MOLECULAR BIOLOGY AND BIOCHEMISTRY MAJOR

MAJOR DESCRIPTION

The Major in Molecular Biology and Biochemistry (MB&B) is designed to accommodate a broad range of academic interests and allow students to concentrate on particular disciplines such as molecular biology, biochemistry, biophysics, structural biology, cell biology, genetics, epigenetics, genomics, and computational modeling.

While focused on exploring and understanding the molecular basis of life, the MB&B major allows for flexible, interdisciplinary studies, enabling students to couple their affinity for biological sciences with other majors.

Curious students who bring a passion for learning about the intricacies of the natural world, have a keen interest in science, and apply a logical, analytical, meticulous approach to their studies are likely to find great meaning and satisfaction in the MB& B major. Students with mathematical aptitude, perseverance, patience, and effective communication skills are those who excel in this course of study.

The Major in Molecular Biology and Biochemistry provides foundational training for various professional careers in medicine, public health, the pharmaceutical/ biotechnology industry, public policy, science journalism, and teaching, among others.

ADMISSION TO THE MAJOR

Students are encouraged to begin coursework toward the MB&B major in their first year to take maximum advantage of upper-level MB&B courses, research, and study-abroad opportunities in later years. However, the major can certainly be completed successfully if initiated during sophomore year.

MAJOR REQUIREMENTS

The requirements for the MB&B major are described in detail on this page. See the (https://www.wesleyan.edu/mbb/major/pathway.html)**Pathway Through the Major** page for a recommended path to fulfill the MB&B requirements.

The MB&B major begins with the core introductory biology series (the MB&B181 and MB&B182 lecture series and the associated laboratory MB&B191 and MB&B192) and/or the core general chemistry series (CHEM141/CHEM143 and CHEM142/CHEM144 lecture plus the associated laboratory, CHEM152). Our introductory cell and molecular biology course, MB&B181, is offered in small sections featuring problem-based learning to help students acclimate to their first semester of university-level biology. Visit Frequently Asked Questions About Introductory Biology for more information (https://www.wesleyan.edu/mbb/major/intro-faq.html).

The Molecular Biology and Biochemistry major requires the following coursework:

Code	Title	Hours
Introductory Biology		
MB&B181	Principles of Biology I: Cell Biology and Molecular Basis of Heredity	1
MB&B191	Principles of Biology I--Laboratory	0.5
MB&B182	Principles of Biology II	1
MB&B192	Principles of Biology II: Laboratory	0.5
General Chemistry		
CHEM141/143	General Chemistry I	1
CHEM142/144	General Chemistry II	1
CHEM152	Introductory Chemistry Laboratory	0.5
Gateway Molecular Biology		
MB&B208	Molecular Biology	1
Organic Chemistry		
CHEM251	Organic Chemistry I	1
CHEM252	Organic Chemistry II	1
Mathematics		
Select one Mathematics course (calculus or statistics recommended)		1
Physical Chemistry		
MB&B381	Physical Chemistry for the Life Sciences	1
Biochemistry		
MB&B383	Biochemistry	1
Advanced Laboratory		
MB&B394	Advanced Laboratory in Molecular Biology and Genetics	1
or MB&B395	Structural Biology Laboratory	
Electives		
Select two elective courses, at least one of which must be a **300**-level **MB&B** course		2

We require one semester of a chemistry lab course, which would typically be satisfied by introductory lab CHEM152 (offered in both fall and spring). This lab course requirement can also be satisfied by taking the intermediate chemistry lab, CHEM257.

One semester of college mathematics, typically calculus or statistics, is required (AP credit is not accepted). Students with deep theoretical knowledge in areas of mathematics, as evidenced by advanced coursework (e.g., in physics) or quantitative forms of research, may petition for the use of a less theoretical mathematics course (e.g., QAC courses) to satisfy the MB&B math major requirement.

One advanced laboratory class is required. Majors interested in a concentration in molecular biology should take MB&B394, which is offered every spring semester and generally taken in the junior or senior year. Students interested in the molecular biophysics minor should take MB&B395, which is offered every other year in fall semester. The Chemistry Integrated Laboratory courses (CHEM375 and CHEM376) do not satisfy the lab course requirement. Students taking both of the advanced lab courses (MB&B394 and MB&B395) may count one of the two courses as their 300-level elective.

MB&B381 may be replaced by two semesters of Introductory Physics (PHYS111 and PHYS112, or PHYS113 and PHYS116) or by Physical Chemistry (CHEM337 and CHEM338). Students who take two semesters of physics or physical chemistry may count MB&B381 as one of their required 300-level electives.

One of the two required electives must be a 300-level MB&B course. This may be fulfilled by taking a 1.0-credit 300-level course, or by taking two 0.5-credit 300-level courses.

