



# B.S. in Bioinformatics

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## Career Outlook

The Genomic Era in biology really kicked off at the beginning of this century, with the sequencing of the human genome, and it's been gathering momentum as an astounding amount of genome sequence data from all over the world has been made available in public databases online.

Breakthroughs in technology have dramatically decreased the cost of genome sequencing, making it feasible to sequence the genomes of more and more different species from all of the kingdoms of living things, and from more and more individual humans.

Scientists, mathematicians, and computer programmers have simultaneously been developing better and better algorithms for analyzing genome sequences to find biologically relevant information. Other technologies have improved our ability to determine gene activation in which cell types under which circumstances, determine the structures of proteins, which proteins interact with each other, and where proteins localize in cells.

All of this information is giving us a more comprehensive understanding of the machinery that keeps living things going, and that make each species of living thing unique.

Bioinformatics combines the skillsets of biology, mathematics, computer science, chemistry, and physics to arrive at fundamental new insights into how living things function. These insights lead to better understanding human diseases such as cancer, infectious diseases, and genetic disorders. In fact, the tremendous explanatory power of bioinformatics has made it a central part of the modern science of biology, and the full potential of

this field has not been realized yet. If problems in biology and medicine excite you and you find mathematics and computer science interesting, then our bioinformatics major may be for you.

## Opportunities

The field of bioinformatics is growing at a breathtaking rate. The beginning of this century saw the first human genome sequence at a cost of over one billion dollars. Now, thousands of individual human genomes are sequenced every year for only a few thousand dollars each. Genomics and proteomics promise to play an ever-increasing role in medicine, making this a perfect pre-medical major.

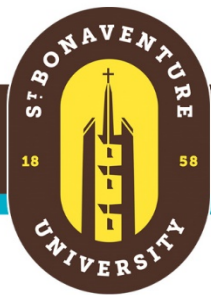
Future bioinformaticians will mine sequence data for insights into biological function and into disease processes. They will engineer proteins for new uses and will formulate and solve new problems in mathematics, statistics, and computer science.

Researchers trained in bioinformatics can lead research teams or work collaboratively with a variety of research teams at one company, university, or research institute.

The mathematical skills of bioinformaticians in particular distinguish them from many other biologists, as the statistical and other mathematical tools used in biology become increasingly sophisticated.

## Curriculum

Our curriculum gives you excellent preparation for careers in either research or health care. In addition to mastering the core natural-science courses of the biology major, our students develop expertise in mathematics and computer science, as well.



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Classes are small with many opportunities to gain practical hands-on experience.

Depending on your interests, you can emphasize the biological or the computational side. Throughout your four years, faculty participate in helping you choose a curriculum best suited to your interests and preparing you for the next stage of your career. Your last year will bring you to the forefront of this exciting new field.

Undergraduates earning a bachelor of science degree in bioinformatics have an interdisciplinary knowledge base ideally suited to pursuing graduate studies in bioinformatics, genomics, molecular biology, computational biology, protein chemistry, and allied fields—or professional studies in health-care.

## Degree Requirements

The bioinformatics major has one of the most interdisciplinary curricula in the university, including courses in biology, mathematics, computer science, chemistry and physics. Depending on what electives a student takes, one can fulfill almost all of the prerequisites for medical school and other health-care professional programs within the Bioinformatics major.

### Biology courses

BIO 105. Biological Science I  
BIO 106. Biological Science II  
BIO 291. Genetics  
BIO 371. Biochemistry  
BIO 466. Molecular Biology  
BIO 494. Genomics

### Mathematics courses

MATH 151. Calculus I  
MATH 152. Calculus II

MATH 207. Discrete Mathematics I  
MATH 208. Discrete Mathematics II  
MATH 322. Mathematical Probability  
MATH 323. Mathematical Statistics

### Computer Science courses

CS 131. Computer Science I  
CS 132. Computer Science II  
CS 333. Algorithms and Data Structures

### Chemistry courses

CHEM/CHML 101. General Chemistry I  
CHEM/CHML 102. General Chemistry II  
CHEM/CHML 301. Organic Chemistry I

### Physics courses

PHYS/PHYL 103. General Physics I  
PHYS/PHYL 104. General Physics II

### Bioinformatics electives (two of the following)

BIO 321. General Microbiology  
BIO 390. Evolution  
MATH 241. Linear Algebra  
MATH 431. Numerical Analysis  
CS 243. Database Management Systems  
CS 332. Theory of Computation  
CHEM 302. Organic Chemistry II  
CHEM 401. Physical Chemistry I  
CHEM 470. Mechanisms in Biological Systems

Bioinformatics majors also complete the same general education requirements as other SBU students.