
Bioinformatics and Medical Informatics

In the College of Sciences

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General Information

Bioinformatics and medical informatics (BIOMI) are multidisciplinary fields at the intersection of computing and informatics, mathematics and statistics, biology, chemistry, and engineering.

The explosion in genomic information and in the elucidation of pathways of various types has created an unprecedented, but largely unmet, need for professionals with a working knowledge of the biological sciences and computing/statistical methods. The shortage, which is especially severe in the biotechnology and pharmaceutical industries, has been documented by various studies and discussed in the press. We can also observe a comparable demand in hospital and other clinical settings as the impact of new technologies spreads into clinical research and medical practice.

Research and development (R&D) in BIOMI can be categorized into one of three branches. The first branch is the algorithm development branch in which R&D specialists use mathematical and engineering techniques to develop new, more efficient, and/or more accurate methods to mine biological or clinical data. The second branch falls within the software engineering paradigm and primarily focuses on R&D in human-computer interface. The third branch seeks to find answers to specific biological or medical questions including drug development or working to uncover the underlying mechanisms involved in specific biological systems or specific diseases. In the first year of the program, students in consultation with their graduate adviser will take basic courses within two of the following four disciplines: biology, chemistry, computer science, and mathematics/statistics.

For specialization in the algorithm development branch, students can choose courses and projects in areas such as statistics, data mining, pattern recognition, artificial intelligence, search strategies, network architecture, digital image processing and advance imaging, modeling, decisions systems design, and analytical studies in various biological and clinical specializations. For specialization in the human-computer interface branch, students can choose courses and projects in areas such as principals of software design, human interface design, network architecture, usability studies, database design and management, computer graphics and animation, CAD, and programming languages. For the third specialization students take a combination of courses in the areas listed above plus some specialized courses such as computer aided drug design.

The change towards quantitative analysis in life and clinical sciences has been so rapid that universities have been caught unprepared: few offer suitable courses, and virtually none offer a well integrated curriculum that meets the needs that are sure to grow and evolve as life sciences become increasingly conceptual and quantitative.

San Diego State University's BIOMI graduate program offers two related but separable programs. The first is a professional science master concentration preparing students for immediate productivity in industrial or clinical settings. The second is a classical master of science preparing students for academic setting or continuation in a Ph.D. program.

Admission to Graduate Study

In addition to the general requirements for admission to the university with classified graduate standing, as described in Part Two of the Graduate Bulletin, a student must satisfy the following requirements before being considered for recommendation to enter the masters program.

(1) Meet the requirements deemed equivalent to a baccalaureate degree in biology, chemistry, computer science, mathematics, statistics, or a field in engineering.

(2) Meet BIOMI program's expectations on the GRE General Test.

(3) Be considered as capable of graduate work in bioinformatics or medical informatics by at least two letters of reference submitted to the BIOMI program director.

Students applying for admission should electronically submit the university application available at <http://www.csumentor.edu> along with the \$55 application fee.

Students who do not meet all of the above requirements for admission with classified graduate standing may be admitted with conditionally classified graduate standing upon the recommendation of the research program. Students so admitted will be advised as to the nature of their deficiency and the time to be allowed to achieve full classified graduate standing. Conditions may include satisfactory passing of certain undergraduate courses. These courses will be in addition to the minimum of 33-38 units required for the program.

Graduate Admissions

All applicants must submit admissions materials separately to SDSU Graduate Admissions and to the Bioinformatics and Medical Informatics program.

The following materials should be submitted as a complete package directly to:

Graduate Admissions
Enrollment Services
San Diego State University
San Diego, CA 92182-7416

(1) Official transcripts (in sealed envelopes) from all postsecondary institutions attended;

Note:

- Students who attended SDSU need only submit transcripts for work completed since last attendance.
- Students with international coursework must submit both the official transcript and proof of degree. If documents are in a language other than English, they must be accompanied by a certified English translation.

(2) GRE scores (<http://www.ets.org>, SDSU institution code 4682);

(3) TOEFL score, if medium of instruction was in a language other than English (<http://www.ets.org>, SDSU institution code 4682).

