

# Master of Biomedical Informatics

## Capstone Project

*Version Effective as of*

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Harvard Medical School

*Program Director: Nils Gehlenborg, PhD | Program Manager: Rebecca Fitzhugh*

*Capstone Director: Aparna Nathan, PhD*

*Capstone Oversight Mentors: Theodore Feldman, PhD, Shira Fischer, MD, PhD, MMSc, Arjun Manrai, PhD, Aparna Nathan, PhD*

### The Capstone Experience

The mentored, hands-on capstone experience complements the coursework of the Master of Biomedical Informatics program. Students will work on Biomedical Informatics research projects tailored to their professional expertise and interests under the mentorship of faculty members who are actively bringing computational methods and engineering to biomedicine. By proposing and executing a project, students will gain practical real-world understanding of the field by applying what they are learning in their courses as they work alongside a Biomedical Informatics leader in their area of interest. Typical capstone projects include developing new methods and tools, creating data resources, and analyzing biomedical data.

**All capstone assignments must be submitted through the MBI Capstone Canvas site found at [canvas.harvard.edu](https://canvas.harvard.edu). Questions about Capstone can be directed to the Capstone Director, Aparna Nathan, at [aparna\\_nathan@hms.harvard.edu](mailto:aparna_nathan@hms.harvard.edu).**

### Expectations for Capstone Students

- Students are required to submit a project proposal, progress reports, and a final manuscript by the deadlines set by the MBI program.
- Students must get feedback and approval of all project deliverables from their mentorship team (Mentor and Co-Mentors) before the MBI deadlines. To ensure this, students and their mentorship team must identify a reasonable timeline for this feedback well in advance of the program deadlines.
- Students are expected to practice professional courtesy when making and keeping regular appointments with their Mentor and Co-Mentor(s).
- Students are expected to exhibit professional conduct when performing work related to capstone in their Mentor's lab or office space.
- Due to the short timeframe of the MBI capstone project, it is highly unlikely that students will be able to submit their capstone work for publication at the time that the final report is due. Students are **not expected to publish their work during the timeframe of the capstone project**, but are highly encouraged to do so in the future.

### **Compensation for Work on Capstone Project**

- All MBI students receive a total of 6 academic credits towards the MBI degree for the work performed on their capstone project.
- MBI students **CANNOT** receive payment or other compensation for the work that they perform on their capstone project during the academic year.
- Students are allowed to receive compensation for work they perform on their capstone project during the summer if the mentors agree to pay them. Students are not required to work on their projects over the summer and mentors are not obligated to provide paid employment to students for completing work on the capstone over the summer.

### **Capstone Project Time Commitment**

- Students are expected to commit around **190 total hours** towards their capstone research project, including conducting research, writing regular progress reports, and writing the final project report.
- This translates to an **estimated 7.5 hours of work on the capstone project per week during academic terms from the time of mentor selection to the final report and presentation**. Part-time students are expected to devote between 3.5 – 4 hours per week.

### **Project Formation and Execution**

- Students may either work with their mentor to propose an original project idea or work on part of an existing project in their mentor's lab.
- Although students will be expected to work collaboratively with their mentor and co-mentors, **they must be the primary contributor to the work being completed for their capstone project**.

## Deadlines

	<b>Accelerated MBI Full-time, Class of 2023</b>	<b>48-credit MBI Class of 2024</b>	<b>Accelerated MBI Part-time, Class of 2024</b>
<b>Submit list of 3-5 potential mentors along with contact information via Canvas.</b> Request introduction to potential mentors if necessary.	September 16, 2022	December 9, 2022	February 10, 2023
<b>Submit name and contact information of selected mentor via Canvas.</b>	October 7, 2022	March 1, 2023	March 1, 2023
<b>Have mentor sign and return Mentor Agreement form (found in Canvas) to Capstone Director</b>	October 21, 2022	March 15, 2023	March 15, 2023
<b>Submit project proposal</b>	October 24, 2022	March 27, 2023	March 27, 2023
<b>Progress Report #1</b>	December 10, 2022	May 8, 2023	May 8, 2023
<b>Progress Report #2</b>	February 10, 2023	October 2, 2023	October 2, 2023
<b>Progress Report #3</b>	N/A	N/A	December 10, 2023
<b>Progress Report #4</b>	N/A	N/A	February 10, 2024
<b>Submit final report</b>	April 10, 2023	November 15, 2023	April 10, 2024
<b>Capstone presentation</b>	May 11-12, 2023	December 14-15, 2023	May 9-10, 2024

## Process

### Step 1. Identify Mentor

Students come up with a list of 3-5 potential mentors who have a computational or quantitative research program focused on biomedical data.

