SYLLABUS
Computational Biology Bootcamp (ME:800.000)
Fall 2020

Contact Information	**Course Director** : Dr. Winston Timp (wtimp@jhu.edu; Ph: 410-417-8467; Clark 102A) **Course Coordinator:** Sarah Anderson (sande125@jhu.edu; Ph: 410-516-6040; Wyman S224) **Teaching Assistant(s):** Roham Razaghi (rrazagh1@jhu.edu), Ariel Gershman (agershm2@jhmi.edu), McKinzie Garrison (kzgarrison@jhmi.edu), Ray Cheng (ycheng45@jhmi.edu) , Rachael Workman (rworkma2@jhmi.edu)

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Time and Location	**Start Date:** 8/31/2020 **End Date:** 9/4/2020 Classes are held on <u>M-F, 9:00 am - 4:00 PM</u>, via Zoom:
Registration Policies	All participants must be registered, whether taking this course for Credit or Audit. Last day to change status from Credit to Audit: 8/31/20 Last day to withdraw: 8/31/20 If a student withdraws by this date the course will not appear on their transcript. Late withdrawal will be listed on the transcript with the mark of "W." Please inform the Registrar's Office and the Course Administrator if you choose to withdraw or change your status. Students in programs for which this course is a requirement must obtain permission from the program director before withdrawing from the course.

Inclement Weather	If the University closes due to inclement weather, we will reschedule in-person sessions or share a recorded lecture from last year. You will be contacted by the course director or administrator via Blackboard or via email.
Course Description	This intensive one week class is meant to immerse students in computation, and to provide them with the foundational tools to be able to apply modern computational techniques and appropriate statistics to their data. Students learn how to work in a command line shell and different "notebook" style computing environments including Jupyter and Rmarkdown. Throughout the course, students apply these skills to different practical analysis problems for exploratory data analysis, visualization, and interpretation. The presented problems run the gamut from biophysics to cellular and systems biology to genomics.
Prerequisites	None
Target Audience	First year graduate students
Course Objectives	Students successfully completing this course will be able to do the following: ● Understand command-line interactions and utilities for navigating computer systems and manipulating files. ● Identify computational tools, techniques, and resources available for biological data analysis ● Determine genomic methodology and/or public data repository best suited to address biological question of interest ● Apply standard bioinformatic tools to import, clean, filter, normalize and visualize data ● Design and implement computational analysis workflows using standard tools to analyze modern biological datasets, including fits to data with ODEs. ● Analyze data in a way which maximizes reproducibility, using version control and Jupyter notebook documentation ● Predict protein structure and interactions using PyMol.
Course Materials	**Recommended Readings** Automate the Boring Stuff with Python 2nd edition (available here for free) Python Data Science Handbook (available here for free) Articles are available online through the Welch Medical Library. Textbooks are reserved at the Welch Medical Library for your convenience, and are also available at the Matthews Johns Hopkins Bookstore.
Course Format	**Class sessions:** The course will be a five day intensive bootcamp geared towards getting everyone up to speed with basic computational skills. Students will attend from 9am to 4pm for five days. Lessons will be taught to the group and students are required to actively follow along in their jupyter notebook and turn in their work at the end of each class session. The jupyter notebook will determine their course grade.

