Computational Biology (CMPBIO)

Courses

Expand all course descriptions [+]Collapse all course descriptions [-]

CMPBIO 98BC Berkeley Connect in Computational Biology 1 Unit

Terms offered: Fall 2023, Spring 2023, Fall 2022
Berkeley Connect is a mentoring program, offered through various academic departments, that helps students build intellectual community. Over the course of a semester, enrolled students participate in regular small-group discussions facilitated by a graduate student mentor (following a faculty-directed curriculum), meet with their graduate student mentor for one-on-one academic advising, attend lectures and panel discussions featuring department faculty and alumni, and go on field trips to campus resources. Students are not required to be declared majors in order to participate. Course may be repeated.
Berkeley Connect in Computational Biology: Read More [+]
Rules & Requirements

Repeat rules: Course may be repeated for credit with advisor consent.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of discussion per week

Additional Details

Subject/Course Level: Computational Biology/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Instructor: Nielsen

Berkeley Connect in Computational Biology: Read Less [-]

CMPBIO C131 Introduction to Computational Molecular and Cell Biology 4 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021, Fall 2020
This class teaches basic bioinformatics and computational biology, with an emphasis on alignment, phylogeny, and ontologies. Supporting foundational topics are also reviewed with an emphasis on bioinformatics topics, including basic molecular biology, probability theory, and information theory.
Introduction to Computational Molecular and Cell Biology: Read More [+]
Rules & Requirements

Prerequisites: BioE 11 or Bio 1A (may be taken concurrently), plus a programming course (ENGIN 7 or CS 61A)

Credit Restrictions: Students will receive no credit for BIO ENG C131 after completing BIO ENG 131, BIO ENG C131, or BIO ENG C131. A deficient grade in BIO ENG C131 may be removed by taking BIO ENG C131, or BIO ENG C131.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Computational Biology/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructor: Holmes

Also listed as: BIO ENG C131

Introduction to Computational Molecular and Cell Biology: Read Less [-]

CMPBIO 156 Human Genome, Environment and Public Health 4 Units

Terms offered: Spring 2023, Fall 2020, Spring 2019
This introductory course will cover basic principles of human/population genetics and molecular biology relevant to molecular and genetic epidemiology. The latest methods for genome-wide association studies and other approaches to identify genetic variants and environmental risk factors important to disease and health will be presented. The application of biomarkers to define exposures and outcomes will be explored. Recent developments in genomics, epigenomics and other 'omics' will be included. Computer and wet laboratory work will provide hands-on experience.
Human Genome, Environment and Public Health: Read More [+]

Rules & Requirements

Prerequisites: Introductory level biology/genetics course, or consent of instructor. Introductory biostatistics and epidemiology courses strongly recommended

Credit Restrictions: Students who complete PBHLTH 256 or CMPBIO 156 receive no credit for completing PBHLTH C256.

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Computational Biology/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Barcellos, Holland

Human Genome, Environment and Public Health: Read Less [-]

CMPBIO 175 Introduction to Computational Biology and Precision Medicine 3 Units

Terms offered: Prior to 2007
Computational biology is an interdisciplinary field that develops and/or applies computational methods including bioinformatics to analyze large collections of biological data such as genomic data with a goal of making new predictions or discoveries. Precision medicine is an emerging approach for human disease treatment and prevention that takes into account individual variability in genes, environment, and lifestyle for each person. Computational biology and bioinformatics tools are critical for advancing precision medicine. This survey course introduces computational tools for the analysis of genomic data and approaches to understanding and advancing precision medicine.
Introduction to Computational Biology and Precision Medicine: Read More [+]

Hours & Format

Summer: 6 weeks - 12 hours of lecture per week

Additional Details

Subject/Course Level: Computational Biology/Undergraduate

Grading/Final exam status: Letter grade. Alternative to final exam.

