11:126:484 & 16:137:617- Tools for Bioinformatic Analysis
Wednesdays 12:10-3:20pm

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Location: Foran Hall Rm. 124. In case of pandemic or weather- related emergencies Zoom classes will be announced ahead of time. This will be a synchronous class meaning this class will meet in real time.

Class Structure: This class consists of three components each week (except when noted on tentative schedule).

1. Lecture: Background review of concepts, tools and techniques covered in the dry lab exercises.

2. Demonstrations: Every week we learn a new tool or database. Your TA will demonstrate how to navigate this tool and database.

3. Dry Laboratory Exercises: Demonstrations will be followed by dry laboratory exercises that student will start as in class assignments. You may work in small groups. You are expected to stay and try to finish all the lab activities during the class and upload on CANVAS before leaving.

In case the lab is not finished it can be taken home as take-home assignment and must be uploaded by the due date. Late submissions will be penalized; and no submission will be accepted beyond two weeks delay.

Course Policies:

Attendance: Attendance is crucial component of this course as it is hands on lab based course and is therefore MANDATORY.

Absence must be notified ahead of time when possible or as soon as possible. All absences must accompany a valid reason and documentation e.g. doctor's note, conference letter, interview invitation letter etc. In the event of absence it is student's responsibility to learn the tool taught and submit the assignment by the deadline.

There will be NO MAKE UP exams without documentation should you be absent on day of exam.

If you have unexcused, un-notified absence, your work for that week will not be accepted. In addition, more than one unexcused absence will be penalized by deduction of 5 points from your overall grade for each absence.

Tardiness: Students should arrive in the classroom on time. If too many students arrive late it is disruptive to rest of the class. Tardiness will be monitored and penalized. You will be marked tardy if I have already started the lecture (usually within five minutes of class start time). More than one tardy, 5 points will be deducted from your overall grade for each tardiness.

Late Work: Deadlines are firm. Late work will be penalized by deduction of 5 points from that week's score and no work will be accepted after two weeks.

Cell Phones and Social Media: The use of cell phones, mp3 players, social media etc. in the classroom is not acceptable. Please make sure your cell phones are turned off or silent during the class.

You are expected to stay for the entire length of the class time- you will be doing a hands-on dry laboratory exercise each week and you can leave only at the end of the lab period or when you have finished and uploaded the lab.

Any misconduct will be dealt as per Rutgers University's code of student conduct found at http://judicialaffairs.rutgers.edu/university-code-of-student-conduct. Students are expected to abide by all Rutgers University regulations with regards to academic misconduct.

Course Description Learning Objectives:

This course introduces the students to various bioinformatics tools and databases used to study and complement biological data. This course involves a mixture of lecture, seminar and hands on activities. The learning objectives for this course are as follows:

1. To obtain the ability to critically examine biological meta- databases such as NCBI, Ensembl etc.
2. To understand bioinformatic methods of DNA and RNA sequence analysis.
3. To understand computational methods that aid in studying protein structure, domains & motifs.
4. To utilize *in silico* methods to design and explore drug like candidates.
5. To recognize interdisciplinary approach to biological discovery process.
6. To be able to interpret current scientific literature in the field of bioinformatics (for graduate students)

Course Textbook: Following are **recommended** books for this course, additional material will be provided in the class:

1. Bioinformatics and Functional Genomics, Jonathan Pevsner (Author), Wiley-Blackwell; 2nd edition (May 4, 2009) ISBN: 0470085851

2. Introduction to Genomics, Arthur M. Lesk (Author), Oxford University Press; 2nd edition (April 26, 2012) ISBN: 019956435

3. Understanding Bioinformatics. Marketa Zvelebil and Jeremy O. Baum (Authors); Garland Science; 1st edition (2008) ISBN: 0815340249.

Course Site:

Both undergraduate and graduate sections have one course canvas site. All the relevant materials including weekly lectures, labs, quizzes, projects etc. will be posted on it. All weekly submissions and grading is done online as well. It is your responsibility to make sure that you are enrolled in my CANVAS class and to check it regularly for updates. Any emergency announcements regarding class including but not limited to any class cancelation will also be posted via CANVAS.

