BIOCHEMISTRY AND MOLECULAR BIOLOGY, MHS

The Master of Health (M.H.S.) Program

Overview

The Master of Health Science (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 includes courses within a core curriculum focused around biochemistry, molecular biology, reproductive biology, and the biology of disease and public health.

Program Requirements

Course location and modality is found on the BSPH website (https://www.jhsph.edu/courses/).

Course Requirements

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH.550.865</td>
<td>Public Health Perspectives on Research</td>
<td>2</td>
</tr>
<tr>
<td>PH.340.721</td>
<td>Epidemiologic Inference in Public Health</td>
<td>3</td>
</tr>
<tr>
<td>PH.340.751</td>
<td>Epidemiologic Methods</td>
<td>1 &amp; 3</td>
</tr>
</tbody>
</table>

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 II: Major Metabolic Pathways 5
- PH.120.601 Concepts of Molecular Biology (1st term) 4
- PH.120.602 Special Studies-Current Topics in BMB (pass/fail) 1
- PH.120.624 Cancer Biology (4th term) 3

Select at least five of the following upper-level BMB courses, while also taking at least one BMB course each term:

- PH.120.603 Molecular Biology of Pandemic Influenza (2nd term) 0.5
- PH.120.620 Fundamentals of Reproductive Biology (1st term) 0.5
- PH.120.626 Principles of Cell Biology (2nd term) 0.5
- PH.120.608 Gene Editing, therapy and Manipulation (3rd term) 0.5
- PH.120.613 Nucleic Acid Chemistry (3rd term) 0.5
- PH.120.606 Cellular Stress in Physiology and Disease (4th term) 0.5
- PH.120.622 Molecular and Cellular Mechanisms of Reproduction (4th term) 0.5
- PH.120.605 Genome Integrity (4th term) 0.5

Thesis Requirement

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

Total Credits: 50.5-51.5

1. An online, 2 credit pass/fail course in 2nd term, required of all BSPH students, except those in the MPH program.
2. 1st term or online 3rd term – This is a good "all-purpose" epidemiology course, designed for a wide audience of SPH students.
3. 1st term – This course is more advanced than PH.340.721 Epidemiologic Inference in Public Health I in terms of the statistics background that is expected. Please see the course site in the course catalogue for further information on the statistics prerequisites.

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 your total number of credit hours they must be completed to fulfill your degree. These courses are Pass/Fail, and to receive credit for each of them, you must earn a Pass in each to fulfill your degree requirements. Failure to pass any of these courses may preclude you 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. You may add in as many as you wish per term; yet, I encourage you to be mindful of how many you are taking, particularly in light of the other coursework you have during the given term.

Waivers

Waivers from the School’s epidemiology can be granted in the following circumstances:

- If you took Course AS.280.350 Fundamentals of Epidemiology, (offered at the Homewood campus), you can be granted a waiver from the School’s requirement to take an epidemiology course. Please contact Vicki Keller or Erika Vaitekunas and they will arrange with the Registrar’s office to have this noted in your records. However, be advised that no course credit is given.
- If you have previously taken a graduate level course in epidemiology at a U.S.-based, accredited school of public health, you can be granted a waiver from the School’s epidemiology requirement. Please contact Vicki Keller or Erika Vaitekunas and they will arrange with
the Registrar’s office to have this noted in your records. However, be
advised that no course credit is given.

- If you have previously taken an epidemiology course, but not
  graduate-level or at an U.S.-accredited school of public health, then
  the Department of Epidemiology offers a waiver exam. The contact
  for information about this exam is Allyn Arnold, instructor in the
  Department of Epidemiology (aarnold2@jhu.edu). If the student
  passes the waiver exam, the student is waived of the requirement
to take basic epidemiology, and this waiver is noted in the student’s
academic record with Records and Registration (however, no course
credit is given for passing the waiver exam).

