:

Non-Required but potentially useful Textbook: PRACTICAL COMPUTING FOR BIOLOGISTS 1st edition by Haddock and Dunn. It is available on Amazon new, used and for rent. I think that there is a Kindle version if that is your thing! It should also be available in the campus bookstore, but you may pay more there!

RON Account: We will set up computing accounts on the teaching cluster for each student

Laptop: Please no one purchase a laptop for this course!!! But please bring it to all course meetings if you do. A Mac or Linux machine will make your life much easier. Windows machines will work with some additional effort.

10. GRADES:

The grade scale is: 94-100=A; 90-94=A-; 87-90=B+; 84-87=B; 80-84=B-; 77-80=C+; 74-77=C; 70-74=C-; 67-70=D+; 64-67=D; 60-64=D-; Below 60=F

Item	Maximum Points
Exams (2 x 100)	200
Discussion Participation	50
Lab Practical	50
Lab Notebook	50
Final Project + Presentation	50
Total Points	**400**

11. COURSE POLICIES:

Student conduct: Honesty is a core value at the University of New Hampshire. The members of this academic community require and expect one another to conduct themselves with integrity. The Student Rights, Rules and Responsibilities handbook (www.unh.edu/student/rights) explains UNH's expectation for academic honesty and defines those actions that constitute academic misconduct with regard to exams, homework, plagiarism, computers, etc. The penalty for the first incident of cheating, plagiarism or other breaches of the university's academic honesty policies will be an automatic F grade for that assignment. A second infraction will result in an F grade for the class. The Dean's office will be notified and dismissal from the university could result.

Disability Services for Students: The University of New Hampshire is committed to providing students with documented disabilities equal access to all university programs and facilities. If you have a disability requiring accommodation, you must register with Disability Services for Students (DSS). Contact DSS at 862-2607. If you have received an Accommodation Letter for this course from DSS, please meet with me privately to review those accommodations.

12. CODE OF CONDUCT:

Need Help? You can reach the course instructor, Jeffrey Miller at Jeffrey.Miller@unh.edu. Conversations are held in confidence, to the extent that it is allowed by UNH policy (https://www.unh.edu/sharpp/reporting-requirements) and state and federal law.

The Code: Our class is dedicated to providing a harassment-free classroom experience for everyone, regardless of gender, age, sexual orientation, disability, physical appearance, race, or religion (or lack thereof). I do not tolerate harassment of class participants in any form. Sexual language and imagery is not appropriate for any class venue. Class participants violating these rules will be reported to the COLSA Dean's office.

Harassment includes offensive verbal comments related to gender, age, sexual orientation, disability, physical appearance, race, religion, sexual images in public spaces, deliberate intimidation, stalking, following, harassing photography or recording, sustained disruption of talks or other events, inappropriate physical contact, and unwelcome sexual attention. Class participants asked to stop any harassing behavior are expected to comply immediately. If a participant engages in harassing behavior, the instructor may take any action they deem appropriate, including warning the offender, or reporting to the Dean's office. If you are being harassed, notice that someone else is being harassed, or have any other concerns, please contact me or the TA immediately.

We will be happy to help participants contact local law enforcement, provide escorts, or otherwise assist those experiencing harassment to feel safe for the duration of the class. This code of conductwas adapted from http://angus.readthedocs.io/en/2019/code-of-conduct.html

13. HOW TO GET AN A:

Receiving an A in this should be really easy (I mean it!), assuming you follow these basic guidelines. - Come to class and lab, pay attention, be interactive: Active learning far outcompetes passive, so while coming to class itself is good, interacting/asking questions will be much better. - Ask questions when your confused. Come to office hours, or schedule a time to meet. - Don't cram! Study a little, several times per week. You will remember more, and the exams will be less stressful.

14. COURSE SCHEDULE - SUBJECT TO CHANGE:

Week	Topic	Lab
Jan 27	Intro to Bioinformatics & Next Gen Seq	Take home lab
Jan 30	Sequence Data & Technology, QAQC	Introduction to Bioinformatics
Feb 6	DNA & RNA Seq, Metadata and Genome Alignment	Introduction to the Command Line for Genomics 1
Feb 13	Advanced Search and alignment (BLAT/HMM/others)	Introduction to the Command Line for Genomics 2
Feb 20	Molecular Evolution	Data Wrangling and Processing for Genomics 1
Feb 27	Genome Assembly and Annotation	Data Wrangling and Processing for Genomics 2
Mar 6	Exam Review	Take Home Lab
Mar 8	***EXAM 1***	
Mar 13	BREAK	No Lab
Mar 20	Community Genomics	Data Wrangling and Processing for Genomics 2
Mar 27	Stats and Genomics	Practical Review
Apr 3	Functional Genomics	Practical Exam Given in Lab
Apr 10	RNA and Transcriptomics	Microbiome analysis 1
Apr 17	MDS and Linear Models	Microbiome analysis 1
April 24	Human Genomics	Project work session
April 26	Exam Review	
April 28	***EXAM 2***	
May 2	Human Genomics	Project work session
May 9	Project Presentations	No Lab