

Bergen Community College
Division of Mathematics, Science, and Technology
Department of Biology and Horticulture

Introduction to Bioinformatics (BIO-211)

General Course Syllabus
Spring 2016

Course Title:	Introduction to Bioinformatics (BIO-211)
Course Description:	This course is designed to give students both a theoretical background and a working knowledge of the techniques employed in bioinformatics. Emphasis will be placed on biological sequence (DNA, RNA, protein) analysis and its applications.
Prerequisites:	BIO 101 General Biology I and BIO 210 Introduction to Biotechnology
General Education Course:	No
Course Credits:	3.0
Hours per week:	4.0: 2 hours lecture and 2 hours lab
Course Coordinator:	John Smalley
Required Textbook;	Practical Bioinformatics, 1st ed., Agostino, M., Garland Science, 2013
Required Lab Manual:	None

Student Learning Objectives

The student will be able to:

1. Students will become familiar with a variety of currently available genomic

and proteomic databases. Assessment will be based upon performance on computer assignments and exam questions.

2. Students will be able to search and retrieve information from

genomic and proteomic databases (e.g. GenBank, Swiss-Prot), and to analyze their search results using software available on the internet (e.g. BLAST, ClustalW). Assessment will be based upon performance on computer assignments and exam questions.

3. Students will learn how to compare and analyze biological

sequences and how to interpret the results of their analyses. Assessment will be based upon performance on computer assignments and exam questions.

4. Students will learn how to construct phylogenetic trees based

on biological sequence data. Assessment will be based upon performance on computer assignments and exam questions.

5. Students will be able to locate consensus sequences,

genes and open reading frames within biological sequences. Assessment will be based upon performance on computer assignments and exam questions.

6. Students will become familiar with the principles and

applications of microarrays. Assessment will be based upon performance on exam questions.

7. Students will be able to perform elementary predictions

of protein structure and function. Assessment will be based upon performance on computer assignments and exam questions.

8. Students will be able to perform elementary comparative genomic analysis.

Assessment will be based upon performance on computer assignments and exam questions.

9. Students will use the scientific method of inquiry, through the acquisition of scientific knowledge.

10. Students will use computer systems or other appropriate forms of technology to achieve educational and personal goals.

Student Assessment Tools:

The above student learning objectives will be generally assessed or evaluated by instructors using a variety of **assessment instruments** including **lecture exams, laboratory exams, quizzes, laboratory reports, written reports, presentations, projects, etc.** The decisions concerning the type or types and number of instruments that are used in a specific section of the course will be left to the instructor of that section. This information, when given by the instructor should be recorded by the student in the **Student Assessment Section** of this document.

Course Content (Lecture):

Week 1 Introduction, Review of DNA replication, transcription, and translation, Genome organization

Week 2 Review of molecular biology methods

Week 3 Introduction to DNA and protein databases, data storage, file formats, information retrieval

Week 4 Database queries, sequence retrieval, Creation of restriction endonuclease maps

Week 5 Dot plots, Sequence alignment, Local alignment, Global alignment, Multiple alignments

Week 6 Sequence alignments continued, Alignment scores, Statistical significance of database searches

Week 7 Genetic distances, Distance based phylogenies, Phylogenetic tree construction

Week 8 Phylogenetic tree construction continued, Character based phylogenies

Week 9 Consensus sequences, Finding genes and open reading frames in DNA sequences

Week 10 Microarrays and the transcriptome

Week 11 Microarray analysis and applications of microarrays

Week 12 Introduction to proteomics

Week 13 Prediction of protein structure and function

Week 14 Prediction of protein structure and function continued, Comparative genomics

Week 15 Comparative genomics continued, Future directions of bioinformatics

Course Content (Laboratory):

Week 1 Introduction to NCBI

Week 2 Navigating the NCBI website

Week 3 Performing keyword searches of the Online Mendelian

Inheritance In Man (OMIM), NCBI Taxonomy, NCBI Genome, and Swiss-Prot Databases

Week 4 Sequence retrieval from genomic databases, Restriction endonuclease mapping

Week 5 Comparison of sequences using Basic Local Alignment Search Tool (BLAST), Interpretation of BLAST search results, Local Alignment using L-Align

Week 6 Global Alignment using MatGAT, Multiple Alignment using Clustal

Week 7 Construction of distance based phylogenetic trees

Week 8 Construction of character based phylogenetic trees

Week 9 Determination of consensus sequences, locating genes (gene prediction) and open reading frames in DNA sequences

Week 10 Gene prediction II

Week 11 Prediction of protein structure and function I

Week 12 Prediction of protein structure and function II

Week 14 Comparison and analysis of whole genomes I

Week 15 Comparison and analysis of whole genomes

Student Assessment: Lecture Examinations %

Laboratory Component %

Student Project/Report %

Class Participation %

Other %

Total 100%

If you have a medical condition or develop a medical condition during this semester, which prevents you from fulfilling the requirements of this course, you must notify your physician. You and your physician must decide whether or not it is appropriate for you to remain in this course. If the decision is to remain in this course, please obtain a letter from your physician indicating that your continued participation in this course is appropriate and present it to the Department Chair.

