

Biochemistry and Molecular Biology

BIOLOGICAL SCIENCES

Charles J. Bieberich
Molecular biology of development

Rachel Brewster
Developmental biology, neuroscience, genetics, molecular and cell biology

Mauricio M. Bustos
Plant molecular biology

Nessly C. Craig
Molecular biology of mammalian cells

David M. Eisenmann
Developmental biology, genetics, molecular biology

Philip J. Farabaugh
Molecular genetics

Lasse Lindahl
Molecular biology, gene expression

Paul S. Lovett
Microbiology, molecular biology, gene expression

Patricia McGraw
Molecular biology, membrane transport

Kevin Omland
Evolution, molecular systematics, avian behavior/ecology

Michael C. O'Neill
Genetic regulation

Phyllis R. Robinson
Neurobiology

Suzanne O. Rosenberg
Immunology

Richard E. Wolf, Jr.
Molecular biology, gene regulation

Janice Zengel
Molecular biology/genetics, structure/function of RNA, ribosome synthesis

J. Lynn Zimmerman
Plant molecular biology, plant development

CHEMISTRY AND BIOCHEMISTRY

Bradley R. Arnold
Time-resolved polarized spectroscopy

C. Allen Bush
Biophysical chemistry of complex carbohydrates

Donald J. Creighton
Enzyme chemistry of sulfur

Daniele Fabris
Bioanalytical chemistry, mass spectrometry of nucleic acid adducts, protein-nucleic acid interactions

James C. Fishbein
Organic chemistry, reaction mechanism and reactive intermediates, chemical toxicology

Susan K. Gregurick
Molecular dynamic modeling

Ramachandra S. Hosmane
Organic synthesis, biomedical chemistry

Richard L. Karpel
Protein-nucleic acid interactions

Lisa A. Kelly
Photoredox-initiated bond cleavages

William R. LaCourse
Pulsed electrochemical detection techniques

Mark Perks
Organic and environmental chemistry

Ralph M. Pollack
Bio-organic chemistry and enzymatic catalysis

Vera R. da Silva
Biochemistry laboratory, health science chemistry

Paul J. Smith
Protein and DNA binding by small molecules

Michael F. Summers
Nuclear magnetic resonance, bioinorganic chemistry

Veronika A. Szalai
Bioinorganic chemistry of amyloid proteins — nucleic acid-based majestrate materials

programs while being mentored by experienced, enthusiastic and dedicated faculty.

Career and Academic Paths

Approximately 60 percent of all UMBC biochemistry graduates continue their education in graduate and other professional programs, including those at such highly competitive schools as Harvard; University of Virginia; Duke; Washington University; Stanford; University of California, San Francisco; MIT; The Johns Hopkins University; Princeton; Cal Tech; and Carnegie Mellon.

Program graduates also compete well in the work force, finding employment with such organizations as the National Cancer Institute, Hoffmann LaRoche, Proctor & Gamble, GlaxoSmithKline and the FDA.

Academic Advising

First-year students (both freshman and transfer students) who express an interest in biochemistry and molecular biology initially will be advised by the program's first-year advisor. After one year, they will be assigned to one of the participating faculty for advising. Students are required to see their advisors at least once each semester. Academic progress is monitored through graduation.

Courses in this program are listed under BIOL and CHEM.

The Biochemistry and Molecular Biology Program (under the auspices of the biological sciences and the chemistry and biochemistry departments) offers students a unique interdisciplinary curriculum and exposure to a range of faculty members. With a curriculum drawing from both disciplines, as well

as specific biochemistry courses, the program provides a broad background in the physical and life sciences. It is suitable for students planning careers in laboratory research or further training in graduate, medical or other biomedical professional programs, such as medicine, dentistry and medical technology.

Research centers for electron and light microscopy, mass spectrometry, nuclear magnetic resonance spectroscopy and labs specializing in varied topics, including gene regulation, neurobiology, laser spectroscopy and plant molecular biology, give students the opportunity to work in actual research

Major Program**Bachelor of Science (B.S.)**

The B.S. program consists of 75-78 credits distributed as in the following list. Note that students are expected to complete CHEM 437, 438, 437L and the two electives at UMBC. Any other courses required for the major must be approved by the program.

A. Chemistry (26-27 credits)

CHEM 101
Principles of Chemistry I

CHEM 102
Principles of Chemistry II

CHEM 102L
Introductory Chemistry Lab

CHEM 300
Analytical Chemistry

CHEM 301
Physical Chemistry I **OR**
CHEM 303
Physical Chemistry for
the Biochemical Sciences

CHEM 351
Organic Chemistry I

CHEM 352
Organic Chemistry II

CHEM 351L
Organic Chemistry
Laboratory I

CHEM 352L
Organic Chemistry
Laboratory II

B. Biology (15 credits)

BIOL 100
Concepts of Biology

BIOL 100L
Concepts of
Biology Laboratory

BIOL 302
Molecular and
General Genetics

BIOL 303
Cell Biology

BIOL 302L
Molecular and General
Genetics Laboratory **OR**
BIOL 303L
Cell Biology Laboratory