The second elective may be a 200-level or 300-level MB&B course. Two consecutive semesters of research (in the same laboratory) for credit (MB&B423 and MB&B424, Advanced Research Seminar) with an MB&B faculty member (or a pre-approved faculty member in another department conducting research in molecular biology/biochemistry/biophysics) can be substituted for the 200-level elective, provided that it is taken for 1.0 credit each semester and a grade of B or higher is achieved. Honors Thesis (MB&B409 and MB&B410) may not be used to satisfy an elective requirement.

For potential elective courses outside of MB&B, including study abroad courses, students must consult with their faculty advisor and the MB&B chair in a timely manner. Prior approved courses outside MB&B that can be taken to satisfy the lower-level elective requirement include BIOL218 Developmental Biology, BIOL334 Shaping the Organism, and CHEM396 Molecular Modeling and Design. These courses offered by other (non-MB&B) departments may only be used to satisfy the 200-level elective requirement for completion of the MB&B major (even if the course has a 300-level designation).

All courses credited toward the MB&B major, both those hosted inside and outside the department, must be taken for a letter grade.

Pre-meds and pre-grads: Organic chemistry laboratory courses (CHEM257 and CHEM258) are requirements for virtually all graduate and medical schools. Most medical schools also require one year of physics with related labs and two semesters of mathematics. Many MB&B majors take more than the two required electives to better prepare for graduate or medical school.

All of the life science community is enriched by the weekly departmental seminar series (https://www.wesleyan.edu/mbb/seminars/)held on Wednesdays at 12:10 p.m. during the academic year, in which speakers are invited from different institutions to speak about their research. All are welcome to come learn about the latest cutting-edge work in the life sciences. You may receive a quarter credit for your attendance by enrolling in MB&B338 and/or MB&B339.

COURSES FOR NON-MAJORS

MB&B offers several courses designed to broadly introduce molecular biology to non–life science majors. Examples include MB&B103, MB&B107, and MB&B117. Alternatively, many non-science majors will take one of our introductory courses, MB&B181, or MB&B182 to meet NSM requirements. See WesMaps (https://www.wesleyan.edu/wesmaps/) for current course offerings.

MB&B228 is an introductory biochemistry course for non-majors intending to pursue a medical degree.

STUDENT LEARNING GOALS

- Acquire mastery of core foundational knowledge of molecular biology and biochemistry
- Acquire selective familiarity with our primary literature and key resources
- Achieve familiarity with major questions at the forefront of our field
- Acquire mastery of analytical, quantitative, and creative approaches to analyze problems in our field and to synthesize them in order to create logical hypotheses and experimental plans
- Acquire ability to use multidisciplinary approaches to synthesize a cogent experimental plan
- Acquire mastery of important methodologies in our field
- Acquire hands-on experience with key experimental techniques in our field
- Acquire proficiency in oral, written, and visual modes of effective scientific communication

STUDY ABROAD

Like all Wesleyan students, MB&B majors often choose to study abroad for a semester or more. In recent years, MB&B majors have visited Australia, Chile, Denmark, South Africa, England, France, Tanzania, and Germany, among other countries. During their semester abroad, MB&B majors may choose to take courses that satisfy their major or general education requirements, and may also arrange to do research at the host institution. Decisions about whether courses taken abroad can count for credit towards the MB&B major are made by the department on a case-by-case basis. Students should consult with their major advisor and receive course approval from the chair of the MB&B department prior to their departure.

ADVANCED PLACEMENT

Wesleyan awards one credit to students with AP Biology scores of 4 or 5. Since high school AP Biology courses rarely include the full range of topics or depth covered in MB&B181, this credit does not automatically place out students from MB&B181, our introductory cell and molecular biology course. Students with exceptional preparation can place out of MB&B181 by passing a placement exam. The placement exam must be taken during the first week of the student's first semester at Wesleyan (this applies to both incoming freshmen students and transfer students). Interested students should contact Professor Cori Anderson (canderson05@wesleyan.edu (canderson@wesleyan.edu/)) to schedule a placement exam.

Prospective MB&B majors with a score of 4 or 5 in AP Chemistry must meet the Chemistry Department requirements for advanced placement credit.

AP credit is not accepted for the math requirement.

PRIZES

Majors are eligible for several prizes based on their academic performance and contributions to the MB&B Department.

Hawk Prize: The gift of Philip B. Hawk, Class of 1898, as a memorial to his wife, Gladys, to the students who have done the most effective work in biochemistry.

Scott Biomedical Prize: Awarded to a member or members of the Molecular Biology and Biochemistry senior class who have demonstrated excellence and interest in commencing a career in academic or applied medicine.

William Firshein Prize: In honor of founding faculty member William Firshein, awarded to the graduating MB&B student who has contributed the most to the interests and character of the Molecular Biology and Biochemistry department.

American Society for Biochemistry and Molecular Biochemistry Honor Society: The ASBMB Honor Society recognizes exceptional undergraduate juniors and seniors pursuing a degree in the molecular life sciences. Students are recognized for their scholarly achievement, research accomplishments, and outreach activities in the molecular life sciences.

