MOLECULAR BIOLOGY, BIOCHEMISTRY AND BIOINFORMATICS PROGRAM

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The Program

The goal of the Molecular Biology, Biochemistry and Bioinformatics (MB3) Program (https://www.towson.edu/fcsm/departments/molecularbio) is to train students in the specific disciplines of molecular biology, biochemistry and bioinformatics, and to engage them in the process of scientific inquiry so that they will have the ability to grow with their chosen discipline throughout their scientific careers. The Molecular Biology, Biochemistry and Bioinformatics major provides undergraduate preparation for students interested in biochemistry, bioinformatics, pharmacology, biophysics, biotechnology, cell biology, genetics, immunology, microbiology or molecular biology. The curriculum is also excellent for students interested in medical, dental, pharmacy school or related Allied Health fields. One of the main advantages of this program is the breadth of training given to students in preparation for either post-graduate training or careers in the workforce. This versatility in training allows MB3 students to be very competitive in both job markets and post-graduate educational programs. The MB3 program is accredited by the American Society for Biochemistry and Molecular Biology (ASBMB (https://www.asbmb.org)).

Students complete a flexible curriculum that includes lecture and state-of-the-art laboratory courses, as well as an independent undergraduate research project that emphasizes the practical application of discipline-based knowledge. Because of the emphasis placed on providing a practical understanding of the fundamental nature of the scientific discipline, the program challenges students to get involved in an undergraduate research project with a mentor who engages them in the process of scientific research on a one-on-one basis. These research projects may be completed in a variety of different formats including laboratory experiences in academic, business, government or hospital environments. To facilitate information exchange, networking and to facilitate a community spirit in the MB3 program, students engaged in research give seminars describing their experiences at the Bimonthly MB3 seminar series.

The major consists of three concentrations:

- Molecular Biology
- Biochemistry
- Bioinformatics

The Molecular Biology Track examines the basis of life, using molecular approaches to understand the processes of living systems, with applications in all areas of biology. The Biochemistry Track also examines the molecules of living systems with emphasis on the chemical structure and reactivity that shape biological function. The Bioinformatics Track combines the study of the molecular basis of life with the study of computer science. This track focuses students on interacting with the genomic databases that are changing the face of science as we know it.

All three tracks are interdisciplinary in their approach. Students choose a track in addition to completing courses common to all three tracks.


Courses

MBBB 201 PROGRAMMING FOR BIOLOGISTS (4)
An overview of basic programming concepts for automating biological data analysis, specifically biological sequence data. Concepts covered include computer software and hardware, operating systems, software development life cycle, data types and data representation, arithmetic and logical operations, conditional execution, iteration, functions, and arrays. Python is used to build working programs, and emphasis is placed on designing and executing programs for Bioinformatics applications. Prerequisite: declared MBBB major or department consent.

MBBB 301 INTRO TO BIOINFORMATICS (4)
Fundamental principles of bioinformatics, including searching genomic and protein databases, sequence alignment, multiple sequence alignment, protein structural analysis, graphical tools for studying protein structures, RNA databases and RNA structure prediction, functional genomics, including analysis of DNA microarrays. Prerequisites: BIOL 309 or CHEM 351.

MBBB 315 GENOMICS (3)
The study of genes, their expression within a cell and how they interact with cellular components. An overview that details how genes within living systems operate and affect living populations. Topics include sequencing of genomes, genome organization, evolution and genomic changes, genomic identification and annotation, gene and genome circuits, synthetic biology, proteomics and systems biology. Prerequisite: MBBB 301 (may be taken concurrently) or consent of instructor.

MBBB 401 ADVANCED BIOINFORMATICS (3)
Advanced topics in bioinformatics, and the use of computational tools in simulation, animation, modeling and visualization of biological data. Techniques such as statistical analysis, data mining, databases, and data warehousing are covered. Prerequisite: MBBB 301 and COSC 237.

MBBB 490 HONORS RESEARCH IN MOLECULAR BIOLOGY, BIOCHEMISTRY, AND BIOINFORMATICS (2)
Individual research under the direction of a faculty member, culminating in an honors thesis. Credit for MBBB 490 not awarded until MBBB 491 is successfully completed. Prerequisites: Open only to advanced honors candidates and by consent of MBBB Program Director. Repeatable for a total of 4 units towards the major.

MBBB 491 SENIOR THESIS IN MOLECULAR BIOLOGY, BIOCHEMISTRY, AND BIOINFORMATICS (2)
Writing of an honors thesis based on an individual research done under the direction of a faculty member. Prerequisites: Open to advanced honors candidates and by consent of MBBB program director.

MBBB 493 SEMINAR IN BIOETHICS (1)
Ethical and legal issues associated with current trends in molecular biological, biochemical and bioinformatics research. Prerequisite: BIOL 309.
MBBB 495 CAPSTONE PROJECT IN MBBB (3)
Instructor led class/group project in Molecular Biology, Biochemistry and Bioinformatics. Projects emphasize the interdisciplinary nature of the major. Repeatable for a maximum of six units. Prerequisite: senior standing in MBBB major or department consent.

MBBB 499 HONORS THESIS IN MBBB (2)
Writing of an honors thesis based on individual research done under the direction of a faculty member. Prerequisites: open to advanced honors candidates and by consent of MBBB program director.