### Term by Term Breakdown of Course Requirements

<table>
<thead>
<tr>
<th>Term</th>
<th>Course</th>
<th>Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Year</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Term</td>
<td>PH.120.872 Special Studies-Current Topics in BMB (pass/fail)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>PH.120.602 Concepts of Molecular Biology</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>PH.120.620 Fundamentals of Reproductive Biology</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td><strong>Required</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Optional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PH.120.600</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Second Term</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Required</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Select at least one of these upper-level BMB courses (a minimum of five are required):</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>• PH.120.603 Molecular Biology of Pandemic Influenza</td>
<td></td>
<td>3.4</td>
</tr>
<tr>
<td></td>
<td>• PH.120.626 Principles of Cell Biology</td>
<td></td>
<td>3.5</td>
</tr>
<tr>
<td></td>
<td><strong>Optional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• PH.120.601 Biochemistry II: Major Metabolic Pathways</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td><strong>Credits</strong></td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Third Term</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Required</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PH.120.860 Thesis Preparation (pass/fail)</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Select at least one of the following upper-level courses (a minimum of five are required):</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>• PH.120.608 Gene Editing, therapy and Manipulation</td>
<td></td>
<td>3.7</td>
</tr>
<tr>
<td></td>
<td>• PH.120.613 Nucleic Acid Chemistry</td>
<td></td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>• PH.120.627 Stem Cells and the Biology of Aging and Disease</td>
<td></td>
<td>3.9</td>
</tr>
<tr>
<td></td>
<td><strong>Credits</strong></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Fourth Term</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Required</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>PH.120.624 Cancer Biology</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>PH.120.870 Thesis in Biochemistry and Molecular Biology</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Select one of the following upper-level BMB courses (a minimum of five are required) if needed:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• PH.120.624 Cancer Biology</td>
<td></td>
<td>1.10</td>
</tr>
<tr>
<td></td>
<td>• PH.120.606 Cellular Stress in Physiology and Disease</td>
<td></td>
<td>11</td>
</tr>
</tbody>
</table>

**Required BMB courses must be taken for a grade** (not Pass/Fail or for Audit credit)

1. Usually required for PH.120.601 Biochemistry II: Major Metabolic Pathways
2. Biochemistry I and II are fundamental biochemistry courses and are excellent options for students who would like a biochemistry refresher for taking/re-taking the MCAT.
3. Satisfies the MHS degree requirement as one of the five upper-level courses
4. Literature-based course addressing one of the most interesting examples of the intersection of public health and the basic biomedical sciences.
5. Topics-based cell biology course; good choice for students who will be taking/re-taking the MCAT.
6. Second half of Biochemistry, continues from Biochemistry I (although it is not a strict requirement to take Biochemistry I in order to take Biochemistry II)
7. Addresses the genetic basis of health and disease, with emphasis on treating conditions with gene therapy or cutting-edge genome editing techniques.
8. Good choice for students with a strong chemistry background or seeking to build on their chemistry background; addresses the syntheses and chemical modifications of nucleotides, oligonucleotides, and nucleic acids, and in the application of oligonucleotides to solving problems in biology.
9. Covers topics in this cutting-edge area of biomedical science relevant to regenerative medicine, and reproductive and cancer biology.
10. Examines topics such as DNA repair, chromosome maintenance, and cell cycle control as these apply to cancer and other diseases.
11. Addresses the emerging, hot area of biomedical science on the "cell biology of stress" – events like cellular stress sensing pathways and stress response pathways, pertinent to many diseases and pathological states, such as neurodegeneration. Feedback from recent MHS alums is that this course material on oxidative stress is highly relevant to medical school!
12. For students interested in reproductive biology and health; this course builds on PH.120.620 Fundamentals of Reproductive Biology, in 1st term.

**You must take a minimum of four of the upper-level BMB courses for a letter grade** (and you are urged to take all for a letter grade, as P/F in a letter-graded course really doesn’t do your credentials much good!).