American Society for Biochemistry and Molecular Biochemistry Research Award: The ASBMB rewards exceptional rising seniors pursuing a degree in the molecular life sciences who have developed an exciting research project. More information is available on the ASBMB web page (http://www.asbmb.org/education/studentchapters/awards/ugresearch/).

Dr. Neil Clendeninn Prize: Established in 1991 by George Thornton, Class of 1991, and David Derryck, Class of 1993, for the student who has achieved academic excellence in biology and/or molecular biology and biochemistry. This student must have completed his or her sophomore year and in that time have exemplified those qualities of character, leadership, and concern for the Wesleyan community as shown by Dr. Neil Clendeninn, Class of 1971.

RELATED PROGRAMS OR CERTIFICATES

Molecular Biophysics Minor (https://www.wesleyan.edu/molbiophys/). Molecular biophysics is an interdisciplinary area of research situated at the intersection of molecular biology, chemistry, chemical biology, physical chemistry, and molecular physics. Wesleyan's program includes faculty in the MB&B, chemistry, physics, and biology departments. Students are strongly encouraged to conduct independent research in the laboratory of a molecular biophysics program faculty member.

Informatics and Modeling Minor (https://www.wesleyan.edu/imcp/). The Integrative Genomic Sciences (IGS) pathway is an integrative program of coursework and research in the areas of bioinformatics, genomics, computational biology, and bioethics. IGS involves faculty and students in the life sciences, physical sciences, information sciences, and philosophy.

BA/MA PROGRAM

This program provides an attractive option for life science majors to enrich their course and research background. Students are advised to begin research by their junior year if they intend to pursue the BA/MA. Admission is competitive and based on GPA, faculty recommendations, and research experience. More information is available here (https://www.wesleyan.edu/grad/graduate-programs/bama_program.html).

ADDITIONAL INFORMATION

UNDERGRADUATE RESEARCH OPPORTUNITIES

Undergraduate research is an important part of the curriculum for many MB&B majors. Wesleyan’s small but excellent graduate program makes it possible for majors to work alongside PhD and MA students at the cutting edge of discovery in molecular biology and biochemistry. To complement laboratory experiences, MB&B majors are also encouraged to gain exposure to current research through journal clubs and seminars. Undergraduate research encompassing multiple semesters or summers may be used towards completion of a senior honors thesis, or form the basis for pursuing a Master of Arts in MB&B through the BA/MA program.

Students interested in independent research for credit must find a faculty research mentor and submit an electronic tutorial form (Research Tutorial, MB&B423 or MB&B424) using the drop/add system in their portal. Based on discussions with the faculty research mentor, students may sign up for 0.25, 0.5, or 1.0 credits. Students enrolling for 1.0 credit are expected to dedicate at least 10 hours per week to their research project, which includes attendance in weekly group meetings and reading and discussion of current literature with group members, in addition to planning and performing experiments. Students will discuss specific expectations with their research mentor.

MB&B majors not participating in research tutorials will gain research experience in the Department's advanced laboratory courses; they are also encouraged to gain exposure to current research through journal clubs and seminars.

HONORS

To be considered for departmental honors, a student must:

- Be an MB&B major and be recommended to the department by a faculty member. The student is expected to have a B average (grade point average 85) in courses credited to the major.
- Submit a thesis based on laboratory research, performed under the supervision of an MB&B faculty member or pre-approved faculty member in another department conducting research in the fields of molecular biology, biochemistry, or biophysics.

Two readers (in addition to the research mentor) must be selected for review of honors theses in MB&B. It is expected that these readers will be MB&B research faculty; any exception requires approval of the MB&B department chair.

CAPSTONE EXPERIENCE

Independent laboratory research is strongly encouraged as it provides students with an exceptionally valuable learning experience. As research students, MB&B majors interact with faculty and graduate students in an environment that fosters strong intellectual and social connections. Moreover, many graduate and professional schools specifically recruit candidates with research experience. MB&B majors not participating in laboratory research can get a measure of this experience through participation in departmental and inter-departmental seminar series and journal clubs.

Faculty research interests cover an exciting range of current topics in molecular and cellular biology and biochemistry. Research areas include DNA replication and repair mechanisms, membrane transport processes, DNA-protein interactions, gene regulation, genome organization and structure, and membrane protein structure-function and dynamics. Students are encouraged to learn more about ongoing research (https://www.wesleyan.edu/mbb/grad_studies/research_areas.html) in the MB&B department. Many MB&B majors gain research experience at Wesleyan and other institutions in the summer months; the MB&B office and Wesleyan Career Resource Center can direct students to research opportunities.

All MB&B majors participate in independent research projects as part of our experiment-based advanced laboratory courses MB&B394 and MB&B395, at least one of which is required.