C. Biochemistry (12 credits)

CHEM 437
Comprehensive Biochemistry I

CHEM 437L
Biochemistry Laboratory

CHEM 438
Comprehensive Biochemistry II

D. Any two of the following electives (6-8 credits):

BIOL 411
Bacterial Physiology

BIOL 414
Eukaryotic Genetics and
Molecular Biology

BIOL 420
Advanced Topics in
Cell Biology

BIOL 425
Immunology

BIOL 426
Approaches to
Molecular Biology

BIOL 428
Computer Applications in
Molecular Biology

BIOL 434
Microbial Molecular Genetics

BIOL 443
Advanced Topics in
Developmental Biology

BIOL 445
Signal Transduction

BIOL 451
Neurobiology

BIOL 454
Vision Science

BIOL 456
Plant Molecular Biology

BIOL 475
Biology of Bacteria

BIOL 483
Evolution: From Genes
to Genomes

CHEM 406
Bioinorganic Chemistry

CHEM 431
Chemistry of Proteins

CHEM 432
Advanced Biochemistry

CHEM 433
Biochemistry of Nucleic Acids

CHEM 435
Biochemistry of Complex
Carbohydrates

CHEM 441
Physical Chemistry
of Macromolecules

CHEM 442
Physical Biochemistry

CHEM 443
Spectroscopy of Biopolymers

CHEM 444
Molecular Modeling
in Biochemistry

CHEM 450
Chemistry of
Heterocyclic Compounds

CHEM 451
Mechanisms of
Organic Reactions

CHEM 453
Organic Chemistry of
Nucleic Acids

CHEM 455
Biomedical Chemistry

CHEM 457
Total Synthesis of
Natural Products

CHEM 461
Advanced Instrumental
Methods of Analysis

CHEM 470
Toxicological Chemistry

CHEM 472
Enzyme Reaction Mechanisms

CHEM 601
Special Topics in Chemistry:
Advance NMR Spectroscopy

CHEM 635
Biochemistry of
Complex Carbohydrates

CHEM 640
Special Topics in
Molecular Structure

CHEM 680
Seminar in
Biophysical Chemistry

CHEM 682
Current Topics in Biochemistry

CHEM 684A
Special Topic:
Organic Spectroscopy

E. Mathematics and Physics (16 credits)

PHYS 121
Introductory Physics I

PHYS 122
Introductory Physics II

MATH 151
Calculus and Analytic
Geometry I

MATH 152
Calculus and Analytic
Geometry II*

F. Individual lab research 1-4 credits (recommended)

Students have the opportunity to integrate what they have learned by doing independent research with participating faculty. Those working with a biological sciences faculty member may register for BIOL 399 or 499. Those working in a chemistry and biochemistry departmental faculty laboratory may register for CHEM 399 or 499.

*MATH 251 and CHEM 302 are recommended for those anticipating graduate study in chemistry, biophysical chemistry or biophysics.

G. Electives

The following courses, which have variable topics, may be approved as biochemistry electives in those years when their topic is appropriate (subject to confirmation in each case by the Biochemistry Undergraduate Committee):

CHEM 490A
Special Topics in Chemistry

CHEM 601
Current Topics in Chemistry

CHEM 670
Special Topics in Dynamics and Mechanisms Appropriate UMB courses

CHEM 684
Special Topics in Chemistry

In fulfilling major requirements, CHEM 437, 438 and 437L must be completed with a grade of "C" or better. An overall "C" average must be maintained in required courses. Prerequisites for all courses in the major must be satisfied with a grade of "C" or better.

Honors Program

While the Biochemistry and Molecular Biology Program does not have an honors program, specific honors sections of BIOL 100H: Concepts of Biology and CHEM 101H and CHEM 102H: Introductory Chemistry courses are offered. In addition, departmental honors are awarded by the chemistry and biochemistry department to biochemistry and molecular biology graduates achieving scholastic excellence in their chemistry and biochemistry courses, which is defined as a GPA of 3.5 or better in 18 or more credit hours of chemistry and biochemistry classes, combined with an overall GPA of at least 3.0.

Eligible students also may apply for the honors program of the biological sciences department (see "Honors Program" under Biological Sciences).

Combined B.S./M.S.

Qualified students may pursue a combined B.S. in Biochemistry and Molecular Biology/M.S. in Applied Molecular Biology. Students interested in the Applied Molecular Biology Program will be considered for admission to the five-year combined program on a competitive basis. Students can use up to two courses from their undergraduate degree in biochemistry and molecular biology and, in so doing, save money and reduce their graduate course work.

Students should consult with the director of the Applied Molecular Biology Program for advisement as to which courses will be appropriate for both degrees. Application for admission should be submitted prior to the final semester of the senior year. For more information, see the AMB Web site at www.umbc.edu/biosci/Graduate/amb.html.

Special Opportunities

Biochemistry majors have the opportunity to participate in research in both participating departments at UMBC, as well as at nearby institutions such as the National Institutes of Health and the Walter Reed Medical Center. Special programs and fellowships have placed biochemistry students in labs of eminent scientists nationally and internationally.

Many advanced biochemistry and molecular biology majors are tutors in the Chemistry Tutorial Center, helping to provide free tutoring for fellow students enrolled in freshman and sophomore chemistry courses.

Student Organizations

Biochemistry majors play an active role in the Chemistry/Biochemistry Council of Majors (CHEM/COM), an American Chemical Society student affiliate chapter, which supports an active professional and social program. CHEM/COM activities are described in the student organizations section of the chemistry and biochemistry department listing.

Majors are also often active in various preprofessional societies (premedical, pre dental, etc.) on campus. Some majors are also active in the Biology Council of Majors described under the biological sciences department listing.