**Note:** If you have previously taken any of these BMB courses (e.g., in satisfaction of your undergraduate degree or as a special student at Hopkins):

- If you have previously taken any of BMB courses, you do not have to re-take the course (nor are you allowed to take the course over again and have it count toward your Master's degree). If you are placing out of a BMB course, then you satisfy your requirement for BMB-based courses by taking one additional BMB course for each course that you placed out of. You should take a minimum of eight BMB classes over the four terms of the academic year.
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:

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

Term By Term Required and Other Courses

Notes:

1. 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: www.jhsph.edu/courses (https://www.jhsph.edu/courses/)

2. 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.

Course Title Credits
First Year
First Term
Before Labor Day to late October

BMB Required Courses
PH.120.602 Concepts of Molecular Biology 4
PH.120.620 Fundamentals of Reproductive Biology 3
PH.120.872 Special Studies-Current Topics in BMB (pass/fail) 1

BMB Optional 1st Term Course
PH.120.600

BSPH Epidemiology Required Courses
PH.340.721 Epidemiologic Inference in Public Health I 5
PH.340.751 Epidemiologic Methods I 5

Various 1st Term Courses of Interest
PH.120.821 MHS Student Research (pass/fail) 1
PH.140.611 Statistical Reasoning in Public Health I
PH.140.621 Statistical Methods in Public Health I
PH.180.609 Principles of Environmental Health 2 3
PH.180.611 The Global Environment, Climate Change, and Public Health
PH.187.610 Public Health Toxicology
PH.221.613 Introduction to Humanitarian Emergencies
PH.260.611 Principles of Immunology I 4 5

PH.260.623 Fundamental Virology
PH.260.636 Evolution of Infectious Disease
PH.300.651 Introduction to the U.S. Healthcare System
PH.330.662 Public Mental Health
PH.380.604 Life Course Perspectives on Health
PH.410.600 Fundamentals of Health, Behavior and Society
PH.410.612 Sociological Perspectives on Health
PH.550.630 Public Health Biology

Credits 18

Second Term
Late October to just before the December holiday season

School-wide Required Course for all BSPH Students Not in the MPH Program
PH.550.865 Public Health Perspectives on Research (online, pass/fail)

BMB Upper-level Courses
PH.120.603 Molecular Biology of Pandemic Influenza 3
PH.120.626 Principles of Cell Biology 3

BMB Optional 2nd term Course
PH.120.601 Biochemistry II: Major Metabolic Pathways

Various 2nd Term Courses of Interest
PH.120.821 MHS Student Research (pass/fail) 1
PH.120.720 Applying Reproductive Biology Literacy Through Service-Learning 6
PH.140.612 Statistical Reasoning in Public Health II 7
PH.140.622 Statistical Methods in Public Health II 8
PH.180.650 Fundamentals of Clinical Oncology for Public Health Practitioners
PH.180.610 Applied Environmental Health Practice 3 6 9
PH.183.631 Fundamentals of Human Physiology
PH.187.632 Molecular Toxicology 10
PH.187.610 Public Health Toxicology (online)
PH.223.662 Vaccine Development and Application
PH.260.612 Principles of Immunology II (5,9)
PH.260.631 Immunology, Infection and Disease
PH.260.635 Biology of Parasitism
PH.380.720 Masculinity, Sexual Behavior & Health: Adolescence & Beyond
PH.410.611 Under Pressure: Health, Wealth & Poverty

Credits 8

Third Term
Mid-January to Mid-March

BMB Required Courses
PH.120.860 Thesis Preparation (pass/fail)

BMB Upper-level Courses
PH.120.608 Gene Editing, therapy and Manipulation 3
PH.120.613 Nucleic Acid Chemistry 3
PH.120.627 Stem Cells and the Biology of Aging and Disease 3

BSPH Epidemiology Required Courses
PH.340.721 Epidemiologic Inference in Public Health I (online) 5
### Various 3rd Term Courses of Interest