Introduction to Computational Biology and Precision Medicine: Read Less [-]

CMPBIO C176 Algorithms for Computational Biology 4 Units

Terms offered: Fall 2022
This course will provide familiarity with algorithms and probabilistic models that arise in various computational biology applications, such as suffix trees, suffix arrays, pattern matching, repeat finding, sequence alignment, phylogenetics, hidden Markov models, gene finding, motif finding, linear/logistic regression, random forests, convolutional neural networks, genome-wide association studies, pathogenicity prediction, and sequence-to-epigenome prediction.
Algorithms for Computational Biology: Read More [+]

Objectives & Outcomes

Student Learning Outcomes: Understand the basic elements of molecular, cell, and evolutionary biology.
Understand the key probabilistic and machine learning models used in computational biology applications.
Understand various data structures and algorithms that arise in computational biology.

Rules & Requirements

Prerequisites: COMPSCI 70 and COMPSCI 170, MATH 54 or EECS 16A or an equivalent linear algebra course

Credit Restrictions: Students will receive no credit for COMPSCI C176 after completing COMPSCI 176. A deficient grade in COMPSCI C176 may be removed by taking COMPSCI 176.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Computational Biology/Undergraduate

Grading/Final exam status: Letter grade. Final exam required.

Instructors: Song, Yun, Ioannidis

Also listed as: COMPSCI C176

Algorithms for Computational Biology: Read Less [-]

CMPBIO 198BC Berkeley Connect in Computational Biology 1 Unit

Terms offered: Fall 2023, Spring 2023, Fall 2022
Berkeley Connect is a mentoring program, offered through various academic departments, that helps students build intellectual community. Over the course of a semester, enrolled students participate in regular small-group discussions facilitated by a graduate student mentor (following a faculty-directed curriculum), meet with their graduate student mentor for one-on-one academic advising, attend lectures and panel discussions featuring department faculty and alumni, and go on field trips to campus resources. Students are not required to be declared majors in order to participate. Course may be repeated.
Berkeley Connect in Computational Biology: Read More [+]

Rules & Requirements

Repeat rules: Course may be repeated for credit with advisor consent.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of discussion per week

Additional Details

Subject/Course Level: Computational Biology/Undergraduate

Grading/Final exam status: Offered for pass/not pass grade only. Final exam not required.

Instructor: Nielsen

Berkeley Connect in Computational Biology: Read Less [-]

CMPBIO 201 Classics in Computational Biology 3 Units

Terms offered: Fall 2015, Fall 2014, Fall 2013
Research project and approaches in computational biology. An introducton to the diverse ways biological problems are investigated computationally through critical evaluation of the classics and recent peer-reviewed literature. This is the core course required of all Computational Biology graduate students.
Classics in Computational Biology: Read More [+]

Rules & Requirements

Prerequisites: Acceptance in the Computational Biology Phd program; consent of instructor

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of lecture and 2 hours of discussion per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Classics in Computational Biology: Read Less [-]

CMPBIO C210 Introduction to Quantitative Methods In Biology 4 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021
This course provides a fast-paced introduction to a variety of quantitative methods used in biology and their mathematical underpinnings. While no topic will be covered in depth, the course will provide an overview of several different topics commonly encountered in modern biological research including differential equations and systems of differential equations, a review of basic concepts in linear algebra, an introduction to probability theory, Markov chains, maximum likelihood and Bayesian estimation, measures of statistical confidence, hypothesis testing and model choice, permutation and simulation, and several topics in statistics and machine learning including regression analyses, clustering, and principal component analyses.
Introduction to Quantitative Methods In Biology: Read More [+]

