Bioinformatics

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Bioinformatics is the study of biology, biochemistry, biophysics, medicine, and health, using the discrete analytical tools of mathematics and computer science. Technologies spawned by the Human Genome Project have produced an avalanche of biological and biomedical data in the last two decades, with more being produced all the time. In order to make sense of this data computational and statistical techniques are essential, in addition to a deep understanding of biology.

Students majoring in Bioinformatics can look forward to careers in research institutes affiliated with governments, universities, and health systems, and in the healthcare, biotechnology, and pharmaceutical industries. This is a growing field with a wide range of career opportunities at the Bachelors, Masters, and Doctoral degree levels. Graduates of the program may find themselves creating databases for a gene discovery project, using computer modeling to characterize the structure and function of a newly discovered protein, employing computational models to predict the spread of disease, or managing complex data sets produced by clinical trials or hospital diagnostics.

Bioinformatics at Saint Vincent College provides students with a distinctive combination of analytical and scientific training coupled with a broad-based liberal arts education. This mixture is a natural fit at Saint Vincent, allowing students to experience interdisciplinary connections both among the sciences and in relation to the world around them. Opportunities for exploring individual interests within and across disciplines are encouraged, including summer internships and research experiences, and students are able to design and carry out their own bioinformatics project as a capstone experience.

BS Bioinformatics
Requirements for a Bachelor of Science degree in Bioinformatics
(See Core Curriculum requirements.)

Major Requirements (66 credits)
The student must complete the requirements listed in the following categories:

Computing and Information Science Requirements (18 credits)

CS 110	Computing and Information Science I	3
CS 111	Computing and Information Science II	3
CS 170	Discrete Structures I	3
CS 221	Data Structures	3
CS 310	Programming Languages	3
CS 350	Database Concepts and Information Structures	3

Mathematics Requirements (8 credits)

MA 111	Calculus I	4
MA 112	Calculus II	4

Biology Requirements (19 credits)

BL 150	General Biology I	3
BL 152	General Biology II	3
BL 151	General Biology Laboratory I	1
BL 153	General Biology Laboratory II	1
BL 208	Cell Biology	3
BL 209	Cell Biology Laboratory	1
BL 214	Molecular Genetics	3
BL 215	Molecular Genetics Laboratory	1
BL 260	Biostatistics	3

Chemistry Requirements (12 credits)

CH 101	General Chemistry I	3
CH 102	General Chemistry II	3
CH 103	General Chemistry Laboratory I	1
CH 104	General Chemistry Laboratory II	1
CH 170	Organic Chemistry Overview	3
CH 171	Organic Chemistry Overview Laboratory	1

Bioinformatics Requirements (9 credits)

BIN 218	Bioinformatics, Genomics, and Proteomics	3
BIN 219	Biomedical Informatics	3
BIN 358	Bioinformatics Project I	1
BIN 359	Bioinformatics Project II	2

Typical Freshman Year Schedule	Fall	Spring
General Biology I and II	3	3
General Biology Laboratory I and II	1	1
Computing and Information Science I and II	3	3
Calculus I and II	4	4
Language & Rhetoric and		
Exploring Religious Meaning (Core)	3	3
Total:	14	14

Course Descriptions

BIN 218 Bioinformatics, Genomics, and Proteomics
An introduction to various techniques used in bioinformatics, including the algorithms and statistical concepts upon which they are based. The focus is on comparison and analysis of DNA and protein sequences. Students will learn about the types of biological questions that can be addressed using computational methods, and develop a deeper understanding of the computational tools available to address these questions. This understanding will be demonstrated in an end-of-semester project. Topics covered will include pairwise sequence alignment, sequence database searching, multiple sequence alignment, genome analysis, protein structure modeling, and an introduction to proteomics. Students majoring in any of the natural sciences, computing and information science, or mathematics are welcome to take the course. Offered Fall semester. Three credits.

BIN 219 Biomedical Informatics
An introduction to a variety of data types, databases, and data structures used in bioinformatics. The focus is on relational databases and integration of diverse data types in a biomedical context. Students will learn how existing database tools, such as Microsoft Access and MySQL, can be used in biomedical informatics using data from authentic clinical trials as an example. Topics covered will include relational databases, data modeling, and integration of biological data. Also covered will be introductions to various biomedical assays (e.g. flow cytometry, microarrays, Enzyme-linked immunosorbent assays) and the types of data they produce. Students majoring in any of the natural sciences, computing and information science, or mathematics are welcome to take the course. Offered Spring semester. Three credits.

BIN 333 Special Study
The student will pursue a faculty directed course of study. Variable credit. May be repeated.

BIN 358 Bioinformatics Project I
The capstone senior project is begun in this course. The student will pick a project, research the literature, and determine the requirements for completing the project. The student will present a project proposal, and may begin working on the project. Projects may be part of a team project, and students may have co-advisors from different departments. Offered Fall semester. One credit.

BIN 359 Bioinformatics Project II
The capstone senior project initiated in BIN 358 is completed in this course. The student will give written and oral presentations on the project at the end of the semester. Prerequisite: BIN 358. Offered Spring semester. Two credits.

BIN 550 Bioinformatics Internship
Work experience program extending the learning experience beyond the college into the world of work, through internships, field work, and cooperative programs. Students may or may not be paid depending on the site. May be repeated. Variable credit.

Biology

James G. Barnett, Chairperson
David A. Bell, Jr.; Bruce D. Bethke; James S. Kellam; Jennifer L. Koehl; Michael Rhodes; Cynthia A. Walter

The biology program lays a foundation for graduate study in biology, and for training in the professions and technologies based upon the biological sciences. As undergraduates, students should be broadly trained; should be knowledgeable in an area of specialization; should understand the process by which scientists ask and pursue the answers to questions; and should be acquainted with ethical principles and issues as they relate to the field of biology.

Both the B.A. and B.S. degrees are awarded in Biology. B.S. students must complete 36 credits in biology while B.A. students must complete 33 credits. Freshman students begin with General Biology (BL 150-153) where cellular, organismal and population biology are introduced. Subsequently, they elect one of three areas for concentration. During the sophomore, junior and senior years, they complete Cell Biology, one advanced course with lab in each of the three areas, and an additional advanced course with lab in their chosen concentration. Additionally, during the last semester of the junior year and through the senior year, students plan and complete a senior research project under the supervision of individual faculty. Finally, students also must complete one year of General Chemistry, one year of Organic Chemistry, and one year of Physics. B.S. students must complete one year of Calculus while one semester of Calculus is required of students electing the B.A. degree. It is strongly recommended that B.A. students complete a second semester of Calculus, and that all students complete one semester of statistics before their senior year. General Biology is a prerequisite for all advanced courses. With the exception of General Biology, only courses above BL 200 may be applied toward the total biology credits required.

In individual circumstances and with permission of the chairperson, a course may be substituted for one of the required courses listed under the cellular, organismal, and population concentrations. Students should work closely with their advisors.

Students are cautioned to give careful and serious consideration to the selection of courses because requirements and recommended courses may differ among professional and graduate schools.

Finally, since questions of an ethical and moral nature often arise in biology and related fields, students are encouraged to include a bioethics course in their curriculum.

Teacher Preparation

Additional Science Course Requirements for Certification in Biology (7-12): In addition to a major in biology, the certification candidate must satisfy the following special requirements:

PH 106	Physical Geology	3
PH 107	Physical Geology Laboratory	1

See Education Department guidelines to plan core classes and other courses required for certification.