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH.120.821</td>
<td>MHS Student Research (pass/fail)</td>
</tr>
<tr>
<td>PH.140.615</td>
<td>Statistics for Laboratory Scientists I</td>
</tr>
<tr>
<td>PH.182.640</td>
<td>Food- and Water- Borne Diseases</td>
</tr>
<tr>
<td>PH.183.638</td>
<td>Mechanisms of Cardiopulmonary Control</td>
</tr>
<tr>
<td>PH.380.640</td>
<td>Children in Crisis: An Asset-Based Approach to Working With Vulnerable Youth</td>
</tr>
<tr>
<td>PH.221.635</td>
<td>Global Advances in Community-Oriented Primary Health Care</td>
</tr>
<tr>
<td>PH.223.687</td>
<td>Vaccine Policy Issues</td>
</tr>
<tr>
<td>PH.260.627</td>
<td>Pathogenesis of Bacterial Infections</td>
</tr>
<tr>
<td>PH.260.635</td>
<td>Biology of Parasitism</td>
</tr>
<tr>
<td>PH.260.650</td>
<td>Vector Biology and Vector-Borne Diseases</td>
</tr>
<tr>
<td>PH.260.656</td>
<td>Malariaology</td>
</tr>
<tr>
<td>PH.260.665</td>
<td>Biological Basis of Aging</td>
</tr>
<tr>
<td>PH.308.610</td>
<td>The Political Economy of Social Inequalities and Its Consequences for Health and Quality of Life</td>
</tr>
<tr>
<td>PH.330.661</td>
<td>Social, Psychological, and Developmental Processes in the Etiology of Mental Disorders</td>
</tr>
<tr>
<td>PH.340.607</td>
<td>Introduction to Cardiovascular Disease Epidemiology</td>
</tr>
<tr>
<td>PH.380.665</td>
<td>Family Planning Policies and Programs</td>
</tr>
<tr>
<td>PH.380.760</td>
<td>Clinical Aspects of Reproductive Health</td>
</tr>
<tr>
<td>PH.410.610</td>
<td>Housing Insecurity and Health</td>
</tr>
<tr>
<td>PH.410.613</td>
<td>Psychosocial Factors in Health and Illness</td>
</tr>
<tr>
<td>PH.410.651</td>
<td>Health Literacy: Challenges and Strategies for Effective Communication</td>
</tr>
</tbody>
</table>

| Credits | 16 |

### Fourth Term
Mid/end of March to mid/end of May

#### BMB Required Courses

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH.120.624</td>
<td>Cancer Biology</td>
</tr>
<tr>
<td>PH.120.870</td>
<td>Thesis in Biochemistry and Molecular Biology</td>
</tr>
</tbody>
</table>

| Credits | 3 |

| Credits | 5 |

#### Additional BMB Courses
(if still need courses for the minimum of five upper-level BMB courses)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH.120.606</td>
<td>Cellular Stress in Physiology and Disease</td>
</tr>
<tr>
<td>PH.120.622</td>
<td>Molecular and Cellular Mechanisms of Reproduction</td>
</tr>
<tr>
<td>PH.120.605</td>
<td>Genome Integrity</td>
</tr>
</tbody>
</table>

| Credits | 3 |

#### Other 4th Term Courses of Interest

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>PH.120.821</td>
<td>MHS Student Research (pass/fail)</td>
</tr>
<tr>
<td>PH.140.616</td>
<td>Statistics for Laboratory Scientists II</td>
</tr>
<tr>
<td>PH.183.631</td>
<td>Fundamentals of Human Physiology (online)</td>
</tr>
<tr>
<td>PH.183.642</td>
<td>The Cardiopulmonary System Under Stress</td>
</tr>
<tr>
<td>PH.187.661</td>
<td>Environmental Health in Neurological and Mental Disorders</td>
</tr>
<tr>
<td>PH.223.682</td>
<td>Clinical and Epidemiologic Aspects of Tropical Diseases</td>
</tr>
</tbody>
</table>

