11:126:383: Nucleotide Sequence Analysis

Meeting Time & Location
Section 01- Thursday 10:55am-3:35pm; Foran Hall- Rm 124
Section 02- Friday 10:55am-3:35pm; Foran Hall- Rm 124

Instructor: Dr. Sonia Arora
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Office Hours: Monday, Tuesday, Wednesday: 10am- 12:30pm
Thursday, Friday: By Appointment

Teaching Assistant: Stephanie Rossi
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Office Hours by Appointment

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

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

2. 1. Bioinformatics and Functional Genomics, Jonathan Pevsner (Author), Wiley-Blackwell; 3rd edition (2015) ISBN: 978-1-118-58178-0

3. Practical Bioinformatics, Michael Agostino (Author); Garland Science; 1st edition (2012). ISBN: 0815344562

Course Description and Learning Objectives:

This is a mixture of lecture & dry laboratory based course. It is aimed at examining the basic tools that form the foundation of bioinformatics. The course introduces students to DNA, RNA & amino acid sequence analysis using publically available and web based tools such as Blast, Clustal etc. The course also covers biological databases; and identification of genes & proteins in these databases. The students obtain mastery of analyzing information on NCBI, Genbank and OMIM databases. In addition, the course familiarizes students with techniques of genetic manipulation, recombinant DNA technology & restriction mapping. The students learn how to use programs like NEBcutter, Net Primer and Primer 3Plus. The course also covers analysis of primary data obtained from DNA sequencers, assembly of raw data into a contiguous sequence, finding open reading frames, translating nucleotide sequences into amino acid sequences, determining protein and DNA characteristics using computer program like CLC Bio Main Workbench.

Upon completion of the course, students should be able to

1. Critically analyze nucleotide and amino acid sequences; and find homologous sequences.
2. Examine and extract gene, protein & disease information available at various biological databases.
3. Utilize computational methods to design genetic manipulation experiments in wet-laboratory.
4. Understand & analyze primary sequence data obtained from DNA sequencing projects.
5. Employ current fundamental bioinformatics (computational) methods to access information regarding a gene or protein, to conduct research, and to communicate findings.

Course Policies

Sakai & Turnitin: Weekly lecture notes, lab assignments and other documents regarding project, practice exam etc. will be posted on sakai. It is your responsibility to make sure that you are enrolled in my sakai 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 sakai. Turnitin portal will be used for uploading term projects- details will be given during the class. Rutgers give access to turnitin to all students- please make sure you have an account on turnitin.com.

Attendance: Attendance is mandatory as this is a laboratory based course.

Evaluation: You will be evaluated as follows:

(A) In Class Dry Lab Exercises- 40% of grade

You will be evaluated based on weekly in-class dry lab exercises and/or take home assignments. Each assignment will be given in the beginning of the class and will be due before next class. You will need to submit your lab results as a hard copy. Late submissions will be penalized by deduction of 10 points/per week delay from that week's total score.

(B) Exams- 40% of grade (20% each)

There will be two closed book closed notes examinations - see schedule for dates. The exams will involve written as well as practical portions. 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 bona fide emergency. The format of the make-up exam may be different from the original exam.

(C) Take Home Final Assignment- Project Based- 20% of grade

You will be assigned an unknown gene sequence. You will use dry lab techniques taught in the class to identify the gene and its encoded product. You will decipher known or predicted structure of the encoded protein, its clinical relevance in a disease process and its evolutionary conservation. Based on your research you will answer the questions included in your take home final assignment, which will be posted on the course sakai site. You will submit your final assignment by the due date on the sakai site using drop box. All submitted files must be .docx files and must be named as "YourLastName-FinalAssignment-Section1".

Classroom Behavior: Students should make every attempt to arrive in the classroom on time. If too many students arrive late it is disruptive to rest of the class. So please be courteous to your fellow students. In case you have to leave early, please do so very quietly without disturbing the class. The use of cell phones, i pods, mp3 players etc. in the classroom is unacceptable. Please make sure your cell phones are turned off or silent during the class. 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.

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, exams 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 Class Schedule

Week	Date	Topic	Lab
I	Section 1: 9/8 Section 2: 9/9	Introduction Review- Structure of DNA	Take Home Assignment- Watch the movie: Secret of Photo 51 & write the critique.
II	Section 1: 9/15 Section 2: 9/16	Biological & Genomic Databases	**Lab 1:** Tour of NCBI
III	Section 1: 9/22 Section 2: 9/23	Sequence Alignment I	**Lab 2:** Sequence Analysis using BLAST
IV	Section 1: 9/29 Section 2: 9/30	Sequence Alignment II	**Lab 3:** BLAST contd.; Clustal Omega
V	Section 1: 10/6 Section 2: 10/7	Review- Transcription & Translation Gene Structure Practice Exam and Study Guide	**Lab 4:** Virtual lab; NCBI ORF-Finder, Sequence Manipulation Suite
VI	Section 1: 10/13 Section 2: 10/14	**Exam I (100 Points)** **Exam based on material covered in weeks I-V**	
VII	Section 1: 10/20 Section 2: 10/21	Review of Molecular Cloning	**Lab 5:** DNA technology virtual lab @ HHMI
VIII	Section 1: 10/27 Section 2: 10/28	Review of PCR & Primer Design	**Lab 6:** NEB Cutter & Net Primer
IX	Section 1: 11/3 Section 2: 11/4	DNA Sequencing	**Lab 7:** Chromas
X	Section 1: 11/10 Section 2: 11/11	Amino Acid Sequence Analysis Protein Structure	**Lab 8:** PDB and Uni-Prot Database
XI	Section 1: 11/17 Section 2: 11/18	**Exam II (100 Points)** **Exam based on material covered in weeks VII- X**	
XII	Section 1: 11/24 Section 2: 11/25	Thanksgiving Week- No Classes	
XIII	Section 1: 12/1 Section 2: 12/2	CLC Bio Workshop Day 1	**Lab 9:** Sequence Analysis using CLC main workbench- Part I (mini lab)
XIV	Section 1: 12/8 Section 2: 12/9	CLC Bio Workshop Day 2	**Lab 10:** Sequence Analysis using CLC main workbench- Part II (mini lab)
XV	12/10-12/23	Project Based Take Home Final: Due by midnight (11:59pm) on December 23rd.	