Bio 200A Topics in Biology: Introduction to Bioinformatics **FALL 2018**

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Office: SSC 204
Office Hours: Mondays and Thursdays 1:00 – 3:00 PM or by appointment.

Course Info: Course Website**:** https://rsh249.github.io/bioinformatics/
Course Slack: https://bio200-bioinformatics.slack.com

Lecture Schedule: BIO 200 A, MW 4:00-5:15PM, SSC142

Required Lecture Material:

- **Course textbook:**
  Required: Buffalo, V., 2015. *Bioinformatics data skills: Reproducible and robust research with open source tools*. " O'Reilly Media, Inc.". (ISBN: 978-1449367374) **Available new and used on Amazon**
  Recommended: Lesk, A., 2014. *Introduction to bioinformatics*. Oxford University Press. (ISBN: 9780199651566)
- **Laptop.** Access to a computer, preferably running a Mac or Unix/Linux operating system. Common bioinformatics software installation (including the R and Python programming languages) will be covered in class.

BIO 200 Course Description:
This course introduces common concepts and tools in the field of Bioinformatics with a focus on developing a basic skill set for working with large biological data sets. The digital age has resulted in a period of rapid growth of data, and in biology this is revolutionizing how we look at the world. Understanding how the field uses computational tools to manage and study these massive datasets is a crucial skill set for the modern Biology student. This course will cover the major sources of data in biology and an overview of the myriad of computational tools available.

Course Goals & Objectives:
After having completed Introduction to Bioinformatics you will be able to:

- Discuss Biology as a subdiscipline in “Data Science”
- Understand the major sources of ‘big-data’ in Biology and the scale and nature of the data being produced.
- Perform fundamental operations (data input/output, statistics, data visualization) in both R and Python programming environments.
- Use common bioinformatics tools using the Unix command line, R, and Python.
- Run bioinformatics programs from the Unix command line to perform analysis of DNA sequence data.
- Understand the importance of reproducibility and open access for data and computer code in bioinformatics.

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BIO 101 Tentative Lecture Schedule

Date	Day	Lecture	Topic	Reading	Assignments/Links
8/28	T	1	Introductions		
9/3	M		*Labor Day – No Class*		
9/5	W	2	L: Biology as a "Data Science" – The scale of Biology's data problem	BDS: Preface, 1-17	
9/10	M	3	L: Data Collection Day		
9/12	W	4	P: Intro to R	BDS pgs. 175-198	
9/17	M	5	L: Intro to Computing		
9/19	W	6	P: Data Wrangling and Vis. in R	BDS pgs. 199-260	
9/24	M	7	L: Modern DNA sequencing		
9/26	W	8	P: Introduction to the Unix command line and common DNA sequence file formats	BDS pgs. 125-173, 339-352	
10/1	M	9	L: Alignment and DNA string comparison		
10/3	W	10	P: Pairwise Alignment – BLAST to bwa	BDS pgs. 355-378	
10/8	M	11	*Columbus Day – No Class*		
10/10	W		L/P: Multiple Sequence Alignment – *mafft, Muscle*		
10/15	M	12	L: Phylogenetics		
10/17	W	13	P: Evolutionary tree building – *phylotaR, RAxML, TNT*	Baum, et al. 2005	https://goo.gl/vMkjWF
10/22	M	14	----------		**EXAM 1**
10/24	W	15	L: The importance of open-science	BDS pgs. 68-69	bioRxiv Lit search
10/29	M	16	L: Microbiomes/Metagenomics		Project Proposals DUE (Tue. 11PM)
10/31	W	17	P: Taxonomic classification of mixed DNA sequence – *Kraken/Centrifuge*	Ashinnekoo, et al. 2015	https://goo.gl/P15k1d
11/5	M	18	L: Molecular Medicine		
11/7	W	19	P: Cancer Sequencing	TBA	
11/12	M	20	L: Geospatial Bioinformatics		
11/14	W	21	P: Biodiversity and Ecological Niche Modeling	Phillips, et al. 2017	https://goo.gl/7HBDG6
11/19	M	22	L/P: Ecological Forecasting		
11/21	W	23	*Thanksgiving break – No Class*		
11/26	M	24	Python 1 – Libraries, loops, and functions		
11/28	W	25	Python 2 – Biopython		
12/3	M	26	Peer project consultation day		
12/5	W	27	Term Project Presentation Day		
12/10	M	28	Catch-up or Exam Review		
12/19	W		**FINAL EXAM**		Comprehensive Exam

*These topics will be presented as pre-recorded lectures available on eLearn Blackboard

EXAMS:
One mid-term and one final exam will be given in this class. The date and location for the cumulative final exam will be posted on Stonehill's website and announced in class.

