# BIOCHEMISTRY AND MOLECULAR BIOLOGY

CURRICULUM COMMITTEE:
*William Morgan (Biology), Chair*
*Paul Edmiston (Chemistry)*
*Dean Fraga (Biology)*
*Mark Snider (Chemistry, on leave 2012-2013)*
*Stephanie Strand (Biology)*
*James West (Biochemistry and Molecular Biology)*

This interdisciplinary program, jointly administered by faculty from the Departments of Biology and Chemistry, enables students to ask and explore fundamental questions concerning the molecular events that occur in organisms. Students who complete this program will possess an understanding of the structures of biological molecules, the reactions involved in biological energy conversions, the formation and organization of complex cellular structures, and the communication of biological information spatially and temporally.

Through its curriculum, the Biochemistry and Molecular Biology Program seeks to develop students who:

- Possess a broad and fundamental understanding of biology and chemistry with particular focus on how molecules found in biological systems confer the properties of living organisms.
- Are able to perform the common methods and use the tools of the field including laboratory and computational techniques.
- Can conduct independent scientific investigation and scientific inquiry.
- Are able to locate, evaluate, and communicate scientific information effectively both by written and oral presentation.

**Major in Biochemistry and Molecular Biology**

Consists of sixteen courses:

- CHEM 11000 (see note below)
- CHEM 12000
- MATH 11100 (see note below)
- BIOL 20000
- BIOL 20100
- CHEM 21100
- CHEM 21200
- PHYS 20300 or 10100
- BIOL 30500
- BIOL 30600
- BCMB 30300
- BCMB 33100
- One of the following courses: BCMB 33200 or 33300
- Junior Independent Study: BCMB 40100
- Senior Independent Study: BCMB 45100
- Senior Independent Study: BCMB 45200

**Special Notes**

- Refer to the catalogue section for *Chemistry* for information concerning CHEM 11000/12000 placement exams. Students who place out of CHEM 11000 must

take one elective from the following: BCMB 33200, 33300, BIOL 30400, 30700, 33500, CHEM 21500, IDPT 20013, or NEUR 38000.

- The MATH 11100 requirement may be fulfilled by successful completion of both MATH 10700 and 10800.
- There is no minor in Biochemistry and Molecular Biology.
- A student may not double major in Biochemistry and Molecular Biology with Biology, Chemistry, or Neuroscience.
- To complete the Biochemistry and Molecular Biology major, students should follow the sequence below:

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| First Year: | CHEM 12000 (and 11000, if needed)<br>BIOL 20000, 20100 |
| Sophomore Year: | CHEM 21100, 21200<br>BIOL 30500, 30600<br>MATH 11100 (or 10700 and 10800)<br>PHYS 20300 (or 10100) |
| Junior Year: | BCMB 30300, 33100, and either 33200 or 33300<br>BCMB 40100 |
| Senior Year: | BCMB 45100, 45200<br>One required elective for students placing out of CHEM 11000 |

- A student who desires to replace a course listed above with a different course to count toward the major can petition the BCMB Curriculum Committee.
- A BCMB major who desires an American Chemical Society-Certified Biochemistry Degree is required to take the following courses in addition to the course requirements for the BCMB major: CHEM 21500, CHEM 31800, MATH 11200, and PHYS 20400. The A.C.S.-certified degree is encouraged for those students who plan to enter a graduate program in a biochemical discipline.
- Required courses in the major, including Physics and Mathematics, must be passed with a grade of C– or higher. All courses must be taken concurrently with the corresponding laboratory.

## BIOCHEMISTRY AND MOLECULAR BIOLOGY COURSES

**BCMB 30300. TECHNIQUES IN BIOCHEMISTRY AND MOLECULAR BIOLOGY (Biology, Chemistry)**
This laboratory-based course gives students hands-on experience with experimental methods used in biochemistry and molecular biology. It is organized around a semester-long project in which students design and work toward specific research goals. This course counts for major credit in Biology and Chemistry. BCMB majors are encouraged to have prior or concurrent enrollment in BCMB 33100. *Prerequisites: C- or better in CHEM 12000 and BIOL 20100. Annually. Fall and Spring 2012-2013.*

**BCMB 33100. PRINCIPLES OF BIOCHEMISTRY (Biology, Chemistry)**
This course focuses on the structural and chemical properties of the four main categories of biological molecules — amino acids, nucleic acids, carbohydrates, lipids — as a means of critically analyzing the functions of complex biological macromolecules and cellular processes at the molecular level. Structure, equilibria, thermodynamics, kinetics and reactivity of biological macromolecules, with emphasis on proteins and enzymes, are the course cornerstones. Principles of bioenergetics and intermediary metabolism (glycolysis, citric acid cycle, and oxidative phosphorylation) also discussed. Critical thinking and inquiry encouraged by analysis and discussion of current research literature. This course counts for major credit in Biology and Chemistry. Concurrent enrollment in BCMB 30300 highly recommended. Suggested previous courses: BIOL 20100, 30500 and 30600. *Prerequisite: C- or better in CHEM 21200 and BIOL 20000 or by permission of instructor. Annually. Fall. [MNS]*

**BCMB 33200. BIOCHEMISTRY OF METABOLISM (Biology, Chemistry)**
A continuation of BCMB 331 with molecular and mechanistic emphasis on advanced cellular metabolism, metabolomics, signal transduction, as well as DNA, RNA and protein metabolism. Critical thinking and inquiry encouraged by analysis and discussion of current research literature. This course counts for major credit in Biology and Chemistry. *Prerequisite: C- or better in BCMB 33100 or permission of instructor. Annually. Spring. [MNS]*

**BCMB 33300. CHEMICAL BIOLOGY (Biology, Chemistry)**
This course explores how chemistry can be utilized to examine and manipulate molecular events in biological systems. Specifically, the course is divided into different units, including proteomic profiling, enzyme activity profiling, metabolic engineering, and protein engineering. Critical thinking and inquiry encouraged by analysis and discussion of current research literature. This course counts for major credit in Biology and Chemistry. *Prerequisite: C- or better in BCMB 33100 or permission of instructor. Alternate years. Not offered 2012-2013.*

**BCMB 40000. TUTORIAL**
Special and advanced topics in Biochemistry & Molecular Biology. Evaluation of the student's accomplishment will be based on a contract with the supervising professor. Students apply to the program chairperson for this option. This course does not count toward a major in Biochemistry and Molecular Biology. *(.5 - 1 course credit) Prerequisite: The approval of both the supervising faculty member and the chairperson is required prior to registration.*

**BCMB 40100. INTRODUCTION TO INDEPENDENT STUDY**
This course focuses on scientific writing, experimental design, and informational retrieval systems, including accessing and evaluating the growing collection of molecular databases. Students explore the literature related to their proposed senior I.S. thesis through a series of structured writing assignments that culminate in a research proposal for the senior project. In addition, students learn the mechanics of scientific presentations and give a brief seminar on their proposed project. *Annually. Spring.*

**BCMB 45100. SENIOR INDEPENDENT STUDY – SEMESTER ONE**
An original investigation is conducted, culminating in a thesis and oral defense of the thesis in the second semester. During the year each student gives at least one research poster and oral presentation on the research topic. A student normally has one research advisor. *Prerequisite: C- or better in BCMB 40100.*

**BCMB 45200. SENIOR INDEPENDENT STUDY – SEMESTER TWO**
The thesis is evaluated by the research advisor and one other professor from the BCMB Curriculum Committee, in consultation with the other members of the BCMB Curriculum Committee. *Prerequisite: BCMB 45100.*