Assessment: You will be evaluated as follows:

(A) In Class Dry Lab Exercises and Assignments

You will be evaluated based on weekly in-class dry lab exercises and take home assignments. Each lab exercise and/or assignment will be given in the beginning of the class and will be due before next class. You will need to upload your lab assignments on CANVAS site. Late submissions will be penalized by deduction of 5 points/per week delay from the total score. No submission will be accepted after two weeks.

(B) Unit Exams

There will be two closed book closed notes exams and will involve written as well as practical sections. Written exam may contain questions ranging from multiple choice questions; labeling diagrams, and short answer questions. Practical exam will involve mini dry lab exercises similar to the one done during the classes. There will be no make-up exam except under extreme emergency with prior notice and adequate documentation of a valid emergency. The format of the make-up exam may be different from the original exam.

(C) Oral Seminar Presentation and Discussion

Graduate students in MBS program enrolled in 11:137:617 course will present an oral seminar.

Each graduate student will be assigned a topic/technique/tool or primary literature article from the field of applied bioinformatics. The student will prepare and give 25-30 min presentation of the topic that should include background, history, methodology-specifically the biological principle, significance, uses and current status. You are expected to go in search of primary literature articles, review articles and other reference material in order to gain in depth understanding of the assigned topic. Oral presentations will be followed by 5-10 min discussion and q/a session. All the students (undergraduate and graduate) are expected to participate in the discussion.

UNDERGRADUATE students will submit one-two page talk summary after the presentation that should entail the scientific concepts learned behind the technology, its significance and application.

Grading Scheme:

11:126:484 (Undergraduates)

Labs and Assignments: 30%
Exams: 60%
Seminar Report- 5%
Discussion: 5%

01:137:617 (Graduates)

Labs and Assignments: 20%
Exams: 60%
Oral Presentation: 15%
Discussion: 5%

Academic Integrity: Students are responsible for reading and complying with Rutgers University academic integrity policy. To view the Rutgers University's Academic Integrity Policy go http://academicintegrity.rutgers.edu/academic-integrity-policy. The academic integrity/ honesty policies hold good for all in-class work, quizzes, projects and take-home assignments. Plagiarism, cheating or other violations of Rutgers University's Academic Integrity Policy will be subject to appropriate penalty based on the infarction.

Accomodations for Students with Disabilities: Please follow the procedures outlined at https://ods.rutgers.edu/students/registration-form. Full policies and procedures are at https://ods.rutgers.edu/.

Tentative Lecture-Laboratory Schedule

Week	Date	Topic & Assignments	Assignments
I	1/17	Course Policies and Syllabus Introduction to Bioinformatics	Assigned Reading Take Home Assignment
II	1/24	Biological Information & Databases I	Lab: NCBI
III	1/31	Biological Databases II (Asynchronous)	Lab: Ensembl
IV	2/7	Pairwise Sequence Alignment	Lab: BLAST
V	2/14	Student Presentation (1) Multiple Sequence Alignment	Summary Report Lab: MSA using MAFFT, MUSCLE, T-Coffee
VI	2/21	Student Presentations (1) DNA Chromatograms Primer	Summary Reports Lab: Finch TV- MEGA
VII	2/28	EXAM I (Based on materials covered in Week I-VI)	
VIII	3/6	Structural Bioinformatics I- Protein Structure and Families	Lab: InterProScan, Prosite, Predict Protein
IX	3/13	Spring Break	
X	3/20	Structural Bioinformatics II- X Ray Crystallography & Protein Structure Visualization	Lab: PDB and DS Visualizer
XI	3/27	Student Presentation (1) CADD Lab: *In Silico* Screening	Summary Report Lab: Pubchem, Drug Bank
XII	4/3	Student Presentation (1) CADD Lab: *In Silico* Docking I	Lab: Argus Lab I
XIII	4/10	Student Presentation (1) CADD Lab: *In Silico* Docking II	Summary Report Lab: Argus Lab II
XIV	4/17	Student Presentations (3)	Summary Reports
XV	4/24	EXAM II (Based on material covered in weeks VIII-XIV)	