

# BIOCHEMISTRY AND MOLECULAR BIOLOGY, MHS

## The Master of Health (MHS) Program

### Overview

The Master of Health Science (<https://publichealth.jhu.edu/academics/mhs-dept-of-biochemistry-and-molecular-biology/>) (MHS) degree program is designed for students interested in graduate-level preparation for careers in medicine, biomedical research, public health, and related health sciences. Our MHS students pursue advanced graduate work, a career in medicine, or positions in industry or public health. The MHS in the Department of Biochemistry and Molecular Biology (<https://publichealth.jhu.edu/departments/biochemistry-and-molecular-biology/>) includes courses within a core curriculum focused on biochemistry, molecular biology, and the biology of disease and public health.

## Program Requirements

Course location and modality are found on the BSPH website (<https://publichealth.jhu.edu/courses/>).

### Course Requirements

Code	Title	Credits
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#### Council on Education for Public Health Accreditation Required Courses

All of the following **must** be taken:

PH.552.601	Foundational Principles of Public Health (1st & 3rd term)	0.5
PH.552.602	The Role of Quantitative Methods in Public Health (2nd term)	0.5
PH.552.603	The Role of Qualitative Methods and Science in Describing and Assessing a Population's Health (1st & 3rd term)	0.5
PH.552.604	Causes and Trends in Morbidity and Mortality (2nd term)	0.5
PH.552.605	The Science of Primary Secondary and Tertiary Prevention in Population Health (2nd term)	0.5
PH.552.606	The Critical Importance of Evidence in Advancing Public Health Knowledge (2nd term)	0.5
PH.552.607	Essentials of Environmental Health (1st term)	0.5
PH.552.609	Psychological and Behavioral Factors That Affect A Population's Health (1st & 3rd term)	0.5
PH.552.610	The Social Determinants of Health (2nd & 4th term)	0.5
PH.552.611	Globalization and Population Health (2nd & 4th term)	0.5
PH.552.612	Essentials of One Health (1st term)	0.5

#### Departmental Required Courses

PH.120.600	Biochemistry I: Protein Structure and Enzyme Catalysis	3
PH.120.601	Biochemistry II: Major Metabolic Pathways	5
PH.120.602	Concepts of Molecular Biology (1st term)	4
PH.120.616	Advanced Concepts in Biochemistry, Cell and Molecular Biology (terms 1-4)	1
PH.120.624	Cancer Biology (4th term)	3

PH.120.872	Special Studies-Current Topics in BMB (pass/fail)	1
Select at least five of the following courses:		15-18

PH.120.605	Genome Integrity (4th term)	
PH.120.606	Cellular Stress in Physiology and Disease (4th term)	
PH.120.608	Gene Editing, Therapy and Manipulation (3rd term)	
PH.120.612	The Chemical Biology of Drugs that Shape Public Health	
PH.120.613	Nucleic Acid Chemistry (3rd term)	
PH.120.614	Genetic Engineering for the Public's Health	
PH.120.620	Fundamentals of Reproductive Biology (1st term)	
PH.120.626	Principles of Cell Biology (2nd term)	

#### Thesis Requirement

PH.120.860	Thesis Preparation (3rd term, pass/fail)	2
PH.120.870	Thesis in Biochemistry and Molecular Biology (4th term)	5

<b>Total Credits</b>	<b>44.5-47.5</b>
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### Council on Education for Public Health Accreditation Required Courses

- Please note that 552.XXX are 0.5 credit courses and are required of all MHS students. While the credits for each of these courses do not count towards the total number of credit hours, they **must** be completed to fulfill the degree requirements. These courses are Pass/Fail, and to receive credit for each, students *must* earn a **Pass** to fulfill the degree requirements. Failure to pass any of these courses may preclude students from graduating in May.
- These courses are offered online only, and many of them are offered during two different terms – either 1st and 3rd or 2nd and 4th. Students may add in as many as they wish per term; however, students are encouraged to be mindful of how many are taken at a time, particularly in light of other coursework during the given term.

### Thesis Requirements

The **independent study MHS thesis** is completed by BMB MHS students. This thesis is a literature review (see details below), and there are two components that students register for as part of this process:

- Students must complete and receive a P (Pass) in Course PH.120.860 Thesis Preparation in the 3rd term.
- Students must receive a grade of **B or better on the thesis** to be eligible for the MHS degree. The grade students receive on the thesis will show in their transcript for Course PH.120.870 Thesis in Biochemistry and Molecular Biology in the 4th term and will figure into their cumulative GPA.