- Primary Mentors must be Assistant Professors, Associate Professors, or Professors. Instructors may act as mentors with permission of the Program Director.
- Primary Mentors must have a faculty appointment at Harvard University.
- Co-mentors such as postdoctoral fellows or other suitable personnel, as well as faculty at other institutions, may be proposed in addition to the Primary Mentor.

Students will be provided with lists of previous MBI capstone mentors and other appropriate faculty who have expressed interest in mentoring an MBI student for the capstone experience. Students can also search for other faculty they may be interested in working with by using resources such as Harvard Catalyst Profiles at <https://connects.catalyst.harvard.edu/profiles/search/people>. This database of all Harvard Medical School-affiliated faculty allows users to search by research area, institution, and faculty type.

Students are expected to contact and set up meetings with prospective mentors on an individual basis. This can begin even before submitting the list is due. MBI Program Staff are available to help as needed: for example, introducing students to potential mentors if no previous relationship exists, looking over introductory emails to send to potential mentors, and helping students think through potential mentors they may be interested in reaching out to. **If you are struggling with how to connect with a potential mentor, please reach out to Aparna as early as possible before your mentor selection is due.** Once you select a mentor and the mentor agrees to work with you, you will submit their name in Canvas and begin working with them to develop a project proposal (see next section).

#### *Deadlines for Mentor Selection and Approval*

	<b>Accelerated MBI Full-time, Class of 2022</b>	<b>48-credit MBI</b>	<b>Accelerated MBI Part-time, Class of 2023</b>
<b>Submit list of 3-5 potential mentors along with contact information via Canvas.</b> Request introduction to potential mentors if necessary.	September 16, 2022	December 9, 2022	February 10, 2023
<b>Submit name and contact information of selected mentor via Canvas.</b>	October 7, 2022	March 1, 2023	March 1, 2023
<b>Have mentor sign and return Mentor Agreement form (found in Canvas) to Capstone Director</b>	October 21, 2022	March 15, 2023	March 15, 2023

## Step 2. Propose project together with Mentor

Students develop a project proposal with input from their mentor and co-mentors. Once the mentor has approved the proposal, students submit the proposal to Canvas for approval by the Capstone Oversight Committee. Program staff may reach out to Capstone Mentors at any time to verify that they have reviewed and approved a submitted proposal.

### ***Steps to Create and Submit the Project Proposal***

- Discuss project idea, identify data sources and techniques with mentor.
- Discuss how to obtain IRB and other approvals required for proposed project.
- Write project proposal following specified format (see below) and receive approval from capstone mentor.
- Submit project proposal as a .pdf or .doc document to Canvas site.
- Obtain approval for proposed project from Capstone Oversight Committee.
- Declare project start date if submitted before deadline listed below.

### ***Project Proposal Format***

The mentor-approved proposal should be 3 to 5 pages in length and include the following sections:

- Objectives of the research
- Current state of the field and significance of the project's contributions
- Approach and methods
- References
- Timeline
- Plans for submitting an IRB proposal, if relevant. Please include the institution where the IRB will be or was submitted and any policies and dates relevant to the IRB.

### ***Project Proposal Deadlines***

	<b>Accelerated MBI Full-time, Class of 2022</b>	<b>48-credit MBI + Accelerated MBI Part-time, Class of 2023</b>
<b>Submit project proposal</b>	October 24, 2022	March 27, 2023

## Step 3. Conduct Research under Guidance of Mentor

Students conduct research under the guidance of their mentor and co-mentors. Students and mentors meet regularly to discuss the project. Students submit regular progress reports for review by their Capstone Oversight Mentor.

### ***Steps to Conduct Research and Submit Progress Reports***

- Meet with primary mentor at least once a month to discuss progress, challenges arising in the project, and to address feedback on progress reports.
- Submit progress reports approximately every 8 weeks by the deadlines (see below) for review and approval by the Capstone Oversight Committee

### **Progress Report Format**

The progress report must outline what the student has accomplished so far and detail issues that the student has encountered in data collection, analysis, writing, and IRB approval. The report must describe the next steps and explain possible changes to the plan compared to the original proposal.

**Students should use the MBI Progress Report Template from the Capstone Canvas site.**

As they approach the end of the capstone experience, students should also begin thinking about the format of their final report. If the student chooses to submit a final report formatted as a manuscript to submit to a journal, the *final* progress report must indicate which journal the student and mentor have selected for the project and a link to the journal's "Instructions for Authors" must be included.