| PH.260.656 | Malarialogy |
| PH.260.712 | Clinical Immunology |
| PH.223.687 | Biologic Basis of Vaccine Development |
| PH.300.651 | Introduction to the U.S. Healthcare System (online) |
| PH.380.667 | Women's Health Policy |
| PH.380.762 | HIV Infection in Women, Children, and Adolescents |
| PH.410.652 | Interpersonal Influence in Medical Care |

| Credits | 8 |

#### Total Credits | 50 |

---

### The M.H.S. 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.

You get a grade for the MHS thesis. Your thesis grade will show on your transcript and will figure in to your cumulative GPA, through a five-credit thesis 'course' listed for 4th term, PH.120.870 Thesis in Biochemistry and Molecular Biology. Although the grade is assigned in 4th term, you will be working on your thesis for significantly more than one term. (Indeed, if you only work on the thesis starting over spring break before 4th term, you are very likely not to get a passing grade.)

#### Procedure and Rules for the MHS Thesis

1. A list of thesis topics will be distributed. You will select your top 3-4 topics from this list. The deadline for submitting your choices will be in 2nd term; you will receive email notifications to your 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.")
2. You will be assigned one of your topic choices, and a thesis supervisor to advise on this topic; you will know your topic and thesis supervisor by approximately midway through 2nd term.

3. You then should consult with their thesis supervisor regarding topic, tips for starting your work, etc. The MHS thesis is intended to be an independent study project in which you work one-on-one with your faculty supervisor to assist your research as needed. There are several important milestones and deadlines related to the MHS thesis:

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Deadline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Students submit 5 topics of interest via BMB Masters Resource CoursePlus site</td>
<td>Monday, September 26, 2022, 11:59 PM</td>
</tr>
<tr>
<td>Student notification of topic and advisor</td>
<td>Friday, October 7, 2022, 11:59 PM</td>
</tr>
<tr>
<td>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</td>
<td>No later than Friday, October 28, 2022, 5:00 PM</td>
</tr>
<tr>
<td>Meeting 2 - Progress report with thesis supervisor at least once by Week 2 of 3rd term (and before the end of 2nd term is encouraged, so that you can work more on your general outline over winter break)</td>
<td>Before Friday, December 16, 2022, before the end of 2nd term if possible</td>
</tr>
<tr>
<td>2-4 page initial outline due – email to thesis supervisor, and also submit via CoursePlus website for PH.120.860</td>
<td>No later than Friday, January 27, 2023, 11:59 PM (sooner is encouraged)</td>
</tr>
<tr>
<td>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</td>
<td>Before Friday, February 17, 2023</td>
</tr>
<tr>
<td>~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</td>
<td>No later than Friday, March 10, 2023, 11:59 PM (sooner is encouraged)</td>
</tr>
<tr>
<td>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</td>
<td>No later than Friday, March 24, 2022</td>
</tr>
<tr>
<td>Final Thesis Due (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</td>
<td>Friday, April 14, 2023, 11:59 PM</td>
</tr>
</tbody>
</table>

4. Document uploads will use dropboxes associated with the appropriate CoursePlus course site, for PH.120.860 Thesis Preparation in 3rd term and PH.120.870 Thesis in Biochemistry and Molecular Biology in 4th term.

5. The work-in-progress document – i.e., the detailed outline or partial rough draft due (depending on which your thesis supervisor on what s/he prefers), including references. This document must be submitted to your thesis supervisor by email and submitted to the CoursePlus inbox by 11:59 PM of the Monday of the week between 3rd and 4th terms to get a Pass for Course PH.120.860 Thesis Preparation.

6. Final MHS thesis is due by Sunday, April 14, 2023, 11:59 PM. Communicate with your thesis supervisor and secondary reader to determine if they prefer a hard copy or an e-copy. You 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. You may also use CoursePlus to upload your thesis to your academic portfolio.

7. Thesis grade: You must receive an A or B on the MHS thesis to be eligible for the MHS degree. As noted above, your grade on your thesis will show on your transcript and figure in to your cumulative GPA, for the five-credit course PH.120.870 Thesis in Biochemistry and Molecular Biology. The grade you get on the thesis that you hand in on April 14, 2023 is the final grade that goes and stays on your transcript, and figures in to your cumulative GPA.

