

Free Program Overview

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Biotechnology, Bioinformatics, Bioscience Business and Marketing

Are you interested in learning about the Bioinformatics, Biotechnology, and Bioscience Business and Marketing certificate programs, and about careers in these fields? Offered four times a year, these special free information sessions provide opportunities to meet instructors and other students, learn about program prerequisites, course content and program requirements, and see how these programs can help you advance your current career or break into a new field.

Course 16649
and 22402

Explore UCSC Extension's Other Bioscience Programs

Biotechnology

Clinical Trials Design and Management

Medical Devices

Regulatory Affairs

Bioscience Business and Marketing

See ucsc-extension.edu/biosciences for more information.



Gain Real-World Skills in Biological Data Analysis and Interpretation

Biological data continue to accumulate at a phenomenal rate. UCSC Extension in Silicon Valley's Bioinformatics Certificate Program was created in consultation with industry leaders to meet the need for biologists and computer scientists with the ability to analyze and interpret this deluge of biological information.

Learn the Fundamentals and Applications of Bioinformatics

Courses in the Bioinformatics Certificate Program provide a rich combination of theoretical foundations and practical skills in bioinformatics. The required courses build the necessary computational and scientific foundations. Electives allow our students to tailor their studies to their individual needs and interests. Life scientists learn how to effectively use the tools and methods of bioinformatics to enhance their work. Computer scientists gain a background in molecular biology and important bioinformatics methods and tools.

Benefits of Studying Bioinformatics at UCSC Extension

- Learn from experienced molecular biologists and bioinformatics professionals
- Instructors bring real-world perspectives and cutting-edge technologies into their classrooms
- Gain a foundation in the biological concepts central to bioinformatics
- Understand the origins of biological data, as well as how to manipulate them and determine their quality
- Hands-on experience with the latest computational tools and methods used in bioinformatics
- Learn to perform effective biological database searches and analyses
- Appreciate how computational methods are applied to the development of new drugs and diagnostic tools

Who Should Attend This Program

This program is designed for working life scientists and computer scientists, as well as other professionals who have a degree in biology, biochemistry, or computer science and want to enrich their careers by learning and applying the key principles and practices of bioinformatics.

Program Contact

Applied and Natural Sciences Department
(408) 861-3860
program@ucsc-extension.edu



About UCSC Extension in Silicon Valley

The vital learning community at UCSC Extension in Silicon Valley is well known for its collegial atmosphere and rigorous preparation. Our faculty of expert practitioners teaches state-of-the-art solutions to the everyday problems confronting technology professionals working in Silicon Valley. The professional education programs we offer build expertise, open doors to new opportunity, and deliver tangible value. Our broad portfolio of open-enrollment courses and certificates, affordable pricing, experience-based instruction, and central location in Silicon Valley help turn jobs into careers.

Bioinformatics Certificate

BIOINFORMATICS CERTIFICATE

16-unit minimum

PREREQUISITE COURSES

	Units	Course	F	W	Sp	Su
Molecular Biology, Introduction	3.0	4213	■	■	■	
Probability and Statistics, Introduction	3.0	0656	○	○	○	

REQUIRED COURSES (three)

	Units	Course	F	W	Sp	Su
Bioinformatics Tools, Databases and Methods	3.0	2447	■		■	
Experimental Methods in Molecular Biology	3.0	1912		■		■
Statistical Analysis and Modeling for Bioinformatics and Biomedical Applications	3.0	1032	■		■	

ELECTIVE COURSES (7 units required)

	Units	Course	F	W	Sp	Su
Take required courses before electives.						
Cellular Biology	3.0	3383	■		■	
* Computational Intelligence	1.5	19951		■		■
DNA Microarrays: Principles, Applications and Data Analysis.....	3.0	2183			■	
Drug Discovery, Introduction	3.0	4853	■		■	
Gene Expression and Pathways	2.0	6020		■		
Molecular Diagnostics	1.5	21972	■		■	
Perl for Bioinformatics	2.0	19971	■			
* Sequence Analysis in Bioinformatics, Advanced	2.0	0036		■		
Structure Analysis of Biological Molecules	2.0	5925	■			

* Suggested electives for computer scientists and IT professionals

■ held in classroom ○ offered online □ both classroom and online sessions are available

Visit ucsc-extension.edu for the most current program schedule.

Prerequisites

Familiarity with the principles of modern molecular biology is required. Completion of "Molecular Biology, Introduction" or an equivalent course within the last five years at another institution, or equivalent experience satisfies this requirement. An understanding of probability and statistics are required for "Statistical Analysis and Modeling for Bioinformatics and Biomedical Applications." Students without this background should first complete "Probability and Statistics, Introduction" or the equivalent.