### **Progress Report Deadlines**

	<b>Accelerated MBI Full-time, Class of 2022</b>	<b>48-credit MBI, Class of 2023</b>	<b>Accelerated MBI Part-time, Class of 2023</b>
<b>Progress Report #1</b>	December 10, 2022	May 8, 2023	May 8, 2023
<b>Progress Report #2</b>	February 10, 2023	October 2, 2023	October 2, 2023
<b>Progress Report #3</b>	N/A	N/A	December 10, 2023
<b>Progress Report #4</b>	N/A	N/A	February 10, 2024

### **Step 4. Submit Final Report**

Students submit a capstone report in the form of a full-length scientific manuscript structured either according to the recommended MBI format *or* the format recommended by their targeted journal. The Capstone Oversight Committee may request revisions.

#### **Steps to Submit Final Report**

- Use the sections recommended by MBI (see below) or by your target journal (often on the journal's Instructions to Authors page) to outline the appropriate sections of your report
- Draft a final report and receive approval from your mentor.
- Submit report as .pdf or .doc to Canvas and Turnitin (instructions will be provided)
- Receive feedback from Capstone Oversight Committee and incorporate feedback into the final report.

The *mentor must approve the completed written manuscript* in advance of submission. Program staff may reach out to Capstone Mentors at any time to verify that they have reviewed and approved a submitted report. Students are strongly encouraged to eventually submit their manuscript to the selected journal, although this is unlikely to happen within the span of the capstone and may require additional work after completing the MBI program.

Students also have the option to submit their final report to DASH (**D**igital **A**ccess to **S**cholarship at **H**arvard), which is a central open-access repository of research by members of the Harvard community. Students must have permission of their project mentor to deposit to DASH. Learn more at [dash.harvard.edu](https://dash.harvard.edu).

***Final Report Format***

The completed capstone paper should be structured like a scientific manuscript. The format that MBI recommends is:

- Introduction
- Methods
- Results
- Discussion
- References
- Acknowledgments

Alternatively, if a student is preparing to submit a manuscript based on their capstone project to a journal, they may submit a final report that follows the journal’s recommended format. If a student chooses this option, they must provide a link to the formatting instructions for their chosen journal.

***Final Report Deadlines***

	<b>Accelerated MBI Full-time, Class of 2023</b>	<b>48-credit MBI, Class of 2024</b>	<b>Accelerated MBI Part-time, Class of 2024</b>
Submit final report	April 10, 2023	November 15, 2023	April 10, 2024

**Step 5. Defend Capstone Research**

Students present and defend their final approved report at a “Capstone Research Day” that is open to the public and held once per semester. Presentations are 10 minutes plus 5 minutes for questions.

***Capstone Research Days***

	<b>Accelerated MBI Full-time, Class of 2023</b>	<b>48-credit MBI, Class of 2024</b>	<b>Accelerated MBI Part-time, Class of 2024</b>
Capstone presentation	May 11-12, 2023	December 14-15, 2023	May 9-10, 2024

## Changes to Project and/or Mentor

If a student needs to significantly change their project or select a new mentor after submitting a project proposal, they and their original mentor need to submit the request in writing to the MBI Program Manager for consideration by the Capstone Oversight Committee. The request must include an explanation of why the original project and/or collaboration did not succeed and why a change would be beneficial. Requests to change mentors **must be sent by the due date of the first progress report (second progress report for part-time students)**. If the change is approved, students will need to submit a new project proposal for approval. Changing mentors or projects may negatively impact the progress made towards the capstone project.

## Grading and Evaluation

The purpose of the capstone project is to give students the opportunity to engage in a professional research project, with the understanding that not all research projects go according to plan. The MBI Capstone Oversight Committee and Program Staff are committed to counseling students throughout their capstone projects on ways to work through any challenges they may encounter. Evaluation of the capstone project is therefore based primarily upon the student's effort and ability to meet the expectations of carrying out a professional project — **not** based on the final results.

Two critical expectations for completing a professional research project are (1) meeting project milestone deadlines and (2) actively incorporating feedback from your mentor(s) and the Capstone Oversight Committee. These two criteria are reflected in the grading scheme detailed below. Points are awarded for each step of the capstone experience based on content and/or on-time submission. See below for further details about how these points are awarded. The capstone courses BMI 751 and BMI 752 are graded as 'Satisfactory' or 'Unsatisfactory'. A 'Satisfactory' grade is defined as a minimum of 80% of the points for the course, or the equivalent of a B minus or higher, and students must earn a 'Satisfactory' grade in both BMI 751 and BMI 752 to successfully complete their capstone experience. Students must complete their capstone experience to earn the Master in Biomedical Informatics degree.

