Biochemistry and Molecular Biology

http://bm.med.miami.edu/

Dept. Code: BMB

(Code for the major is either Track 1: BCHM or Track 2: BCHN)

Introduction

Biochemistry is the chemistry of life. It includes or has large areas of overlap with molecular biology, biophysics, structural biology, cell biology, metabolism, neuroscience, nutrition, genetics, etc. It tries to explain what happens in living organisms and how biological processes are regulated. It is a relatively young science. Our understanding is still developing and students can learn something new every day. An Undergraduate Major in one of our two tracks, Track 1: Biochemistry and Molecular Biology (BCHM) or Track 2: Biochemistry and Nutrition (BCHN), provides an excellent preparation for:

1. Medical School
2. Graduate Studies in all basic medical sciences: Biochemistry, Molecular Biology, Cell Biology, Genetics, Neurobiology, Microbiology, Immunology, Pharmacology, Biophysics, Physiology, Bio-informatics, Biology, Nutrition, Environmental Science, and others.
3. Industry: Biotechnology, Pharmaceutical, Food Production, Food processing, and others.
4. Allied Health Professions: Nutrition, Dentistry, Forensics, Veterinary Medicine, Toxicology, Clinical Chemistry, Environmental Science, and others.

Educational Objectives

The undergraduate program in Biochemistry & Molecular Biology strives to provide

1. superior training in nutrition, biochemistry and molecular biology and
2. encouragement for self-study and research to students seeking a BS degree.

As part of a research-oriented university, the department, through its students, creates new knowledge. As a result of our teaching efforts, the new BS’s created will be able to matriculate into professional and graduate schools or to find positions in teaching professions and/or industry. In addition, the department serves the community by providing expertise in matters related to nutritional and medical biochemistry. For example, it teaches biochemistry to pre-medical and other pre-health students across a wide variety of life science related majors including biology, microbiology, neuroscience, and biomedical engineering.

Degree Programs

As a member of the College of Arts & Sciences, the Department of Biochemistry and Molecular Biology offers an undergraduate BS degree. As a member of the Miller School of Medicine, it offers the following graduate degrees: PhD, Executive PhD, dual BS-PhD, and dual MD-PhD. Also, it offers a Molecular Medicine Pathway for MD students.

Departmental Honors

Departmental honors can be earned by biochemistry majors who have:

1. Successfully completed at least 6 credit hours of BMB 545. This research must be described in a brief thesis that needs to be approved by three BMB faculty members.
2. A 3.5 or higher grade point average in all BMB courses.
3. A 3.3 or higher grade point average in all courses taken at the University of Miami.

Dual Degree Honors Program

The Dual Degree BS-PhD Program in Biochemistry & Molecular Biology is offered to mature high school seniors with strong academic ability and achievement who seek careers in biological or biomedical science. Students can earn both a Bachelor of Science (BS) and a Doctor of Philosophy Degree (PhD) in approximately 6 years. For information see our website (http://www.miami.edu/admission/index.php/undergraduate_admission/academics/dual_degree_honors).

BMB 110. Scientific Basis of Forensic Analysis. 3 Credit Hours.

Basic science topics including mathematics, physics, chemistry, and biology are introduced and related to understanding specific topics in forensic analysis such as fingerprint and blood type analyses. Heavy emphasis is given to hands on, in class projects in which students learn to analyze and interpret experimental observations and outcomes.

Components: LEC.

Grading: GRD.

Typically Offered: Fall & Spring.

BMB 145. Introduction To BMB Research. 2 Credit Hours.

Students will collaborate on a research project and learn valuable laboratory skills. The goal for this course is to make students "research-ready" through an active, inquiry-based, platform for developing core competencies in biology, genetics, BMB (biochemistry & molecular biology), bioinformatics, scientific discourse and ethics.

Components: LAB.

Grading: GRD.

Typically Offered: Fall & Spring.

BMB 245. Foundations in BMB Research. 2 Credit Hours.

Students will collaborate on a research project and learn valuable laboratory skills. The goal for this course is to make students "research-ready" through an active, inquiry-based, platform for developing core competencies in biology, genetics, BMB (biochemistry & molecular biology), bioinformatics, scientific discourse and ethics.

Components: LAB.

Grading: GRD.

Typically Offered: Fall, Spring, & Summer.

BMB 251. Contemporary Topics in BMB. 1 Credit Hour.

Contemporary topics in Biochemistry and Molecular Biology (BMB). Using primary research articles that underlie scientific news in popular press, students participate in weekly discussions and give at least one group presentation. Students learn and develop practical skills in critical reading and presentation of primary research findings.

Components: LEC.

Grading: GRD.

Typically Offered: Fall & Spring.
BMB 260. Introduction to Biochemistry and Nutrition. 3 Credit Hours.
The composition of food and the composition and functioning of a typical
cell are described in chemical terms, leading to an understanding of
how life processes such as digestion, and metabolism occur and are
regulated at the level of the individual molecule and reactions. Applications
of biochemistry and nutrition are discussed.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

BMB 401. Biochemistry For The Biomedical Sciences. 4 Credit Hours.
The biochemical composition, structure, and cellular metabolism of
proteins, carbohydrates, lipids, and nucleic acids are rigorously described,
emphasizing problem solving strategies required of biomedical field
applications.
Prerequisite: CHM 201 or CHM 222.
Components: LEC.
Grading: GRD.
Typically Offered: Fall & Spring.

