

BIOINFORMATICS 2009-10



UNIVERSITY OF CALIFORNIA, SANTA CRUZ

THE BIOINFORMATICS MAJOR

The bioinformatics curriculum combines biology, chemistry, biochemistry, computer science, mathematics, statistics, bioethics, and specialized bioinformatics classes to develop tools to gain knowledge from biological data. We are particularly interested in interpreting data from high-throughput experiments, such as genome sequencing and gene expression chips. The undergraduate bioinformatics degree program prepares students for graduate school or a career in the fast-paced pharmaceutical or biotechnology industries. The B.S. curriculum provides exceptional training in bioinformatics, and is particularly demanding as it requires three graduate courses.

STUDY AND RESEARCH OPPORTUNITIES

- ◆ Undergraduate minor, B.S., M.S., and Ph.D.
- ◆ A combined B.S./graduate degree in bioinformatics is available that enables undergraduates to reduce by two the number of courses required for the graduate degree.
- ◆ Many formal and informal undergraduate research opportunities.
- ◆ The undergraduate minor is well suited for biology and computer science majors who are interested in bioinformatics, but not committed to it as their primary field.

ADMISSION TO THE JACK BASKIN SCHOOL OF ENGINEERING (BSOE)

Please see the current *UC Santa Cruz General Catalog* online for a full description of the BSOE admissions policy.

Freshman Applicants: Admission into a BSOE major is based on high school grade point average, test scores, courses completed in mathematics and sciences, and the personal statement. Applicants who are not accepted into the major at the time of admission to UCSC may still reapply for admission to the major after enrolling at UC Santa Cruz.

Transfer Applicants: Admission into the major is based on academic college record. Applicants are expected to take and excel in all courses that are equivalent to the major's foundation courses (see *Transfer Preparation* section). An applicant will be approved, conditionally approved, or denied. Students must complete most or all of the foundation courses to be approved or conditionally approved for the major.

HIGH SCHOOL PREPARATION

It is recommended that high school students intending to apply to the bioinformatics major have completed four years of mathematics (at least through advanced algebra and trigonometry) and three years of science in high school, including one year each of chemistry and biology. Comparable college mathematics and science courses completed at other institutions may be accepted in place of high school preparation. Students without this preparation may be required to take additional courses to prepare themselves for the program.

TRANSFER PREPARATION

The bioinformatics program strongly encourages applications from transfer students. The prerequisite structure for upper-division courses at UC Santa Cruz requires that many courses be taken sequentially. Because of this, it is necessary for prospective transfer students to have completed as many of the lower-division required courses as possible before transferring.

Transfer students should not follow the Intersegmental General Education Transfer Curriculum (IGETC) because it will not provide enough mathematics and science courses to allow them to complete the bioinformatics program in two years. Most students find it easier to spread the general education requirements out over four years.

Applicants must take and excel in all available courses that are equivalent to the major's foundation courses. UC Santa Cruz foundation courses in bioinformatics are:

- Computer Science 12A/L, *Introduction to Programming with Laboratory*, and 12B/M, *Introduction to Data Structures with Laboratory*
- Chemistry 1A, 1B/M, and 1C/N, *General Chemistry with Laboratory*
- Mathematics 19A and 19B, *Calculus for Science, Engineering, and Mathematics* (two quarters)

In addition to the foundation courses required for admission, transfer students are recommended to take other articulated lower-division courses for the major. Such courses are listed on the web site www.assist.org. For a complete list of lower-division courses for the major, visit www.bme.ucsc.edu/bioinformatics/curriculum.

RECOGNITION

The bioinformatics program is closely affiliated with the Department of Biomolecular Engineering (BME). BME researchers are pioneers in interpreting human genome data. A team of researchers at UC Santa Cruz, including Professor David Haussler and then-graduate student Jim Kent, used bioinformatics to create a powerful new computer program that assembled the “working draft” of the human genome announced in June 2000. The UC Santa Cruz genome browser (genome.ucsc.edu) is now one of the world’s premiere tools for genomic research, particularly comparative genomics. Among many other honors, Professor Haussler has recently been elected to the National Academy of Sciences.

UC Santa Cruz is also a leader in protein structure prediction. Professor Kevin Karplus has led successful teams of undergraduate and graduate students in the last five biennial Critical Assessment of Structure Prediction (CASP) experiments. Computational genomics, protein bioinformatics, systems biology, and RNA genes are major new foci of work at UC Santa Cruz with Professors Lowe, Gerloff, and Stuart.

The BME Department is growing rapidly and has doubled the number of its faculty in the last few years. Many new research opportunities are now available for bioinformatics students to work closely with experimental biology laboratories that demand the creation and application of computational and/or engineering techniques for the analysis of large datasets. These opportunities include working with labs investigating high-throughput and single molecule DNA and RNA sequencing (Professors Pourmand, Deamer, and Akesson), functional genomics investigations of the immune system including stem-cell differentiation (Professor Forsberg) and host-virus interactions (Professor Berman), and the characterization and analysis of multiple archaeal genome sequences (Professor Lowe). Bioinformatics students are encouraged to participate in research projects as juniors and seniors in the program.

See www.cbse.ucsc.edu/research/bioinfproject for more information about bioinformatics research by UC Santa Cruz faculty.

UNDERGRADUATE RESEARCH AND EDUCATION ABROAD OPPORTUNITIES

Undergraduates are strongly encouraged to get involved in biological, computer science, or bioinformatics research by their junior year. All bioinformatics faculty have undergraduates as part of their research teams, and undergraduate researchers often appear as authors on conference and journal papers. BSOE students may wish to develop their cross cultural competency, typically via the Education Abroad Program (EAP). Interested students must work very closely with the faculty and academic advisers in their major very early during the freshman or sophomore year to create a plan for transferability of course work towards graduation. For more EAP information, visit eap.ucop.edu/our_programs/countries.

FOR MORE INFORMATION

For further information about the bioinformatics major go to the bioinformatics page of the BSOE web site at www.bme.ucsc.edu/bioinformatics.

If you have other questions, contact
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