Recommended Course Sequence

Those new to the field of bioinformatics should start with "Bioinformatics Tools, Databases and Methods" and "Experimental Methods in Molecular Biology" (after completing the prerequisite). Courses may then be taken in any sequence, unless otherwise specified in the individual course description.

Certificate Requirements

To satisfy the requirements for the Certificate in Bioinformatics, you must complete **three required** courses and **7 units of electives**, for a minimum total of **16 units**.

How to Apply

Certificate applications can be submitted online. An application fee, listed on the Web page, is required to establish candidacy. Visit ucsc-extension.edu/bioinformatics.

Program Contact

Enroll online now or contact the Applied and Natural Sciences Department for more information: (408) 861-3860 or e-mail program@ucsc-extension.edu.

- **Early Enrollment Discount:** Save 10 percent when you enroll more than 14 days before the first day of class.
- Courses may be taken individually or as part of the certificate program.

Course Descriptions

Prerequisite Courses

Molecular Biology, Introduction

This course provides a comprehensive introduction to molecular biology for nonbiologists and a review for those who want to refresh and update their knowledge of this subject. Topics include fundamental concepts of genes and proteins, central dogma and the genetic code; structure and function of genes; gene expression, transcription and translation; protein structure and function; introduction to genetics; Mendelian analysis; molecular and population genetics, genetic markers and maps; and the impact of modern molecular biology on science and medicine. The course also includes an overview of experimental methods used in molecular biology.

Course 4213

Probability and Statistics, Introduction

This course builds a working knowledge of probability and statistics as a foundation for the study of bioinformatics. Topics include probability theory, probability distributions, statistical tests, linear correlation and regression analysis, parameter estimation, and an overview of information theory. Examples are frequently drawn from bioinformatics. While not overly rigorous for the novice, the course provides some mathematical detail to illustrate basic concepts. No prior background in probability and statistics is required.

Course 0656

Required Courses

Bioinformatics Tools, Databases and Methods

This course provides a practical introduction to the main public domain tools, databases and methods in bioinformatics, including DNA and protein databases such as Genbank and PDB, software tools such as BLAST, and methods including those for aligning sequences. It emphasizes the needs of the user of bioinformatics tools and databases, rather than complex algorithm development and advanced computational methods. Computer lab exercises and online demonstrations of the various databases and tools on the Internet are included.

Course 2447

Experimental Methods in Molecular Biology

This lecture-based course provides a theoretical overview of the key molecular biology techniques used in basic life science research and by the biopharmaceutical industry for the discovery of novel therapeutics. Topics include gene cloning, manipulation and sequencing; PCR; RNA interference; gene expression analysis; protein expression, engineering, and structure determination; and the fundamentals of experimental design. Also addressed are high-throughput sequencing and microarray expression analysis and the types of data these techniques generate.

Course 1912

Statistical Analysis and Modeling for Bioinformatics and Biomedical Applications

This course presents the statistical methods most frequently used in bioinformatics and biomedical research. Topics include probability, hypothesis testing, confidence intervals, t-tests, analysis of variance, regression analysis, power and sample size, and simulations. Students perform statistical analyses using the R programming language. Examples are drawn from biomedical applications such as gene expression analysis, molecular diagnostics, and evaluation of new drugs and medical devices.

Course 1032

Elective Courses

Cellular Biology

Essential to any understanding of biology and its practical applications is an appreciation of the structures, functions and complex biological processes at work in the cell.

This course covers the essential concepts of cellular biology, including the functions of cellular macromolecules, subcellular organization, nuclear control of cellular activity, cytoskeleton, cell signaling, cancer and more. Also addressed are the experimental approaches used to explore cellular activities.

Course 3383

Computational Intelligence

Computer professionals are required to solve increasingly complex problems. "Black-box" computational-intelligence tools can be configured to allow their application to problems, without the user's intimate knowledge of the low-level details. You will learn the strengths and weaknesses of various computational and artificial intelligence techniques, with emphasis on their application to actual problems. This course is well suited to computer professionals who want to explore new techniques for solving problems that are ill-defined, have conflicting constraints, or contain data with high noise levels. Topics include neural networks, genetic algorithms, genetic programming, swarm intelligence, and fuzzy systems.

Course 19951

DNA Microarrays: Principles, Applications and Data Analysis

DNA microarrays have revolutionized molecular biology and are changing the face of discovery research and medicine. This course addresses the underlying principles and applications of the latest DNA microarray technologies, as well as the analysis of microarray data. It is intended for biopharmaceutical professionals, computer scientists and others who are interested in understanding this important technology.