### Term By Term Required and Other Courses

#### Notes:

- Please be aware that **course information can and does change** (e.g., days/times, instructors, sometimes even if the course is going to be offered at all – and sometimes with little notice). For the most up-to-date information on course times, instructors, prerequisites, requirements for instructor permission, etc., **go to the school's** course search engine (<https://publichealth.jhu.edu/courses/>).
- Many of the courses listed here have been **recommended by previous MHS students or are noted here for various reasons of interest to BMB MHS students** (e.g., relevance to medicine and/or public health and/

or MCAT, biological areas of interest, etc.). **But this is by no means a comprehensive list!** There are hundreds of great courses in the School of Public Health—feel free to shop around with the course search engine to see the many other options.

- If students have previously taken any of the BMB courses, they do not have to retake the course (nor are students allowed to take the course over again and have it count toward their Master's degree). If students are placed out of a BMB course, they satisfy their requirement for BMB-based courses by taking one additional BMB course for each course placed out of. **Students should take a minimum of eight BMB classes over the four terms of the academic year.**

## The MHS Thesis

The MHS thesis is the culminating experience of the degree and should "provide new knowledge and/or a critical synthesis and integration of existing knowledge" (as described by the Policy and Procedure manual of the Bloomberg School of Public Health). This is a *library-based* thesis—meaning the thesis does not involve independent research in a laboratory but instead requires a synthesis of the scientific literature in the style of a review article. It is also possible that the thesis could take on elements of a research proposal.

A grade is given for the MHS thesis, which will be reflected on the transcript and will figure into each student's cumulative GPA. This is done through a five-credit thesis 'course' listed for the 4th term, PH.120.870 Thesis in Biochemistry and Molecular Biology. Despite the grade being given in the 4th term, students will be working on their thesis for significantly more than one term. (Indeed, if students only work on their thesis starting over spring break before the 4th term, they are very likely not to get a passing grade.)

### Procedure and Rules for the MHS Thesis

- A list of thesis topics will be distributed. Students will select their top **3-4 topics** from this list. The deadline for submitting choices will be in 2nd term; students will receive email notifications to their JHU email account about this. (Note: There is no advantage to handing a list in sooner than this date, i.e., there is no "first come, first served.")
- Students will be assigned one of their topic choices and a thesis supervisor to advise on this topic. Students will know their topic and thesis supervisor by approximately midway through the 2nd term.
- Students should then consult with their thesis supervisor regarding the topic, tips for starting their work, etc. The MHS thesis is intended to be an **independent study project** in which students work **one-on-one with their faculty supervisor** to assist with research as needed. There are several important milestones and deadlines related to the MHS thesis:

Milestone	Deadline
Coordination with topic/advisor selection starts	Monday, September 23, 2024, 11:59 p.m.
Student notification of topic and advisor	Friday, October 4, 2024, 11:59 p.m.
Meeting 1 - Required organizational meeting with thesis supervisor to discuss topic, overall thesis work plan, and work plan for developing the 2-4 page outline	No later than Friday, October 25, 2024, 5:00 p.m.

Meeting 2 - Recommended Meeting to talk with advisor in preparation for work over the winter break	Before Friday, December 13, 2024
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<b>2-4 page initial outline due</b> – email to thesis supervisor, and also submit via CoursePlus website for PH.120.860	No later than Friday, January 24, 2025, 11:59 p.m. (sooner is encouraged)
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Meeting 3 - Progress report with thesis advisor at least once by end of Week 5 of 3rd term – get feedback on general outline and discuss the detailed outline/rough draft	Before Friday, February 14, 2025
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~10+ page detailed outline or partial rough draft, with references* (consult your thesis supervisor on what they prefer) – email to thesis supervisor and also submit through CoursePlus website for PH.120.860	No later than Friday, March 7, 2025, 11:59 p.m. (Sooner is encouraged)
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Meeting 4 - Progress report with thesis supervisor at least once by end of Week 2 of 4th term - feedback on detailed outline or partial draft	No later than Friday, April 4, 2025, 11:59 p.m. (Sooner is encouraged)
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<b>Final Thesis Due</b> (20-30 pages long, not counting figures, references) – hard copy or e-copy to thesis supervisor and secondary reader, and submit e-copy through CoursePlus website for PH.120.870	Friday, April 18, 2025, 11:59 p.m.
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- Document uploads will use dropboxes associated with the appropriate CoursePlus course site for PH.120.860 Thesis Preparation in the 3rd term and PH.120.870 Thesis in Biochemistry and Molecular Biology in the 4th term.
- The work-in-progress document – i.e., the detailed outline **or** partial rough draft due (depending on what the thesis supervisor prefers), including references, must be submitted to the thesis supervisor by email **and** submitted to the CoursePlus dropbox by 11:59 PM of the Monday of the week between the 3rd and 4th terms to get a Pass for Course PH.120.860 Thesis Preparation.
- The final MHS thesis is due by Friday, April 12, 2024, at 11:59 PM.** Students should communicate with their thesis supervisor and secondary reader to determine if they prefer a hard copy or an e-copy. Students also must submit a PDF version to the CoursePlus website for PH.120.870 Thesis in Biochemistry and Molecular Biology to be saved for departmental records. Students may also use CoursePlus to upload their thesis to their academic portfolio.
- Thesis grade: **Students must receive an A or B on the MHS thesis to be eligible for the MHS degree.** As noted above, the student's grade on their thesis will show on their transcript and figure into their cumulative GPA for the five-credit course PH.120.870 Thesis in Biochemistry and Molecular Biology. **The grade each student receives on their thesis handed in on April 12, 2024, is the final grade that goes and stays on their transcript and figures into their cumulative GPA.**