BMB 402. Principles of Experimental BMB. 2 Credit Hours.
An active, inquiry-based, platform for developing core competencies in
biochemistry & molecular biology, making students "research ready".
Corequisite or Prerequisite: BMB 401.
Components: LEC.
Grading: GRD.
Typically Offered: Fall & Spring.

BMB 411. Readings in BMB. 1 Credit Hour.
Students read and discuss one BMB primary research article each week
and answer a set of questions meant to provoke critical evaluation of the
work. The course introduces students to critical reading of the primary
literature in BMB and is open to students at any level. Peer-mentoring and
informal student-led instruction is central to the course.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

BMB 417. Nutrients, Enzymes, and Metabolic Flux. 3 Credit Hours.
How macronutrients (carbohydrates, protein, and lipids) and (ii)
micronutrients (vitamins and minerals) are obtained in the diet,
digested, absorbed, and processed. Then, students learn to "formulate"
mechanisms of enzyme catalysis and inhibition, further applying to
graphical analysis of authentic enzyme kinetic and binding data. Last,
such analytical skills are used to more rigorously examine metabolic flux
control points. Students finish this course with thorough mechanistic
understanding of (i) macronutrient composition, intake, and energy
production and (ii) requirements of micronutrients in controlling enzyme-
catalyzed reactions that produce energy.
Components: LEC.
Grading: GRD.
Typically Offered: Fall & Spring.

BMB 501. Senior Seminars. 1 Credit Hour.
Students attend seminars of their own choice, presented by either
visiting/residing faculty or graduate/postdoctoral students on recent
research topics in BMB or any other discipline in the basic biomedical
sciences. Students write short reports on these seminars and critically
evaluate the presentations. This course can be taken more than once.
Prerequisite: BMB 401.
Components: SEM.
Grading: GRD.
Typically Offered: Fall & Spring.

BMB 506. Biomedical Case Studies. 1 Credit Hour.
Students explore topics in BMB in the context of solving problems
presented in a clinical/biomedical framework. Students work in small
groups and independently to acquire, critically evaluate, synthesize and
present information.
Corequisite or Prerequisite: BMB 401.
Components: LEC.
Grading: GRD.
Typically Offered: Fall & Spring.

BMB 507. Protein Structure, Function, & Biology. 3 Credit Hours.
The physical characteristics and behavior of proteins are described,
including structure, folding, dynamics, modifications, and interactions.
In addition, experimental approaches to protein structure and function
are addressed. Readings include both textbook assignments and current
research articles, and a term paper is written and submitted for writing
credit.
Prerequisite: BMB 401.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.

BMB 509. Molecular Biology of the Gene. 3 Credit Hours.
Biochemical processes involved in the flow of genetic information in both
prokaryotes and eukaryotes are described, including DNA replication,
repair, genetic recombination, RNA transcription and processing,
protein synthesis, control of gene expression, cell differentiation, and
recombinant DNA technology. Extensive classroom discussion is
mandatory. Reading includes BMB primary research papers, course notes
and a textbook.
Prerequisite: BMB 401.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

BMB 511. Topics in BMB. 3 Credit Hours.
Students independently explore the literature in BMB with guidance
by a BMB Faculty mentor. BMB primary research literature in an area
of mutual interest to the student and the Faculty mentor (usually a
content expert in that area) is discussed. Students prepare a paper or
other appropriate product (e.g. computer software, a structural model, a
dynamic simulation) for evaluation. Writing credit is available for papers.
Components: LEC.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.

BMB 514. Genetics and Genomics: Principles, Mechanisms, and Use. 3
Credit Hours.
The quantitative and analytical problem solving, as well as spatial
reasoning in genetics. The course will propose genetic hypotheses,
identify genetic predictions, create genetic systems for challenging these
predictions, and analyze genetic data to solve practical problems.
Prerequisite: BMB 401.
Components: LEC.
Grading: GRD.
Typically Offered: Fall.
BMB 519. Epigenetics and Nutrition. 3 Credit Hours.
How epigenetic mechanisms control gene expression and (ii) how epigenetic modifications are propagated. Then, students explore how such epigenetic control and inheritance can be modulated through diet and nutrition. Class participation and attendance are required, since in class discussion will be largely based on emerging and late-breaking topics from recent literature.
Prerequisite: BMB 401.
Components: LEC.
Grading: GRD.
Typically Offered: Spring.

BMB 545. Research Problems in BMB. 3-12 Credit Hours.
Participation in the research laboratory of a faculty mentor to work on an independent research project. Students develop abilities to formulate good questions and sound hypotheses, design practical experiments, collect and analyze useful data, and make justifiable conclusions. Students maintain a weekly online journal, write a paper, and present their research in the lab. Two semesters of BMB 545 are required to write a thesis (pre-requisite for graduating with honors in BMB).
Components: LAB.
Grading: GRD.
Typically Offered: Fall, Spring, & Summer.