Topics in Bioinformatics (Spring 2019) | BISC 503 (Section 1)
Tue/Thu 1:00 – 2:15 PM | 516 Shoemaker Hall

Instructor: Erik Hom: 401 Shoemaker Hall; 662-915-1731 (erik@olemiss.edu)
Office hours: By appointment (use email to set-up)

Pre-requisites:
For BISC 503: BISC 160, 161, 162, 163, or graduate standing
For ENGR 596-65: instructor approval

Required Text:
- ***Bioinformatics And Functional Genomics 3rd Edition*** **by Jonathan Pevsner** (https://www.amazon.com/gp/product/8126567686) [e-book or print is fine]
  Available from UM library as e-book:
  https://ebookcentral.proquest.com/lib/olemiss/detail.action?docID=4036479

Overview: This course will survey computational and technological approaches used to analyze and interpret genomic and transcriptomic data. This course is aimed at students who have little or no experience in bioinformatics but who have an interest and/or are serious about learning about the bioinformatics, particularly students in the beginning stages of using bioinformatics in their research who need to develop their skills and establish a foundation for future development. While no previous knowledge of programming/coding or lab experience is required for this course, students will be expected to be courageous, pro-active, and disciplined in learning, being resourceful, and practicing computer skills or understanding lab techniques/methods as needed.

This course is intended to be an introduction to a highly interdisciplinary subject and will address both the fundamentals of molecular biology/genetics (theory and practice) and computer-based/informatics skills needed to analyze modern sequence-based bioinformatics data. We will rely on resources associated with the required text, but students will be expected to exhibit the drive to learn and research what they need in order to accomplish tasks, push an analysis forward, and "learning-by-doing" (this course seeks to guide but not hand-hold).

Assessments will be made via participation in class discussions, course exercises, problem sets, and progress on course projects. Course projects will require practical hands on manipulation and analysis of genomics data (either instructor provided, or associated with a student research project), along with an oral presentation of the work at the conclusion of the course. Exposure to laboratory techniques relevant to bioinformatics data generation will be attempted through out the course at specific times.

Students should expect to spend several hours per week outside of our limited class period time (only 2.5 hrs per week) working on project/course-related assignments as would be expected for a research-based course. As this is an upper division/graduate level course, class periods will essentially be times to "check-in" and clarify questions on content or pertaining to course assignments, not primarily a time for encountering or learning material for the first time (this should be done outside of class), although new content will be addressed during class time. Undergraduates will be expected to participate in all facets of team project and course work, but will not be assessed on the final project written report.

Course Objectives: By the end of this course, students should:

- Have a conceptual overview of key, defining subject matter in the fields of bioinformatics and modern genomics
- Understand how (and under what circumstances) to use select bioinformatics tools to tackle contemporary large data set-driven problems in biology
- Understand how to think more like a bioinformatician and pose/identify research-relevant biological problems amenable to computational analysis
- Be able to work within a UNIX environment to use and string together various bioinformatics tools to derive biological insights
- Have experience processing/analyzing genomic sequence data associated with an active research project, to move the project forward significantly
- Gain a better sense for how genomic data is generated in the laboratory/field

Mini Course Projects: Throughout the first half of the course, there will be several mini-course projects that teams of students will work on for 2-3 weeks. This will include one focused on developing a analysis "pipeline" for identifying and analyzing genome-wide mutations in yeast generated through evolution experiments as part of the BISC 336 Genetics course.

Final Course Projects: Working in groups of 2-3, you will be required to complete a final project, present your findings in class summarizing your work. This project should address a research-relevant problem/question that intersects with topics covered in this course and may follow-up a mini-project with instructor approval. Research-active students are encouraged to choose a problem that might relate to their research. Students may also choose to work on research-related problems of interest posed by the instructor. You are **strongly encouraged** to start thinking about and working on course projects as soon as possible (certainly by 3/15) to ensure successful completion. Doing so will help guide your learning experience and provide a target suite of personalized learning objectives as you progress through the course. The hope is that students can make significantly progress on a research-relevant bioinformatics component of a project.

Grading Rubric:

Graduate Students

- Attendance, discussion, and general participation: 35%
- Problem Sets & Mini Course Projects: 25%
- Final Team Project Presentation: 25% (will include peer-evaluation)
- Final Team Project Written Report: 15%

Undergraduates

- Attendance, discussion, and general participation: 40%
- Problem Sets & Mini Course Projects: 35%
- Final Project Presentation: 25% (will include peer-evaluation)

Course Schedule*

Class will be held at 1:00-2:15 pm on Tue/Thu in Shoemaker 516 (unless otherwise announced). Readings are from Jonathan Pevner's "Bioinformatics and Functional Genomics 3rd Edition" textbook.

#	Date	Topic	Reading
1	1/21,T	Course Overview | What is Bioinformatics | Biological Information | Computer accounts | UNIX	Ch. 1
2	1/23,H	Guest Lecture: Ben Pharr (MS Center for Supercomputing Resources) | PBS Scripts and Cluster Computing at UM	—
3	1/28,T	*[Problem Set #1 (UNIX Tutorial) Due]* Biological Databases & Resources	Ch. 2 pp. 19-66
4	1/30,H	Functional Genomics 1	Ch. 14 pp. 635-670; 682-686
5	2/4,T	Functional Genomics 2	Ch. 14 pp. 635-670; 682-686
6	2/6,H	Eukaryotic DNA & Genes	Ch. 8 pp. 307-314; 323-335; 351-354
7	2/11,T	*[Problem Set #2 Due]* Next-Generation Sequencing 1	Ch. 9 pp. 377-384; 387(top)-425
8	2/13,H	Next-Generation Sequencing 2	Ch. 9 (pp. 377-384; 387(top)-425)
9	2/18,T	Genomes Across the Tree of Life	Ch. 15 pp. 699-727; Table 15.8
10	2/20,H	*[Problem Set #3 Due]* RNA 1 | Description of mini-course projects	Ch. 10 pp. 460-472
11	2/25,T	RNA 2 (RNA-seq) | Description of mini-course projects (cont'd)	Ch. 11 pp. 479-481; Figs. 11.21 & 11.22; TBD
12	2/28,H	Work on mini-course projects & Discussion	—
13	3/4,T	Work on mini-course projects	—
14	3/6,H	*Mini-course projects Due* & Discussion	—
—	3/9-3/14	SPRING BREAK – No Classes	—
15	3/17,T	Work on mini-course projects & Discussion	—
16	3/19,H	Work on mini-course projects	—
17	3/24,T	Work on mini-course projects & Discussion	—
18	3/26,H	*Mini-course projects Due* & Discussion	—
19	3/31,T	Final Project Work & Check-In	—
20	4/2,H	Final Project Work & Check-In	—
21	4/7,T	Final Project Work & Check-In	—
22	4/9,H	Final Project Work & Check-In	—
23	4/14,T	Final Project Work & Check-In	—
24	4/16,H	Final Project Work & Check-In	—
25	4/21,T	Final Project Work & Check-In	—
26	4/23,H	Final Project Work & Check-In	—
27	4/28, T	Final Project Presentations 1	—
28	4/30, H	Final Project Presentations 2	—

** This schedule is subject to revision. Changes will be announced in class and posted on Blackboard.*