Objectives & Outcomes

Student Learning Outcomes: Ability to calculate means and variances for a sample and relate it to expectations and variances of a random variable.
Ability to calculate probabilities of discrete events using simple counting techniques, addition of probabilities of mutually exclusive events, multiplication of probabilities of independent events, the definition of conditional probability, the law of total probability, and Bayes' formula, and familiarity with the use of such calculations to understand biological relationships.
Ability to carry out various procedures for data visualization in R.
Ability to classify states in discrete time Markov chains, and to calculate transition probabilities and stationary distributions for simple discrete time, finite state-space Markov chains, and an understanding of the modeling of evolutionary processes as Markov chains.
Ability to define likelihood functions for simple examples based on standard random variables.
Ability to implement simple statistical models in R and to use simple permutation procedures to quantify uncertainty.
Ability to implement standard and logistic regression models with multiple covariates in R.
Ability to manipulate matrices using multiplication and addition.
Ability to model simple relationships between biological variables using differential equations.
Ability to work in a Unix environment and manipulating files in Unix.
An understanding of basic probability theory including some of the standard univariate random variables, such as the binomial, geometric, exponential, and normal distribution, and how these variables can be used to model biological systems.
An understanding of powers of matrices and the inverse of a matrix.
An understanding of sampling and sampling variance.
An understanding of the principles used for point estimation, hypothesis testing, and the formation of confidence intervals and credible intervals.
Familiarity with ANOVA and ability to implementation it in R.
Familiarity with PCA, other methods of clustering, and their implementation in R.
Familiarity with basic differential equations and their solutions.
Familiarity with covariance, correlation, ordinary least squares, and interpretations of slopes and intercepts of a regression line.
Familiarity with functional programming in R and/or Python and ability to define new functions.
Familiarity with one or more methods used in machine learning/statistics such as hidden Markov models, CART, neural networks, and/or graphical models.
Familiarity with python allowing students to understand simple python scripts.
Familiarity with random effects models and ability to implement them in R.
Familiarity with the assumptions of regression and methods for investigating the assumptions using R.

CMPBIO C231 Introduction to Computational Molecular and Cell Biology 4 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021, Fall 2020
This class teaches basic bioinformatics and computational biology, with an emphasis on alignment, phylogeny, and ontologies. Supporting foundational topics are also reviewed with an emphasis on bioinformatics topics, including basic molecular biology, probability theory, and information theory.
Introduction to Computational Molecular and Cell Biology: Read More [+]
Rules & Requirements

Prerequisites: BIO ENG 11 or BIOLOGY 1A (may be taken concurrently); and a programming course (ENGIN 7 or COMPSCI 61A)

Credit Restrictions: Students will receive no credit for BIO ENG C231 after completing BIO ENG 231. A deficient grade in BIO ENG C231 may be removed by taking BIO ENG 231, or BIO ENG 231.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 3 hours of laboratory per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Instructor: Holmes

Also listed as: BIO ENG C231

Introduction to Computational Molecular and Cell Biology: Read Less [-]

CMPBIO C256 Human Genome, Environment and Public Health 4 Units

Terms offered: Spring 2023, Fall 2020, Spring 2019
This introductory course will cover basic principles of human/population genetics and molecular biology relevant to molecular and genetic epidemiology. The latest methods for genome-wide association studies and other approaches to identify genetic variants and environmental risk factors important to disease and health will be presented. The application of biomarkers to define exposures and outcomes will be explored. Recent developments in genomics, epigenomics and other ‘omics’ will be included. Computer and wet laboratory work will provide hands-on experience.
Human Genome, Environment and Public Health: Read More [+]
Rules & Requirements

Prerequisites: Introductory level biology/genetics course, or consent of instructor. Introductory biostatistics and epidemiology courses strongly recommended

Credit Restrictions: Students who complete PB HLTH 256 receive no credit for completing PH C256.

Hours & Format

Fall and/or spring: 15 weeks - 4 hours of lecture per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Instructors: Barcellos, Holland

Also listed as: PB HLTH C256

Human Genome, Environment and Public Health: Read Less [-]

CMPBIO C256A Human Genome, Environment and Human Health 3 Units

Terms offered: Spring 2017
This introductory course will cover basic principles of human/population genetics and molecular biology
relevant to understanding how data from the human genome are being used to study disease and other
health outcomes. The latest designs and methods for genome-wide association studies and other
approaches to identify genetic variants, environmental risk factors and the combined effects of gene and
environment important to disease and health will be presented. The application of biomarkers to define
exposures and outcomes will be explored. The course will cover recent developments in genomics,
epigenomics and other 'omics', including applications of the latest sequencing technology and
characterization of the human microbiome.
Human Genome, Environment and Human Health: Read More [+]
Rules & Requirements