Absences from an Exam:
An excused absence from an exam will only be granted under exceptional (i.e. extreme illness or a death in your immediate family) **and** documented (i.e. doctor's note) circumstances. Unlike scheduled exams, make-up exams will consist of essays only. Make-ups for the final exam require the signature of the Dean and are arranged through the Dean's office.

Final Exam:
The final exam for this course will be held on Wednesday December 19, 2018 and 4:00PM in Shields Science Center room 142 (our normal meeting space) and will run for approximately 3 hours. The final exam is cumulative and will involve both written and applied components.

Assignments:
Homeworks: Will be assigned on a weekly basis. These will typically be readings and reflection writing but will also include out-of-class data analysis.

Practical Session Reports: Approximately every other class period in this course will consist of hands-on, practical learning. In these sessions we will be learning a new bit of bioinformatics software and applying it to some practice data. After each of these sessions you will be required to submit a "lab-report" like write-up of what went on during the practical session and what we found.

Term paper/project/presentation: After the mid-term exam we will begin working on the term project for this course. Each student will identify an area of bioinformatics not covered in this course and do an exploratory project to investigate the kinds of analyses being done, the input data required, and the kinds of insites that can be derived from their chosen tool or method. Ideally it will be possible to develop a brief teaching module where the chosen tool or method is demonstrated for the class. Unlike a typical term paper, this assignment will consist of a brief project report (1-2 pages single spaced) and a short (10 minute) presentation to be given in front of the class at the end of the term. We will also devote a class period to peer review your developing projects.

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Late work will be accepted with a penalty of 10% per day late. No assignment will be accepted more than 5 days after the assigned due-date (5 days late == 50% credit). There are no make-ups for Homework or Practical Reports. Instead, at the end of the semester your lowest grade in both of those categories will be dropped.

Attendance, Punctuality and Courtesy:
Students are expected to attend all lecture and laboratory sessions and are responsible for all information covered during this time. Lecture slides will be available on Blackboard, but students will be responsible for obtaining class notes from a friend. Late arrivals can be disruptive to the class and are a waste of your tuition dollars.

Academic Expectations:
BIO 200 is worth 3 credits, this means that **students need to schedule 3 hours of lecture time and a minimum of 6 hours of work/study time for BIO 200 each week**. This expectation is in agreement with the guidelines established by the Federal Government when they defined a college course credit. The official definition is shown below and was taken from the New England Association of Schools & Colleges, Inc. Commission on Institutions of Higher Education – 5th Year Interim Report Manual.

The Federal Government definition of **one course credit** is:

"… an amount of work represented in intended learning outcomes and verified evidence of student achievement that is an institutional established equivalence that reasonably approximates not less than-

(1) One hour of classroom or direct faculty instruction and a minimum of two hours of class student work each week for approximately fifteen weeks for one semester or trimester hour of credit, or ten to twelve weeks for one quarter hour of credit, or the equivalent amount of work over a different amount of time.

OR

(2) At least an equivalent amount of work as required in paragraph (1) of this definition for other academic activities as established by the institution including laboratory work, internships, practica, studio work, and other academic work leading to the award of credit hours."

Course Grade:

Your grade for BIO 200 will be calculated as follows:

Homework	10%
Practical Session reports	20%
In-Class participation	10%
Midterm Exam	15%
Cumulative Final:	25%
Term Paper and Presentation:	20%
Total	100%

Grading Scale:

A	93.5 and above	A-	89.5 to 93.4		
B+	86.5 to 89.4	B	82.5 to 86.4	B-	79.5 to 82.4
C+	76.5 to 79.5	C	72.5 to 76.4	C-	69.5 to 72.4
D+	66.5 to 69.4	D	59.5 to 66.4	F	Below 59.5