If you receive a C or D on the thesis, you are not eligible for the MHS degree for May graduation. However, you have the option to re-write the thesis if you still wish to be eligible for the MHS degree. Re-written theses must be submitted to your thesis supervisor, your secondary reader, and the BMB academic affairs office (Vicki Keller and Erika Vaitekunas); the absolute last date that the re-written thesis can be submitted is August 1. This re-written thesis must be of A or B grade quality to make you eligible for the MHS degree. Although the grade of C or D will stay on your transcript, the department will submit a letter to Records and Registration to note that you have satisfactorily completed the thesis requirement.

If you receive an F on the MHS thesis, you will be permanently ineligible for the MHS degree; there is no rectifying this deficiency (theses that receive an F are not eligible for a re-write). The draft that you hand in on April 14, 2023 must get a D or better for you to have the option of receiving the MHS degree in the future.

8. Theses handed in after the due date:
Students should do everything in their power to stay on target for the April due date for MHS thesis submission. If a health or personal emergency develops that will prevent you from submitting your thesis by the deadline, you must provide documentation of this emergency (e.g., from a healthcare professional and/or from the Office of Student Affairs). Also be advised that you will not be eligible for spring graduation and marching in our Convocation ceremonies. You will receive an Incomplete for PH.120.870 Thesis in Biochemistry and Molecular Biology. Completion of your thesis by August 1 and receiving a grade of A or B will make you 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 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 your transcript and will figure in to your cumulative GPA. If you wish to be eligible for the MHS degree, you will have to re-write the thesis; this must be handed in to your thesis supervisor, your secondary reader, the BMB academic affairs office (Vicki Keller and Erika Vaitekunas) by August 1, so that you can be eligible for summer degree conferral. This re-written thesis must be an A or B grade quality to make you
eligible for the MHS degree. Although the grade of D will stay on your transcript, the department will submit a letter to Records and Registration to note that you have 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 your thesis is going to be longer than 30 pages, you should discuss this with your 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 topic, but a general format could include
  - Introduction
  - Background
  - The state of the field currently – including what's known, and 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, you 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#.

- You are strongly urged to use bibliographic software; this will be significantly easier for you than typing all your references into your outlines and thesis drafts or trying to keep the papers you find 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 Reference Manager, EndNote, and Mendeley (www.mendeley.com (http://www.mendeley.com)).

- Welch Library classes and tutorials: welch.jhmi.edu/welchone/Classes-and-Lectures (http://welch.jhmi.edu/welchone/Classes-and-Lectures/)
  Online tutorials and schedule of classes for using various services and databases

- Welch Library's information on RefWorks:
  Online tutorials available through: welch.jhmi.edu/welchone/Online-Tutorials-and-Guides (http://welch.jhmi.edu/welchone/Online-Tutorials-and-Guides/)

- Portal for using RefWorks: Under the "Services" tab at welch.jhmi.edu/welchone/ (http://welch.jhmi.edu/welchone/)

- Illustrations: Illustrations are allowed in the thesis. Figures must include a figure legend. You should consult with your thesis supervisor about including figures and in what format – particularly if your thesis supervisor is comfortable with you using a figure from a published work, or whether you should draw your own illustration (and provide attribution for the inspiration). If you do an exact duplication of a figure (by copy and paste) that was published somewhere, you must provide a citation, with some phrase in the figure legend like "taken from Smith et al., 2014." If you draw your own illustration that is roughly based on one or more figures that have been published, you should cite this as, "adapted from Smith et al., 2014 and Comsnoole et al., 2010."

- Working with others – You should verify with your thesis supervisor, but in general, most thesis supervisors will be supportive of you working with your fellow MHS students, such as exchanging thesis drafts with a friend and checking each other’s draft for readability, grammar, typos, etc.

