Curricular Affairs Committee of the Faculty Senate

To: The UVM Faculty Senate
From: Curricular Affairs Committee of the Faculty Senate, Laura Almstead, Chair
Date: November 7, 2019
Re: Approval of a proposal for a new Minor in Bioinformatics submitted by the College of Agriculture and Life Sciences

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At its meeting on November 7, 2019, the Curricular Affairs Committee approved the actions recommended in the following memo.

The Curricular Affairs Committee approved a proposal for a new Minor in Bioinformatics from the Department of Microbiology and Molecular Genetics (MMG) in the College of Agriculture and Life Sciences (CALS). If approved by the Faculty Senate and Board of Trustees, the minor will be offered beginning fall 2020.

Program Description, Rationale, and Justification

Bioinformatics is a rapidly emerging discipline defined as "the collection, classification, storage, and analysis of biochemical and biological information using computers, especially as applied to molecular genetics and genomics" (Merriam-Webster, 2019). The proposed Bioinformatics minor is designed for students interested in the study of genetic diseases, public health and epidemiology, infectious diseases, microbial ecology, and other life science topics through the application of recent advances in computer technology and statistics. Students completing the minor are expected to be able to 1) describe and apply basic bioinformatics information, concepts, and experimental techniques, and 2) apply ethical principles with regard to scientific research, patient information, student and faculty interactions and resources.

The proposed minor will allow students to take advantage of new employment opportunities in the fields of biotechnology and biomedical research, as well as support their applications to graduate and medical programs.

Evidence for Demand

Current national and international research trends in fields such as ecology, evolution, microbiology, and molecular genetics necessitate a strong working knowledge of the concepts of bioinformatics. Currently a number of UVM laboratories from a variety of departments utilize bioinformatical approaches in their research. This minor would help support the development of a cadre of students able to more fully engage in on-going research across the campus while also preparing them for future employment of further schooling.

Relationship to Existing Programs and Anticipated Impact on Existing Programs

Currently, there are no minors at UVM that include bioinformatics as a core component of their required coursework, or that combine components of biological science, computer science, and statistics as their core and prerequisite requirements.

Curriculum

Completion of the minor will require a total of 18 credit hours comprised of four required courses (12 credits) plus six credits chosen from a set of elective courses (see table below). A total of ten credit hours of prerequisite courses are also required. All courses currently exist and are offered on a regular basis.

Prerequisite Courses (10 credits total)		**Credits**
BIOL 001, BIOL 002, BCOR 011, or BCOR 012	Principles of Biology Exploring Biology	4
CS 20 or CS 21	Programming for Engineers or Computer Programing	3
STAT 111, STAT 141, or STAT 143	Elements of Statistics, Basic Statistical Methods, or Statistics for Engineering	3
Required Courses (12 credits total)		**Credits**
MMG 106	Introduction to Biomedical Research Methods	3
MMG 231	Programming for Bioinformatics	3
MMG 232	Methods in Bioinformatics	3
MMG 233	Genetics and Genomics	3
Elective Courses (6 credits total)		**Credits**
MMG 197/198	Undergraduate Research	1 – 6
MMG 211	Prokaryotic Molecular Genetics	3
CS 124	Data Structures and Algorithms	3
CS 254	Machine Learning	3
STAT 087	Introduction to Data Science	3
STAT 200	Medical Biostatistics & Epidemiology	3
STAT 201	Statistical Computing & Data Analysis	3

The proposed minor will be available to all majors across the University, however students in the minor may only count up to two required or elective courses toward this minor and any other major or minor.

Anticipated Enrollment and Impact on Current Programs

The proposers expect approximately 20 to 30 students will ultimately be enrolled in the minor. They do not anticipate inauguration of the minor will significantly impact enrollments in the courses, nor do they expect the proposed minor to significantly affect any of the existing minors at UVM.

Advising

In addition to current MMG undergraduate advisors (Drs. Gilmartin, Guy, Johnson, Hodge, and Murray), Dr. Julie Dragon, Director of the Bioinformatics core, will also act as an advisor for students in the minor.

Assessment Plan

Assessment of the proposed Bioinformatics minor will be carried out by the MMG advisors and the MMG Undergraduate Affairs Committee. It will focus on determining if students are meeting the proposed learning outcomes which include: 1) to be able to describe and apply basic bioinformatics information, concepts, and experimental techniques, and enrollment in 2) to be able to apply ethical principles with regard to scientific research, patient information, student and faculty interactions and resources. Metrics used for assessment include students' GPAs in the core and elective courses, particularly MMG 231 and MMG 232, and a degree audit assessment.

Staffing Plan, Resource Requirements, and Budget

All courses that are part of the proposed minor currently exist, are taught on a regular basis, and have capacity for the expected enrollment. There are no anticipated new faculty or staff appointments associated with the minor, nor are there any anticipated costs associated with the inauguration of the minor.

Evidence of Support

Letters of support were received from the individuals below. The proposed minor was also approved by the CALS curriculum committee and the CALS faculty.

- Chair of Computer Science, Christian Skalka
- Dean of CALS, Jean Harvey

Summary

Students pursuing an academic career and/or employment in the fields of biotechnology and biomedical research require a strong working knowledge of bioinformatic approaches. It is anticipated that the proposed minor will be of interest to majors from across campus, including animal sciences, biochemistry, biology, integrated biological sciences, computer science, microbiology, molecular genetics, neuroscience, nutrition and food science, plant and soil science, plant biology, and statistics. Students that complete the minor will be better positioned to conduct research while at UVM, and will gain skills beneficial in future graduate studies and/or careers.