**If a student receives a C or D on the thesis, they are not eligible for the MHS degree for May graduation. However, students have the option to rewrite the thesis if they still wish to be eligible for the MHS degree.** Rewritten theses must be submitted to the student's thesis supervisor, their secondary reader, and the BMB academic affairs office. The absolute last date that the rewritten thesis can be submitted is **August 1**. This rewritten thesis must be of an A or B-grade quality to make students eligible for the MHS degree. Although the grade of C or D will stay on their transcript, the department will submit a letter to Records and Registration to note that the student has satisfactorily completed the thesis requirement.

8. **If a student receives an F on the MHS thesis, they will be permanently ineligible for the MHS degree; there is no rectifying this deficiency** (theses that receive an F are not eligible for a rewrite). The draft that each student hands in on **April 12, 2024**, must receive a D or better for students to have the option of receiving the MHS degree in the future.
9. **Theses handed in after the due date:** Students should do everything in their power to stay on target for the April due date for the MHS thesis submission. If a health or personal emergency develops that will prevent students from submitting their thesis by the deadline, they must provide documentation of this emergency (e.g., from a healthcare professional and/or from the Office of Student Affairs). Also, be advised that students *will not be eligible for spring graduation and marching in Convocation ceremonies*. Students will receive an Incomplete for PH.120.870 Thesis in Biochemistry and Molecular Biology. Completion of their thesis by August 1 and receiving a grade of A or B will make them eligible for summer degree conferral. Be advised that grades of Incomplete for PH.120.870 Thesis in Biochemistry and Molecular Biology have to be resolved by 120 days after the conclusion of the 4th term.

Students handing in the thesis late *without* a valid excuse will automatically receive a **D** for Course PH.120.870 Thesis in Biochemistry and Molecular Biology. This grade will stay on their transcript and will figure into their cumulative GPA. If students wish to be eligible for the MHS degree, they will have to rewrite the thesis; this must be submitted to their thesis supervisor, their secondary reader, and the BMB academic affairs office by **August 1**, so the student can be eligible for summer degree conferral. This rewritten thesis must be an A or B grade quality to make students eligible for the MHS degree. Although the grade of D will stay on their transcript, the department will submit a letter to Records and Registration to note that the student has satisfactorily completed the thesis requirement.

### General Guidelines for the MHS Thesis

- Length - 20-30 pages (not counting bibliography or figures).
  - Note: A thesis shorter than 20 pages typically will not provide sufficient depth and breadth to earn an A. If the thesis is going to be longer than 30 pages, students should discuss this with their thesis supervisor and either get approval for a longer thesis or discuss how to shorten the thesis.
- Double-spaced with one-inch margins.
- Must include an **abstract** of 250 words or less at the beginning.
- Font - Arial, Times, Times New Roman, etc. (i.e., nothing crazy looking), size 12 (nothing too tiny, nothing too large).
- For hard copies, binding is not necessary, but certainly welcome.
- Organization varies depending on the topic, but a general format could include:

- Introduction
- Background
- The state of the field currently -- including what's known, what's *controversial*, and/or *unknown*
- Where the field is going (to address controversies and unknowns)
- Conclusions/summary
  - Note: Headings and subheadings can be used to distinguish sections and subsections. A table of contents may be included to highlight these sections and subsections.
- **References:** ~40-100 referenced works (will vary widely, depending on the topic)
- **Reference formats** (for using RefWorks or other bibliographic software, students may select the *Journal of Cell Biology* as style)
  - *In-text citations* (at the end of sentence or phrase needing a citation):
    - If one author: A monoclonal antibody that recognizes Protein X inhibits viral fusion with cells (Jones, 2003).
    - If two authors: A monoclonal antibody that recognizes Protein X inhibits viral fusion with cells (Jones and Smith, 2003).
    - If 3+ authors: A monoclonal antibody that recognizes Protein X inhibits viral fusion with cells (Jones et al., 2003).
  - *Bibliography list of references at the end of the thesis*
    - Alphabetical by first author's last name, formatted as follows: Lastname1 A., Lastname2 B., Lastname3, C. (Year) Title of paper. *Journal name (or abbrev.)* Vol. #: page#-page#.
- **Text:** Students are *strongly urged* to use **bibliographic software**; this will be significantly easier for students than typing all of their references into their outline and thesis draft or trying to keep the papers found and read organized without software. The web-based bibliographic software **RefWorks** is available free to JHU students through Welch Library. Other bibliographic software options include EndNote, Mendeley, and Zotero.
- Links for various services available from Welch Medical Library (<http://welch.jhmi.edu>):
  - Welch Library classes and tutorials (<https://welch.jhmi.edu/>): Online tutorials and schedule of classes for using various services and databases.
  - Welch Library's information on RefWorks (<https://welch.jhmi.edu/>): Provides online tutorials.
  - Portal for using RefWorks (<https://welch.jhmi.edu/>): Under the "Services" tab.
- **Illustrations:** Illustrations are allowed in the thesis. Figures must include a figure legend. Students should consult with their thesis supervisor about including figures and in what format – particularly if their thesis supervisor is comfortable with using a figure from a published work, or whether students should draw their own illustrations (and provide attribution for the inspiration). If students do an exact duplication of a figure (by copying and pasting) that was published somewhere, students must provide a citation with some phrase in the figure legend such as "taken from Smith et al., 2014." If students draw their own illustration that is roughly based on one or more figures that have been published, students should cite this as, "adapted from Smith et al., 2014 and Comsnogle et al., 2010."
- **Working with others:** Students should verify with their thesis supervisor, but in general, most thesis supervisors will be supportive of students working with fellow MHS students, such as exchanging thesis drafts with a friend and checking each other's draft for readability, grammar, typos, etc.

**This is a crucial issue with referencing and with illustrations. Students must avoid plagiarism!!!**

#### *Information from the School's Policies and Procedures*

(Please note: below is an Excerpt from the Policies and Procedures (<https://my.jhsph.edu/Resources/PoliciesProcedures/ppm/Pages/default.aspx>))

#### **Policy and Procedure Memorandum Students - 1**

**Subject:** Academic Ethics

#### **Constitution of the Academic Ethics Board of the Bloomberg School of Public Health**

Article Two. Definitions

Section Two.

Plagiarism is defined as taking for one's own use the words, ideas, concepts or data of another without proper attribution. Plagiarism includes both direct use or paraphrasing of the words, thoughts or concepts of another without proper attribution. Proper attribution includes:

1. use of quotation marks or single-spacing and indentation for words or phrases directly taken from another source, accompanied by proper reference to that source,
2. proper reference to any source from which ideas, concepts, or data are taken even if the exact words are not reproduced.

#### **Tips for working on the MHS thesis:**

- **Students should meet with their thesis supervisor early and regularly.** This is important for getting tips on where to get started and how to make progress. With regard to getting started, there are many different ways to consider, which are based on the student, the topic, and the thesis supervisor. Examples include:
  - Use PubMed or another literature database search (e.g., Google Scholar) with keywords related to the topic.
  - Use PubMed to search for a few authors' names to PubMed to see what leaders in the field are doing.
  - Thesis supervisor might assign a couple of review articles for an overview.
  - Thesis supervisor might assign 2-5 research papers to get the student started on a few key issues in the field.
- Start collecting papers, review, and original research—and dive in and start reading.
- Start jotting down ideas, key concepts, important issues, etc. that come up in these papers.
- Continue meeting with the thesis supervisor and receive feedback during regular progress report meetings.
- As ideas of thesis content start coming together, start working on an **outline**. A short outline is part of the required work in the 3rd term of the thesis. It is highly recommended that students include references during their outlining, both to organize their thoughts and to keep track of citations.
- Make modifications/additions in response to the thesis supervisor's comments.
- Start writing from the outline. Text can be broken into sections and subsections with headings for each section/subsection.

A grade is assigned to the MHS thesis. The thesis grade will be recorded on the student's transcript and contribute to their cumulative GPA.

## **Program Policies**

For a full list of program policies, please visit the Department of Biochemistry and Molecular Biology's for Current Students (<https://publichealth.jhu.edu/departments/biochemistry-and-molecular-biology/info-for-current-students/>) page where students can find the link to the most recent MHS in Biochemistry and Molecular Biology Student Handbook.

Upon successful completion of the Master of Health Science in Biochemistry and Molecular Biology, students will have mastered the following competencies:

- Examine current and future issues in public health by characterizing the fundamental concepts in biology with emphasis on energy needs at the cellular level and metabolism.
- Examine current and future issues in public health related to molecular biology and biotechnology.
- Examine current and future issues in public health related to one of the leading causes of death, cancer.
- Examine current and future issues in public health related to current research and careers in the 21st-century biomedical field.

According to the requirements of the Council on Education for Public Health (CEPH), all BSPH degree students must be grounded in foundational public health knowledge. Please view the list of specific CEPH requirements by degree type (<https://e-catalogue.jhu.edu/public-health/ceph-requirements/>).