

11:126:383: Nucleotide Sequence Analysis

Section 01- Tuesday- 10:20-3:10pm

Section 02- Thursday-10:20am-3:10pm

Instructor: Dr. Sonia Arora
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Office Hours: By Zoom and Email (please make appointment)

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Office Hours: By Zoom and Email (please make appointment)

Location: Zoom and in-person

In person classes will meet in Foran Hall Rm. 124.

Zoom classes will be announced ahead of time. This will be a synchronous class meaning this class will meet in real time. Zoom link is posted in the class CANVAS site. This is hands on lab-based course. You will need to be on your computer station during the class- smartphones, tablets, i pads won't do nor will listening to class while driving or working.

Attendance is MANDATORY

Virtual Classroom Behavior: Students should make every attempt to arrive in the virtual classroom on time. Please have your **cameras ON and audio muted** when you join in. Please use raise hand function of Zoom in case of questions when instructor asks you to. Please DO NOT use chat function of Zoom to text each other- it should be used to speak to TA or instructor. Please familiarize yourself with "Share Screen" as well as "Ask for Help" function of Zoom. It is best to find a quiet corner and use headphones for your meet time. **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 after finishing the lab and uploading it on CANVAS.** Under extenuating valid circumstances, arrangement must be made with the instructor for the possible extension by providing bonafide documentation.

Classroom Behavior for in person classes: 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, ipods, mp3 players etc. in the classroom is unacceptable. 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 after finishing the lab and uploading it on CANVAS.** Under extenuating valid circumstances, arrangement must be made with the instructor for the possible extension by providing bonafide documentation.

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.

Covid Safety Procedures for in person classes: In order to provide everyone with a safe learning environment, I ask that you abide by the following rules for attending class.

- You must be vaccinated to attend this class. I would like you to know that I am vaccinated.
- Please make yourself aware of and follow all Rutgers Community Safety Practices- <https://coronavirus.rutgers.edu/health-and-safety/community-safety-practices/>.
- When you come to campus to attend class, be sure to renew your Campus Pass on MyRutgers.
- If you feel unwell, DO NOT attend class. Let me know and I will work with you to make up work.
- **MASKS are MANDATORY for this class.** I will be wearing a mask while I am lecturing. Every student in this class will also be expected to wear an appropriate mask (exhaust valves not permitted), properly cared for, and worn, covering both the mouth and nose, as detailed in the Rutgers Community Safety Practices. Please come to class prepared. If you forget, a disposable mask will be provided. I will not begin each class session until everyone is wearing a mask.
- Please let me know if you cannot clearly hear what I am saying. Speaking through a mask is challenging. If you let me know I can modify my mask and speech to be more clear.
- Please wash your hands, or sanitize them before coming to class and after departing.

Technology Requirement and Course Site:

For Zoom sessions: You will need a computer (laptop or desktop; both windows or Mac operating system should work) and high-speed internet. Zoom link is posted on CANVAS site under modules. Please make yourself aware of how to navigate several functionalities of Zoom.

For in person class: Laptops are not required as the class is held in computer lab and each student has a designated computer station.

Course Site: Each section has its own course canvas site. All the relevant materials including weekly lectures, labs, quizzes, projects etc. will be posted on it. All 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. Course CANVAS Site:

Class Structure: This class consists of three components each week (except when noted on tentative schedule). Attendance is mandatory. Absence must be notified ahead of time when possible or as soon as possible. All absences must accompany a bonafide reason and documentation.

1. Lecture: Short background/ review of tools and techniques covered in the dry lab exercises.
2. Demonstrations: Every week we learn a new tool. Your TA will demonstrate how to navigate this tool and database. Lectures and demos are not recorded especially for in person class therefore it is in your advantage to pay attention to these.
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 finish all the lab activities during the class and upload on CANVAS before leaving. Late submissions will be penalized; and no submission will be accepted beyond two weeks delay.

Besides weekly laboratory exercises, there will be quizzes, practical exams and project reports. More details in assessment and schedule section below.

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 publicly 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, finding open reading frames, translating nucleotide sequences into amino acid sequences, determining protein and DNA characteristic using several programs.

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 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. 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

Assessment: You will be evaluated as follows:

(A) Weekly Lab Assignments (25% of grade): Each week you will be assigned Computational Lab Exercises. You will need to upload your lab assignments on CANVAS site. Late submissions will be penalized as per instructor's discretion. If for some reason you are unable to finish your work, you **MUST** notify the TA first during the lab period and then instructor by email for a possible extension. This extension is only one-time favor and should be asked for only under extenuating circumstances like power outages, medical condition etc.

(B) Bi-weekly Quizzes- (25% of grade)- There will be bi-weekly quizzes- see attached schedule for dates. Each quiz will be closed book and will be offered before the lecture starts. The content of the quiz will be based of the topics covered in weeks before that week- see schedule for more information. There will be no make-up quiz except under extreme emergency with prior notice and adequate documentation of a bona fide emergency.

(C) Unit Exams- 25% of grade

There will be two closed book practical exams. These 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.

(D) Final Mini-Project- 25% of grade

You will be assigned a gene name/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 evolutionary conservation. Based on your research you will discuss your results in a three page written project report. Your report should have following sections: Introduction, Methods, Result and Discussion and should include in-text citations. You will submit your project report on course CANVAS site (see schedule for submission due date). Your report will be subject to plagiarism check via turnitin.com. More instructions will be provided.

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 infraction.

Accommodations 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
(Section 1- Tuesday, Section 2- Thursday)

Week	Date	Topic	Lab/Assignment
I	Section 1: 1/18 Section 2: 1/20	Introduction Structure of DNA (Self Review)	Assignment 1: Watch the movie: Secret of Photo 51 & write the critique.
II	Section 1: 1/25 Section 2: 1/27	Biological & Genomic Databases	Assignment 2: Tour of NCBI
III	Section 1: 2/1 Section 2: 2/3	Quiz 1-based on weeks I & II Protein Sequence & Structure Databases	Assignment 3: PDB, Uni-Prot Database
IV	Section 1: 2/8 Section 2: 2/10	Sequence Alignment I	Assignment 4: BLAST
V	Section 1: 2/15 Section 2: 2/17	Sequence Alignment II	Assignment 5: Clustal Omega, BioEDIT
VI	Section 1: 2/22 Section 2: 2/24	Quiz 2-based on weeks III & IV PRACTICUM EXAM I (Weeks I to IV material)	
VII	Section 1: 3/1 Section 2: 3/3	Gene Structure	Assignment 6: NCBI ORF-Finder, Genscan
VIII	Section 1: 3/8 Section 2: 3/10	Quiz 3- Based on Week VII Molecular Cloning	Assignment 7: DNA technology virtual lab @ HHMI; NEB Cutter
IX	Section 1: 3/15 Section 2: 3/17	SPRING BREAK	
X	Section 1: 3/22 Section 2: 3/24	PCR and Primer Design	Assignment 8: NET Primer and Primer Blast
XI	Section 1: 3/29 Section 2: 3/31	DNA Sequencing	Assignment 9: Finch TV/Chromas, Trace Archives
XII	Section 1: 4/5 Section 2: 4/7	Quiz 4- Based on Weeks VIII- XI Specialized Databases & Tools	Assignment 10: Sol Genomics, CLC Genomics, SMS
XIII	Section 1: 4/12 Section 2: 4/14	PRACTICUM II (Weeks V, VII, VIII, X)	
XIV	Section 1: 4/19 Section 2: 4/21	PROJECT WEEK- Troubleshooting, Catch up	
XV	Section 1 & 2: 4/28	Project Report DUE	