Prerequisites: Introductory level biology course. Completion of introductory biostatistics and epidemiology courses strongly recommended and may be taken concurrently

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Instructors: Barcellos, Holland

Also listed as: PB HLTH C256A

Human Genome, Environment and Human Health: Read Less [-]

CMPBIO C256B Genetic Analysis Method 3 Units

Terms offered: Prior to 2007
This introductory course will provide hands-on experience with modern wet laboratory techniques and computer analysis tools for studies in molecular and genetic epidemiology and other areas of genomics in human health. Students will also participate in critical review of journal articles. Students are expected to understand basic principles of human/population genetics and molecular biology, latest designs and methods for genome-wide association studies and other approaches to identify genetic variants, environmental risk factors and the combined effects of gene and environment important to human health. Students will learn how to perform DNA extraction, polymerase chain reaction and methods for genotyping, sequencing, and cytogenetics.
Genetic Analysis Method: Read More [+]
Rules & Requirements

Prerequisites: Introductory level biology course. Completion of introductory biostatistics and epidemiology courses strongly recommended and may be taken concurrently with permission. PH256A is a requirement for PH256B; they can be taken concurrently

Hours & Format

Fall and/or spring: 15 weeks - 2-2 hours of lecture and 1-3 hours of laboratory per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Instructors: Barcellos, Holland

Also listed as: PB HLTH C256B

Genetic Analysis Method: Read Less [-]

CMPBIO 275 Computational Biology Seminar/ Journal Club 1 Unit

Terms offered: Fall 2022, Spring 2022, Fall 2021
This seminar course will cover a wide range of topics in the field of computational biology. The main goals of the course are to expose students to cutting edge research in the field and to prepare students for engaging in academic discourse with seminar speakers - who are often leaders in their fields. A selected number of class meetings will be devoted to the review of scientific papers published by upcoming seminar speakers and the other class meetings will be devoted to discussing other related articles in the field. The seminar will expose students to both the breadth and highest standards of current computational biology research.
Computational Biology Seminar/Journal Club: Read More [+]
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1 hour of seminar per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Offered for satisfactory/unsatisfactory grade only.

Computational Biology Seminar/Journal Club: Read Less [-]

CMPBIO 276 Algorithms for Computational Biology 4 Units

Terms offered: Fall 2023, Fall 2022
This course will provide familiarity with algorithms and probabilistic models that arise in various computational biology applications, such as suffix trees, suffix arrays, pattern matching, repeat finding, sequence alignment, phylogenetics, hidden Markov models, gene finding, motif finding, linear/logistic regression, random forests, convolutional neural networks, genome-wide association studies, pathogenicity prediction, and sequence-to-epigenome prediction.
Algorithms for Computational Biology: Read More [+]
Rules & Requirements

Prerequisites: CompSci 70 AND CompSci 170, MATH 54 OR EECS 16A OR an equivalent linear algebra course

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

Fall and/or spring: 15 weeks - 3 hours of lecture and 1 hour of discussion per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Instructors: Song, Ioannidis

Algorithms for Computational Biology: Read Less [-]

CMPBIO 290 Special Topics - Computational Biology 1 - 4 Units

Terms offered: Fall 2022, Fall 2021, Spring 2018
This graduate-level course will cover various special topics in computational biology and the theme will vary from semester to semester. The course will focus on computational methodology, but also cover relevant biological applications. This course will be offered according to student demand and faculty availability.
Special Topics - Computational Biology: Read More [+]
Rules & Requirements

Prerequisites: Graduate standing in EECS, MCB, Computational Biology or related fields; or consent of the instructor

Repeat rules: Course may be repeated for credit with instructor consent.