Faculty Addenda: As per individual faculty member

Lecture Attendance: As per instructor;

Lab Attendance: As per instructor;

Policy Concerning Late Assignments: As per instructor;

Policy Concerning Make-Up Testing: As per instructor;

Safety Information: As per instructor and assigned exercise;

College Policies:

Student Responsibility

Students will be held responsible for reading all pertinent information in college publications regarding withdrawals, course drops, college deadlines, and tuition refunds. Students are responsible for compliance with the rules and regulations as stated in college publications.

Absence of Instructor

Students are expected to wait twenty minutes for a faculty member to come to class. If at the end of twenty minutes, the faculty member does not come, the students should sign an attendance sheet, which indicates the course, date, and time. A student should deliver the attendance sheet to the divisional office (A304) if between 9:00 a.m. and 5:00 p.m. or to the Evening Office (C107) if before 9:00 a.m. or after 5:00 p.m. Students cannot be penalized by faculty for not waiting longer than twenty minutes.

Academic Dishonesty and Plagiarism

Bergen Community College is committed to academic integrity – the honest, fair and continuing pursuit of knowledge, free from fraud or deception. Students are responsible for their own work. Faculty and academic support services staff will take appropriate measures to discourage academic dishonesty. **Plagiarism** is a form of academic dishonesty and may be a violation of U.S. Copyright laws. Plagiarism is defined as the act of taking someone else's words, opinions, or ideas and claiming them as one's own.

Consequences of Violations Academic Integrity

A. Instructor's Sanctions for a Violation

The faculty member will determine the course of action to be followed. This may include:

- Assigning a failing grade on the assignment;
- Assigning a lower final course grade;
- Failing the student in the course
- Other penalties appropriate to the violation;

In all cases, the instructor shall notify the Vice President of Student Services of the violation and the penalty imposed. The student has the right to appeal the decision of the instructor to the appropriate department head.

B. Institutional Sanctions for Violations

When a violation of academic integrity has been reported regarding a student, the Vice President of Student Services may impose disciplinary penalties beyond those imposed by the course instructor, which may include suspension or dismissal from the College. The student shall have the right to a hearing before the Vice President of Student Services or a designated judicial affairs committee. Judicial procedures governing violations of academic integrity are contained in the student handbook.

Class Attendance

All students are expected to attend punctually every scheduled meeting of each course in which they are registered. Attendance and lateness policies and sanctions are to be determined by the instructor for each section of each course. These will be established in writing on the individual course outline. Attendance will be kept by the instructor for administrative and counseling purposes.

Eating and Drinking

Eating or drinking in classrooms, lecture rooms, laboratories, gymnasium, swimming pool, or passageways is forbidden. Covered beverages only are permitted in the library. Eating and drinking are permitted in cafeteria and vending areas only.

Learning Assistance

Henry and Edith Cerullo Learning Assistance Center

The Tutoring Center, English Language Resource Center, Math Walk-In Center and Writing Center are collectively known as the Henry and Edith Cerullo Learning Assistance Center. The Cerullo Learning Assistance Center is located in the Pitkin Education Building, in Room L-125. The telephone number is (201) 447-7489. The Learning Assistance Center, staffed with peer and professional tutors, offers free individual and group tutoring, supplemental instruction, and online tutoring for subjects offered at the College. The Center provides alternative approaches to problem solving and organizational skills. Tutors help clarify classroom lectures and textbooks and help students prepare for exams. These services build student self-confidence and reduce fear of failure. The Center is equipped with the latest technology and software, including tapes, books, review sheets, exercises and software.

Services for Students with Disabilities

Bergen Community College aims to create inclusive learning environments where all students have maximum opportunities for success. Any student who feels he or she may need an accommodation based on the impact of a disability should contact the Office of Specialized Services at 201-612-5269 or via email at ossinfo@bergen.edu for assistance.

Sidney Silverman Library

Main Building, Pitkin Education Center, L-wing, 2nd Floor.

Paramus Library Hours: (201) 447-7131 or visit <http://www.bergen.edu/library/calendar/gcal.htm>

Paramus Service Desk: (201) 447-7970

Meadowlands Location: 1280 Wall Street, Lyndhurst 2nd Floor

Meadowlands Library Hours: <http://www.bergen.edu/library/calendar/gcal.htm>

Meadowlands Service Desk: (201) 301-9692

www.bergen.edu/library

Testing Services

The Bergen Community College Office of Testing Services (OTS) is located in Room S-127. OTS serves the college community by identifying, developing, procuring, administering, processing, and/or evaluating examinations, which meet a variety of administrative and instructional needs. To contact the OTS, please call (201) 447-7202. The Office of Testing Services administers makeup tests as a service for students who, for compelling and exceptional reasons, have missed a scheduled classroom examination. Students must receive prior permission from and make arrangements with their course instructors to take these examinations, under specific conditions, in the Office of Testing Services, Room S-127.

WebAdvisor

WebAdvisor is a web interface that allows students to access information contained in Datatel's Colleague, the administrative database used by Bergen Community College. Students may use WebAdvisor to register for classes, to pay tuition and fees, to view their class schedules, to check grades, to check on progress toward degree requirements, etc. WebAdvisor accounts are available for all students enrolled in credit programs. New students are strongly encouraged to attend an in-person registration or advisement session before using a WebAdvisor account. Eligible students without WebAdvisor user names and passwords may access their WebAdvisor account by going to go.bergen.edu and selecting "I'm new to WebAdvisor." Then, follow the on-screen directions. Check the WebAdvisor FAQ for answers to common questions, such as how to reset your password. Students must have a valid e-mail address on file with the College to use WebAdvisor