Course 2183

Drug Discovery, Introduction

The tools, technologies, and methods used in the discovery and development of safe, effective drugs are constantly evolving. This introductory course provides a framework for understanding the complex process of drug discovery, from target selection to drug optimization. The instructor and a team of guest speakers address fundamental principles and cutting-edge approaches to drug discovery, and provide strategies for implementing and integrating various scientific approaches. Topics include target selection; validation; lead discovery, including primary and secondary screening and selectivity assays; optimization of properties, including combinatorial and medicinal chemistry, molecular modeling and biological approaches; pharmacokinetics and ADME; and toxicology.

Course 4853

Molecular Diagnostics

This survey course provides a foundation in the basic science and technologies that underlie the emerging field of molecular diagnostics, and highlights the potential impact on the health care landscape. The instructor examines the role of pharmacogenomics in the development of new therapeutics and treatment options. He uses case studies to present the applications of molecular diagnostic tools in infectious disease identification and early detection and diagnosis of cancer. Also addressed are the regulatory challenges that face the new wave of diagnostic tests, and the changing dynamics of the molecular diagnostics global marketplace.

Course 21972

Perl for Bioinformatics

This lab-based course covers the fundamentals of Perl programming, with emphasis on Perl's use in bioinformatics and biotechnology research. Lectures address basic operators, string handling, text processing, control flow, scalar values, list and array variables, pattern matching, subroutines, functions, and list manipulation. Students learn how to query and read DNA sequences from Fasta files and how to parse GenBank annotations, PDB files, and BLAST reports. They also gain experience writing utility programs for the analysis of biological data and identifying important sequence motifs.

Course 19971

Enrollment Information

Visit ucsc-extension.edu/biosciences, for the most up-to-date information about all our courses and programs, including textbooks, instructors, schedules and locations.

Enroll online at ucsc-extension.edu.

Sequence Analysis in Bioinformatics, Advanced

Designed for individuals who already have a solid grasp of simple alignment and phylogenetic analyses, this course addresses more sophisticated and cutting-edge computational methods and algorithms for the analysis of complex biological sequence data. Lecture topics include Hidden Markov Models for gene finding and conducting profile-based searches; probabilistic methods for phylogenetic analysis; RNA structure prediction techniques; stochastic context-free grammars for RNA analysis; and methods for conducting ultra-fast database searches.

Course 0036

Structure Analysis of Biological Molecules

The three-dimensional structure of a biological molecule is a critical determinant of its function. This course addresses the experimental and computational methods for determining three-dimensional molecular structure, with a primary focus on proteins. Students explore the concepts that underlie protein-based drug design, protein structure databases, protein structure classification methods, and physicochemical techniques for structural analysis of biological macromolecules. Theoretical and computational tools available for protein structure analysis, structure alignment, and protein structure prediction are also covered. One session is devoted to nucleic acid structure determination.

Course 5925



ucsc-extension.edu/bioinformatics

UCSC^{extension}
Silicon Valley

Silicon Valley's Leading
Bioscience Educator

Premier Bioscience Educator

Nearly 2000 professionals enroll in our bioscience programs each year—making us Silicon Valley's leading provider of professional education for the bioscience industry.

Rigorous Preparation Delivered by Experienced Professionals

Well-educated and well-connected instructors provide a rich learning environment and help to reveal opportunities in the highly interconnected Bay Area bioscience industry. UCSC Extension's bioscience instructors have extensive practical experience addressing real-world industry challenges, strong academic credentials and a passion for teaching.

Dynamic, Highly Educated Student Body

Virtually all of the students who enter our programs have Bachelor's degrees—and many have advanced degrees. Our highly-motivated student population brings a diversity of experience and an energy that enhance the learning environment.

Develop State-of-the-Art Expertise

Courses address the full range of activities—from basic research to non-clinical and clinical to commercialization—in the highly knowledge-based bioscience industry. The curriculum is constantly updated to reflect the latest technological advances, regulatory changes, ethical issues, business trends and standards of practice for U.S. and global markets. Professionals from biotechnology, pharmaceutical, medical device, diagnostics, and tool sectors alike benefit from the breadth and depth of the bioscience course offerings.

Programs That Build Careers

Working professionals come to UCSC Extension to build their careers rather than earn a degree. Students develop practical skills and gain exposure to tools and high-end resources that they can immediately put to work in their current job or to facilitate a career transition. Course projects offer hands-on experience in the development of documentation and strategy. Students hone their analytical skills and, in many of the programs, produce a portfolio of work that can be used to demonstrate their capabilities to potential employers. UCSC Extension has a track record rich with inspiring stories of successful career transitions in the life sciences industry.

How To Get Started—Program Contact

Applied and Natural Sciences Department,
(408) 861-3860 or e-mail
program@ucsc-extension.edu.