Hours & Format

Fall and/or spring: 15 weeks - 1-3 hours of lecture per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Special Topics - Computational Biology: Read Less [-]

CMPBIO 293 Doctoral Seminar in Computational Biology 2 Units

Terms offered: Fall 2023, Spring 2023, Spring 2022
This interactive seminar builds skills, knowledge and community in computational biology for first year PhD and second year Designated Emphasis students. Topics covered include concepts in human genetics/ genomics, microbiome data analysis, laboratory methodologies and data sources for computational biology, workshops/instruction on use of various bioinformatics tools, critical review of current research studies and computational methods, preparation for success in the PhD program and career development. Faculty members of the graduate program in computational biology and scientists from other institutions will participate. Topics will vary each semester.
Doctoral Seminar in Computational Biology: Read More [+]
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Doctoral Seminar in Computational Biology: Read Less [-]

CMPBIO C293 Doctoral Seminar in Computational Biology 2 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021, Fall 2019
This interactive seminar builds skills, knowledge and community in computational biology for first year PhD and second year Designated Emphasis students. Topics covered include concepts in human genetics/genomics, microbiome data analysis, laboratory methodologies and data sources for computational biology, workshops/instruction on use of various bioinformatics tools, critical review of current research studies and computational methods, preparation for success in the PhD program and career development. Faculty members of the graduate program in computational biology and scientists from other institutions will participate. Topics will vary each semester.
Doctoral Seminar in Computational Biology: Read More [+]
Rules & Requirements

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2 hours of seminar per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Instructors: Moorjani, Rokhsar

Also listed as: MCELLBI C296

Doctoral Seminar in Computational Biology: Read Less [-]

CMPBIO 294A Introduction to Research in Computational Biology 2 - 12 Units

Terms offered: Fall 2023, Fall 2022, Fall 2021
Closely supervised experimental or computational work under the direction of an individual faculty member; an introduction to methods and research approaches in particular areas of computational biology.
Introduction to Research in Computational Biology: Read More [+]
Rules & Requirements

Prerequisites: Standing as a Computational Biology graduate student

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-20 hours of laboratory per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Introduction to Research in Computational Biology: Read Less [-]

CMPBIO 294B Introduction to Research in Computational Biology 2 - 12 Units

Terms offered: Spring 2023, Spring 2022, Spring 2021
Closely supervised experimental or computational work under the direction of an individual faculty member; an introduction to methods and research approaches in particular areas of computational biology.
Introduction to Research in Computational Biology: Read More [+]
Rules & Requirements

Prerequisites: Standing as a Computational Biology graduate student

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 2-20 hours of laboratory per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Introduction to Research in Computational Biology: Read Less [-]

CMPBIO 295 Individual Research for Doctoral Students 1 - 12 Units

Terms offered: Summer 2023 10 Week Session, Summer 2022 10 Week Session, Summer 2021 10 Week Session
Laboratory research, conferences. Individual research under the supervision of a faculty member.
Individual Research for Doctoral Students: Read More [+]
Rules & Requirements

Prerequisites: Acceptance in the Computational Biology PhD program; consent of instructor

Repeat rules: Course may be repeated for credit without restriction.

Hours & Format

Fall and/or spring: 15 weeks - 1-20 hours of laboratory per week

Summer: 10 weeks - 1.5-30 hours of laboratory per week

Additional Details

Subject/Course Level: Computational Biology/Graduate

Grading: Letter grade.

Individual Research for Doctoral Students: Read Less [-]

CMPBIO 477 Introduction to Programming for Bioinformatics Bootcamp 1.5 Unit

Terms offered: Prior to 2007

The goals of this course are to introduce students to Python, a simple and powerful programming language that is used for many applications, and to expose them to the practical bioinformatic utility of Python and programming in general. The course will allow students to apply programming to the problems that they face in the lab and to leave this course with a sufficiently generalized knowledge of programming (and the confidence to read the manuals) that they will be able to apply their skills to whatever projects they happen to be working on.

Introduction to Programming for Bioinformatics Bootcamp: Read More [+]

Rules & Requirements

Prerequisites: This is a graduate course and upper level undergraduate students can only enroll with the consent of the instructor

Hours & Format

Summer: 3 weeks - 40-40 hours of workshop per week

Additional Details

Subject/Course Level: Computational Biology/Other professional

Grading: Offered for satisfactory/unsatisfactory grade only.

Introduction to Programming for Bioinformatics Bootcamp: Read Less [-]