Crucial issue with referencing and with illustrations – Must avoid plagiarism!!!

Information from the School’s Policies and Procedures:
Policy and Procedure Memorandum Students - 1
Subject: Academic Ethics

https://my.jhsp.edu/Resources/PoliciesProcedures/ppm/Pages/default.aspx

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:

- Meet with your 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 you, the topic, and your thesis supervisor. Examples include:
  - Use PubMed or other literature database search (e.g., Google Scholar) with keywords related to your 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 review articles for overview
• Thesis supervisor might assign 2-5 research papers to get you 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 your thesis supervisor and feedback during your regular progress report meetings.
• As your ideas of thesis content start coming together, start working on an outline. A short outline is part of the required work in 3rd term on the thesis. It is highly recommended that you include references during your outlining, both to organize your thoughts and to keep track of citations.
• Make modifications/additions in response to thesis supervisor’s comments.
• Start writing from your outline. Text can be broken into sections and subsections, with headings for each section / subsection.

### Academic Requirements

- Must have a minimum of **16 credits per term** for full-time status, and **64 total credits** to graduate.
- Of the 16 credits per term, **up to four credits each term can be BMB Special Studies (120.840, listed as "Special Studies and Research Biochemistry")**. This means that a **minimum of 12 credits** must be non-Special Studies courses. Part of the purpose of Special Studies (120.840) credits is to give you credit for the time you spend in various activities, even though these activities are not formal specific courses for which you get grades (e.g., seminars, meetings, other enrichment activities).
- While a few online courses are offered to MHS students through our department, a large number of online course offerings are available to you through the School. Be advised that many medical schools do NOT accept online courses, particularly those that are required and/or recommended courses for entrance into medical school. You may want to check with the AAMC website or your choice schools’ admissions requirements to determine their online course acceptance preferences.
- The maximum number of credits in one term is 22, unless a student gets permission from the program director (Dr. Roza Selimyan; rselimyan@jhu.edu) to take more than 22 credits in a given term.
- An MHS student must have a minimum cumulative G.P.A. of **2.75** to graduate. Additionally, maintaining a cumulative GPA of 2.75 is required to remain in sufficient academic standing for receiving federal financial aid (known as **Satisfactory Academic Progress, or SAP**).

A student with a cumulative GPA below 2.75 will be:

1. Be placed on departmental academic probation. The student will be required to meet with the program director, Dr. Roza Selimyan, to discuss classes, study needs, and factors that could be addressed to enhance academic performance.
2. Prepare an academic plan for the coming term that identifies specific tactics to start an upward trend in academic performance. Be advised that students who are receiving **federal financial aid** who have a cumulative GPA below 2.75 are asked to prepare an academic plan as part of their **Satisfactory Academic Progress suspension appeal**. This academic plan for the Satisfactory Academic Progress suspension appeal can also be used as the plan for departmental academic probation.

- D or F in any class or failure to have a cumulative GPA of 2.25 is **grounds for dismissal** (note: this differs from automatic dismissal). Also be advised that that no credits are received for a course in which a student receives an F, and therefore a course in which a student receives an F will not count toward the 64 credits one needs to graduate.

The Master of Health Science (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 program is completed in one academic year (late August through mid May). The program’s flexible curriculum allows opportunity to take courses throughout the Bloomberg School of Public Health. Because of the School’s unique academic calendar (https://www.jhsph.edu/academic/calendar/2019-2020.html), with four eight-weeks terms, students have ample opportunity to take a rich variety of courses.

The MHS in the Department of Biochemistry and Molecular Biology includes courses within a core curriculum focused around biochemistry, molecular biology, reproductive biology, and the biology of disease and public health. The remainder of the courses are electives that can be chosen based on interests and career goals. Students have extensive opportunities to have one-on-one interaction with faculty and staff, for advising, career guidance, and thesis preparation. The department also has a part-time pre-health advisor who leads workshops through the academic year to prepare students for applying to medical school or other professional schools in healthcare.