

Common Course Outline
Biology 235
Introduction to Bioinformatics
4 Semester Hours

The Community College of Baltimore County

Description

Introduction to bioinformatics introduces a tools-oriented approach to bioinformatics emphasizing DNA data structure, string representation in PERL, data searches, pair-wise alignments, substitution patterns, protein structure prediction and modeling, proteomics, and use of web-based bioinformatic tools.

4 credits: 4 lecture hours per week

Prerequisites: BIOL 110 and CMSC 201.

Overall Course Objectives

Upon completion of this course the student will be able to:

1. demonstrate the basic skills and concepts involved in writing and debugging computer programs, using PERL as an example;
2. explain basic and intermediate PERL programming concepts;
3. write simple programs in PERL related to bioinformatics topics;
4. explain introductory genomics;
5. explain the tools of molecular biology;
6. use molecular data repositories;
7. analyze DNA and protein sequences using data searches and pair-wise alignments ;
8. analyze genomic information, including applications in phylogenetics and gene recognition;
9. differentiate between prokaryotic and eukaryotic genomes and their gene structures;
10. describe methods of gene recognition, including methods of identifying gene expression by microarrays;
11. analyze how and why the rate of nucleotide substitutions differs within and between genes as well as across species barriers;
12. infer evolutionary relationships in phylogenetics using parsimony and cluster analysis;
13. analyze proteomic information, including the structure and function of RNA and proteins.
14. predict RNA secondary structure;
15. explain protein structure, including levels of structure and models of protein structure; and
16. describe protein classification and modification.

Major Topics

- I. **DNA's Information Content:**
 - A. Course introduction, Information storage in DNA
 - B. Introduction to PERL and UNIX
 - 1. Activation and using CATS accounts
 - 2. Command line UNIX: redirection, pipelines
 - 3. Introduction to PERL
 - C. Basic PERL
 - 1. Scalar and array variables
 - 2. Control structures
 - D. PERL programming
 - 1. Functions and subroutines
 - 2. Parameter passing
 - E. Intermediate PERL
 - 1. Data structures: arrays and hashes
 - 2. File I/O
 - F. Introduction to Genomics
 - 1. Information content in DNA
 - 2. Data searches and pair wise alignments
 - G. Tools of Molecular biology, molecular data repositories
- II. **Genomic Information Content**
 - A. Substitution patterns
 - B. Cluster analysis and phylogenetics
 - C. Parsimony approaches to phylogenetics
 - D. Prokaryotic and eukaryotic genomes and gene structures
 - E. Gene recognition
 - F. Gene expression and microarrays
- III. **Proteomic Information Content**
 - A. Predicting RNA secondary structure
 - B. Phi/psi, protein secondary structure, X-ray structures
 - C. Protein folding - simple models
 - D. Structural modeling and visualization
 - E. Proteomics, protein classification and modification

Course Requirements

Grading/exams: Grading procedures will be determined by the individual faculty member but will include the following: Grades will be based on 3 exams, a term project, and homework assignments.

Writing: The individual faculty member will determine specific writing assignments.

Other Course Information

This course is a biology elective and a Biotechnology Program elective.
This course is taught in a computerized environment.

The Community College of Baltimore County is committed to providing a high-quality learning experience that results in growth in knowledge, attitudes, and skills necessary to function successfully as a transfer student, in a career, and as a citizen. To accomplish this goal, we maintain high academic standards and expect students to accept responsibility for their individual growth by attending classes, completing all homework and other assignments, and participating in class activities and preparing for tests.

We take seriously our responsibility to maintain high-quality programs and will periodically ask you to participate in assessment activities to determine whether our students are attaining the knowledge, attitudes, and skills appropriate to various courses and programs. The assessment activities may take many different forms such as surveys, standardized or faculty-developed tests, discussion groups, or portfolio evaluations. We ask that you take these activities seriously so that we can obtain valid data to use for the continuous improvements of CCBC' courses and programs.

Individual faculty members may include additional course objectives, major topics, and other course requirements to the minimum expectations stated in the Common Course Outline.

(8) Date Revised: MM/DD/YY