Master of Science Degree in Bioinformatics and Medical Informatics

The following materials should be mailed or delivered to:

Bioinformatics and Medical Informatics
(BIOMI) Graduate Program
(Attention: Graduate Adviser)
San Diego State University
5500 Campanile Drive
San Diego, CA 92182

(1) Two letters of recommendation (in sealed and signed envelopes) from persons in a position to judge academic ability.

(2) Personal statement of motivating interest for the program; also briefly describe research interests and educational and professional goals.

Advancement to Candidacy

All students must satisfy the general requirements for advancement to candidacy, as described in Part Two of this bulletin.

Specific Requirements for the Master of Science Degree

(Major Code: 07994)

In addition to meeting the requirements for classified graduate standing and the basic requirements for the master's degree as described in Part Two of this bulletin, the student must complete a program of study totaling 38 units for the concentration in professional science master and 33 units for the master of science as described below:

- Complete 12 units of required core courses.
 - BIOL 510 Molecular Evolution (3)
 - BIOL 568 Bioinformatics (3)
 - CHEM 560 General Biochemistry (3)
 - CS 600 Methods in Bioinformatics, Medical Informatics, and Cheminformatics (3)
- Complimentary: Nine units in a field complimentary to the student's background with approval of the graduate coordinator selected from the following courses.
 - CHEM 567 Biochemistry Laboratory II (3)
 - CS 505 Parallel Computing (3)
 - CS 514 Database Theory and Implementation (3)
 - CS 520 Advanced Programming Languages (3)
 - CS 535 Object-Oriented Programming and Design (3)
 - CS 689 Scientific Visualization (3)
 - STAT 550 Applied Probability (3)
 - STAT 551A Probability and Mathematical Statistics (3)
 - STAT 551B Probability and Mathematical Statistics (3) Devices (3)
- Electives: Six units of approved 500-, 600, or 700-level electives in disciplines related to the student's specialization with approval of the graduate coordinator.
- Six units of research including Thesis:
 - BIOMI 797 Research (3) Cr/NC/RP
 - BIOMI 799A Thesis or Project 799 (3) Cr/NC/RP

Professional Science Master Concentration

- Complete 12 units of required core courses.
 - BIOL 510 Molecular Evolution (3)
 - BIOL 568 Bioinformatics (3)
 - CHEM 560 General Biochemistry (3)
 - CS 600 Methods in Bioinformatics, Medical Informatics, and Cheminformatics (3)
- Complimentary: Twelve units in a field complimentary to the student's background with approval of the graduate coordinator selected from the following courses.
 - CHEM 567 Biochemistry Laboratory II (3)
 - CS 505 Parallel Computing (3)
 - CS 514 Database Theory and Implementation (3)
 - CS 520 Advanced Programming Languages (3)
 - CS 535 Object-Oriented Programming and Design (3)
 - CS 689 Scientific Visualization (3)
 - STAT 550 Applied Probability (3)
 - STAT 551A Probability and Mathematical Statistics (3)
 - STAT 551B Probability and Mathematical Statistics (3) Devices (3)
- Electives: Nine units of approved 500-, 600, or 700-level electives in disciplines related to the student's specialization with approval of the graduate coordinator.
- Six units of research including Thesis:
 - BIOMI 797 Research (3) Cr/NC/RP
 - BIOMI 799A Thesis or Project 799 (3) Cr/NC/RP

Courses Acceptable on Master's and Doctoral Degree Programs in Bioinformatics and Medical Informatics (BIOMI)

Refer to Courses and Curricula and Regulations of the Division of Graduate Affairs sections of this bulletin for explanation of the course numbering system, unit or credit hour, prerequisites, and related information.

GRADUATE COURSES

BIOMI 797. Research (1-3) Cr/NC/RP

Prerequisites: Consent of instructor.

Research in one of the fields of bioinformatics and medical informatics. Maximum credit six units applicable to a master's degree.

BIOMI 798. Special Study (1-3) Cr/NC/RP

Prerequisites: Consent of staff; to be arranged with graduate coordinator.

Individual study. Maximum credit six units applicable to a master's degree.

BIOMI 799A. Thesis or Project (3) Cr/NC/RP

Prerequisites: An officially appointed thesis committee and advancement to candidacy.

Preparation of a project or thesis for the master's degree.