Assignment	Content	On Time
Mentor Selection	N/A	10
Proposal	25	15
Progress Report 1	15	10
Progress Report 2	15	10
Final Report	50	30
Final Presentation	20	N/A
<b>Area Total</b>	110	90
<b>Grand Total Possible Points</b>		<b>200</b>

**\*For Part-Time Accelerated MBI students, each of the 4 progress reports will be worth 7.5 content points and 5 on-time points, respectively.**

## Content Points

### Capstone Oversight Mentor Feedback

When the proposal, progress reports, and final report are submitted, students should expect comments from their Capstone Oversight Mentor within one to two weeks of the submission date. **As soon as the Capstone Oversight Mentor posts feedback on the assignment submission, students are expected to address all comments or concerns within one week.** This includes resubmitting a revised version, if requested. Acknowledging feedback and submitting a first revision within the one-week timeframe will award the student the full content points available for the assignment. **Subsequent progress reports cannot receive full credit if the previous progress report's feedback remains unaddressed.**

### Additional Revisions

At the discretion of the Capstone Oversight Mentor, a second revision may then be required. If the second revision is required because of new concerns or issues that are unique from the content of the first revision, content points will not be affected. **If the second revision is required because the student did not adequately address the feedback on the assignment submission in the first revision, half of the possible content points will be deducted.** The same policy will hold true for any subsequent revisions on the same assignment.

## On-Time Points

### Assignment Due Dates and Extensions

Students are expected to submit their capstone project assignments by the corresponding deadlines. If a student knows that they will not be able to submit their assignment by the deadline, they must notify the Capstone Director **24 hours before** the assignment deadline to be given an extension. Extensions are typically up to 3 business days for progress reports, or 5 business days for mentor selection, project proposal, and final report). Students may request a maximum of one extension per semester. **Any assignment that is submitted late without permission for an extension OR is submitted past the extension deadline will receive 0 on-time points.**

In situations where extenuating circumstances (illness, family emergency, etc.) prevent the student from submitting their capstone assignments on time, they should inform the Capstone Director as soon as possible and the Program Administration will work with the student to determine an appropriate alternate timeline.

**Students who do not submit their final capstone report by the deadline or by an agreed-upon extension date will not be permitted to present at that semester's capstone presentation session and will lose all on-time points for the final report (30) and all points for the presentation (20). These students will be subject to academic disciplinary action.**

### Not Meeting Expectations

When a student has lost 20 points, they must meet with the Capstone Director to discuss their progress and a plan for remediation. If the student loses a total of 30 points, they will be considered as not making [Satisfactory Academic Progress](#) and their case will be reviewed by the HMS Master's Programs' Academic Progress and Review Board (APRB). If the student loses more than a total of 40 points, at the discretion of the

APRB, the student will be issued a Formal Notice indicating that they must extend their time to degree to finish the capstone project.

Students who lose 40 or more points before or while enrolled in **BMI 751 – Capstone Research I** will receive a grade of ‘UNSAT’ for BMI 751 and will not be permitted to enroll in BMI 752 in the next semester. Students who cumulatively lose more than 40 points in BMI 751 and BMI 752 will not be permitted to complete their capstone or present their final presentation in the semester in which they are enrolled. Students in this situation will not qualify for graduation and will not be issued the MBI degree in their expected graduation term. They will receive an ‘Incomplete’ grade for **BMI 752 – Capstone Research II**, be required to finish their project in the next academic term and will have to pay an extension-to-degree fee of \$3,000. This extension fee only allows a student to finish and receive credit for the capstone project and does not allow the student to enroll in any additional Harvard University or MIT classes. If the student fails to complete their capstone in the next semester, they will need to then retake **BMI 752** and pay the part-time MBI tuition rate to continue with their capstone project to graduate from the program.

### **Academic Dishonesty and Plagiarism**

All submitted work for the Capstone Project is expected to be the student’s own work and must include proper citations. Students must follow the guidelines found in [Section 3.09 of the HMS Master’s Student Handbook on Academic Dishonesty and Plagiarism](#).

**All project proposals and final reports will be analyzed using the plagiarism detection software [Turnitin](#). Students will be given access to run their project proposals and final reports through Turnitin for similarity analysis ahead of the assignment due date.**

Information on citing correctly and scientific integrity is available here:

- <https://usingsources.fas.harvard.edu/>
- <https://guides.library.harvard.edu/gsd/write/integrity>

***Plagiarism, fabrication and/or falsification of research results ordinarily will result in the student being required to withdraw, dismissal or expulsion.***