MOLECULAR BIOLOGY AND BIOCHEMISTRY MAJOR

MAJOR DESCRIPTION

The major in Molecular Biology and Biochemistry (MB&B) emphasizes the application of modern molecular science to study the mechanisms of biological processes. In keeping with the culture of liberal education at Wesleyan University, the MB&B major is designed to accommodate a variety of interests and allow students to concentrate in particular areas such as Molecular Biology, Molecular Biophysics, Biochemistry, Cell Biology, Genetics, Integrative Genomic Sciences, and Computational Sciences and Modeling. The interdisciplinary nature and flexibility of the MB&B major also enables students to couple their affinity for biological sciences with other disciplines including mathematics, computer science, psychology, economics, government, anthropology, science in society, chemistry, biology etc. The MB&B major provides excellent preparation for a range of professional careers in medicine, public health, 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 the first year so that they can 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.

A prospective MB&B major can begin with the core introductory biology series (MB&B181 and MB&B182; associated laboratory MB&B191 and MB&B192) and/or the core general chemistry series (CHEM141/143 and CHEM142/144; associated laboratory, CHEM152 ). MB&B181 is offered in small sections rather than a single, large lecture class. These small sections allow for problem-based learning at a more individualized pace as students master the first semester of university-level biology.

MAJOR REQUIREMENTS

The molecular biology and biochemistry major requires the following coursework:

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<tr>
<td><strong>Introductory Courses</strong></td>
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<tr>
<td>MB&amp;B181 &amp; MB&amp;B191</td>
<td>Principles of Biology I: Cell Biology and Molecular Basis of Heredity</td>
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<tr>
<td>MB&amp;B182 &amp; MB&amp;B192</td>
<td>Principles of Biology II and Principles of Biology I–Laboratory</td>
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<tr>
<td>CHEM251</td>
<td>Principles of Organic Chemistry I</td>
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<tr>
<td>CHEM252</td>
<td>Principles of Organic Chemistry II</td>
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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 1

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 CHEM 152 (but could be satisfied instead by the Intermediate Chemistry Lab, CHEM 257). The Chemistry lab may be taken in fall or spring.

One semester of college mathematics 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 this 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). In this case MB&B381 may count as one of the 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).

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 200- and 300-level courses over the curriculum requirement to better prepare for graduate or medical school.

All of the life science community is enriched by the weekly departmental seminar series (https://cascade1.wesleyan.edu/entity/open.act? type=page&id=129642b1b1815062c70413ea600c4caf8&confId=23c7cbcf6185062c01b5683b45f986601) held on Wednesdays at 12:10pm during the Academic Year, in which speakers are invited from different institutions to speak about their work. All are welcome to come learn about the latest cutting-edge research 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

Non-life-science majors are encouraged to consider MB&B103, MB&B107, MB&B119, MB&B181, or MB&B182 as part of their program to meet NSM requirements. See WesMaps (https://www.wesleyan.edu/wesmaps/) for current course offerings.

MB&B228 is an introductory biochemistry course for nonmajors 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 bioinformatic databases
- 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 mastery of a subset of hands-on methodologies 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 the past few 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 must have the appropriate “course approval” form signed before departure by the Chair of the MB&B department, and be sure to inform the Chair if they make changes to their schedule on arrival at their host institution.

ADVANCED PLACEMENT

Prospective MB&B majors who have achieved a score of 4 or 5 in AP Biology may be eligible to place out of one of the two Introductory Biology Courses (MB&B181 or MB&B182). Permission to place out of MB&B181 is based on a short interview with one of the MB&B faculty instructors and a short placement test.

Students interested in placing out of MB&B181 in the fall semester should contact Professor Michelle Murolo (mmurolo@wesleyan.edu (http://mailto:mmurolo@wesleyan.edu)) regarding the placement exam.

These courses are considered essential preparation for our upper level courses; students are highly encouraged to enroll in both semesters.

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

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 Firshtein Prize: In honor of founding faculty member William Firshtein, 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 African American 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. An interdisciplinary program with faculty in the MB&B, chemistry, physics, and biology departments. To complete the Molecular Biophysics minor, students must take MB&B395; MB&B383; MB&B381 or CHEM337 and CHEM338; two upper-level elective courses in molecular
biophysics; and two semesters of Molecular Biophysics Journal Club (MB&B307 and MB&B308). Students are strongly encouraged to conduct independent research in the laboratory of a molecular biophysics program faculty member.

Certificate program in informatics and modeling (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. The IGS course requirements are listed here (https://www.wesleyan.edu/imcp/igs_courses_reqs.html).

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.

ADDITIONAL INFORMATION

UNDERGRADUATE RESEARCH OPPORTUNITIES

Undergraduate research is an important part of the program 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, as well as the basis for pursuing a Master of Arts in MB&B through the BA/MA program.

For initial entry into the world of research, most students sign up for a semester of research for 0.5 or 1.0 credit (MB&B423 or MB&B424). This option allows students to test the waters with respect to research topics, environment, faculty, and graduate students in the department, without an overly long or binding commitment. Students are expected to dedicate at least 10 hours per week on 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. In order to register for this individual tutorial, students must choose a faculty research mentor and submit an electronic tutorial form using the drop/add system in their Portal. This course may be taken more than once.

MB&B majors not interested in laboratory work are 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 or library 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.

Additional information about the (https://www.wesleyan.edu/registrar/honors/requirements_departments.html) honors process can be found here.

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 interested 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.

All MB&B majors participate in independent research projects as part of our experimental-based advanced laboratory courses MB&B394 and MB&B395, at least one of which is required. Students interested in additional research can pursue the following options:

• Independent Research for Course Credit
• Summer Research Program
• Honors Thesis Research
• BA/MA Fifth Year Master’s Program