	Modules: There will be 10 core modules for the course, two modules will be covered each day. Students are expected to engage in active learning where they actively solve problems and perform data analysis during the course sessions. Their understanding of the modules and effort during the class will be evaluated based on the notebook they turn in.
Blackboard	You must register for this course to have access to course materials through Blackboard. Blackboard can be accessed at http://blackboard.jhu.edu or through my.jhu.edu (icon located under "Education" on the left). After logging in with your JHED ID you can find the course name under "My Courses Plus" on the right. We also make regular use of github, a course slack group, and Blackboard for delivering code, lecture notes, and course materials. Some of the materials will include: Starting condition/jupyter notebooks to work through examples Framing problems Discussion papers/links to sources of further information. **If you have registered for this course but cannot access Blackboard please inform the Course Administrator.**
Assessment Information	Grades for all assignments, as well as final grades will be posted on Blackboard as soon as they become available. The course administrator will announce specific times for in-person review of your graded papers. **Student grades are determined from in class assignments. Students will turn in a jupyter notebook at the end of each session (2 modules for 5 sessions = 10 assignments).** **Policy on Assignments:** The policy related to "working together" on in class exercises is outlined below: Please pay very careful attention to this policy Students should work independently to work through exercises on their own. Group discussions are encouraged but should NEVER involve the sharing or copying of code/analysis. Each student is expected to turn in their own notebook for each module. Students who violate these rules will be brought to the attention of their graduate program director and may lose points on the assignment, fail the course, or be dismissed from their graduate program, depending on the severity of the infraction.
Assessment Summary	**Final Grade Calculation**: Final grade is determined from in class participation which will be evaluated from the notebook students turn in for each module. Specifically:

jupyter notebook (module 1-10)	10 points ea.

	Course Evaluation	10 points
	Total	110 points

Grades for all assignments and exams, as well as final grades will be posted on Blackboard as soon as they become available.

You will be assigned a letter grade.

Course Evaluation	We encourage you to submit your course evaluation through blackboard. The evaluation will be made available toward the end of the course.
Additional Information	**Tips for doing well in the course** 1. Participate in active learning during class. Computational biology is best if learned by doing. Try your best to work through the exercise on your own. If you have trouble, consult your classmates and work together before asking for help from TAs/instructor. 2. Read papers! There is a lot of amazing work out there in genomics, protein dynamics, image quantification/analysis. Think about applying what you've learned here to your own research. 3. Comment your code and utilize the github. Future you will thank yourself.
Communication	You may communicate with the instructor(s) and TAs by email or over slack. The instructor will respond within 48 hours. Assessment feedback will be provided within five days of each due date. All official communication, notices, and announcements will be distributed through student JHU-SOM e-mail accounts either directly or via Blackboard. You are accountable for checking this account regularly and for all course communication sent to it.
Policies	Students are expected to abide by the Graduate Student Honor Code, the School of Medicine Academic Integrity Policy, as well as the policies of their individual graduate programs. The health and wellness of students are of utmost importance to us here at Johns Hopkins. If you are struggling with anxiety, stress, depression, or other well being-related concerns, please consider contacting the Johns Hopkins Student Assistance Program (JHSAP). If you are concerned about a friend, please encourage that person to seek out counseling. JHSAP can be reached at 443-287-7000 or jhsap.org. Additional resources are available at Getting Help . If you have a disability or any health issue and may require accommodations in this course, please contact the Disabilities Services Coordinator for graduate students in the School of Medicine (Kristina Nance, GradDisabilityOffice@jhmi.edu , 410-614-3385) to discuss your specific needs.

Course Schedule

8/31/2020 to 9/04/2020

9:00am - 4:00pm over Zoom

#	DATE	TOPICS	INSTRUCTOR
1	Monday, 8/31	- Intro - Unix and working with computing clusters/cloud/etc (scp, etc...) - Version Control/Reproducibility [GitHub + Jupyter Notebooks] - Introduction to Python - Introduction to Biopython	Goff
2	Tuesday, 9/01	- Data Import / Tidy Data - Basic Visualization - Basic Statistics / Data Analysis	Timp
3	Wednesday, 9/02	- Intro to Genomics (basics of alignment) - Start with RNA-seq - ChIP-seq (lunch) - Applied Genomics 1 (Browser) : NCBI, Phylogenetics, UCSC Browser	Wheelan
4	Thursday, 9/03	- Genomics 1 (Browser) : NCBI, Phylogenetics, UCSC Browser - Genomics 2 (Galaxy) - RNA-seq, ChIP-seq, ATAC-seq	Cahan
5	Friday, 9/04	- Biophysics / Biopython - Curve fitting / ODE - Image Processing	Timp