Grade	Definition	Quality Points per Credit Hour
A	**Excellent**, work that is of the highest standard, showing distinction	4.00
A-		3.70
B+	**Good**, work that is of high quality	3.30
B		3.00
B-	**Satisfactory**, work that fulfills requirements in quality and quantity and meets acceptable standard for graduation	2.70
C+		2.30
C		2.00
C-	**Passing**, work that falls below graduation standard, yet is deserving of credit.	1.70
D+		1.30
D		1.00
F	**Failure**, work undeserving of credit	0.00

All grades will be posted in the course sections of Blackboard where you can also view your running course total. It is your responsibility to check the grades I have posted to make sure they match the assignments I have returned to you.

Academic Honesty:
As a member of my class and the Stonehill community, it is expected that you adhere to the College's Academic Honor Code and Academic Integrity Policy. The College's official Academic policy can be found in the Hill Book. It states that "academic dishonesty includes but is not limited to giving or receiving, or attempting to give or receive, unauthorized assistance or information in an assignment or examination."

Any written work must be your own work (in this course "written work" INCLUDES computer code). Therefore, ideas and concepts should be in your own words and should not have similar sentence structure or wording to published work or another student's work. If you use a source to write a paper or lab report, you must cite this source. Simply altering a sentence from a source does not make it your own work so be sure to cite. If you fail to cite the source, this is plagiarism. **Copying or sharing a computer file *at any stage of writing* will *absolutely not be tolerated*.** Such cases will be reported to the Dean of Academic Administration and failure of the entire course will ensue. Any electronic information or file that can be shared will be posted in the eLearn website by the lecture or lab instructor.

Violation of the academic policy can result, at my discretion, in either of the following penalties: (1) loss of credit in the exercise, or (2) failure in the course.

Resources for Academic Support

The Center for Writing and Academic Achievement (CWAA) provides academic support services in a welcoming, professional environment that emphasizes collaborative learning and peer tutoring, supplemented with professional-level support. The CWAA offers a variety of academic support services, including peer tutoring in writing, math, and foreign languages.

The CWAA is located in MacPháidín Library, Room 314. Drop-in hours are offered Sunday – Thursday. Students can visit the CWAA website to view schedules, make appointments, or request a tutor.

Cell Phone and Electronic Device Policy

It is understood that cell phone use is ubiquitous today. Minimal, non-disruptive, discrete use of quiet cell phone use will be tolerated during lectures and practical activities. **Please keep cell phone use to a minimum, at no time should this detract from your class participation.** Absolutely no use of the cell phone or other device is permitted from the time an exam is handed out until it has been turned in to be graded. Failure to follow this policy will result in immediate termination of your exam and a grade of 0 regardless of other work completed.

I**nclusive Classroom Statement**

Stonehill College embraces the diversity of students, faculty, and staff, honors the inherent dignity of each individual, and welcomes their unique cultural and religious experiences, beliefs, and perspectives. We all benefit from a diverse living and learning environment, and the sharing of differences in ideas, experiences, and beliefs help us shape our own perspectives. Course content and campus discussions will heighten your awareness to these differences.

There are many resources for anyone seeking support or with questions about diversity and inclusion at Stonehill. Resources are infused throughout the Mission Division, Academic Affairs, and Student Affairs. If you'd like more information on how to get connected to resources, the Office of Intercultural Affairs is a good first stop: Location: Duffy 149, Phone: 508-565-1409, Email: diversity@stonehill.edu.

If you are a witness to or experience an act of bias at Stonehill, you may submit a bias incident report online or on the Stonehill App. If you would like to learn more on bias incident prevention and response, or submit a report please visit: http://www.stonehill.edu/offices-services/intercultural-affairs/bias-response-protocol/

Students with Disabilities

Stonehill College is committed to providing a welcoming, supportive and inclusive environment for students with disabilities. The Office of Accessibility Resources (OAR) provides a point of coordination, resources and support for students with disabilities and the campus community. If you anticipate or experience physical or academic barriers based on disability, please let me know so that we can discuss options. You are also welcome to contact OAR to begin this conversation or to establish reasonable accommodations for this or other courses. OAR is located within the Academic Services & Advising Suite in Duffy 104. For additional information please call (508) 565-1306 or email accessibility-resources@stonehill.edu.