# The Pittsburgh Biomedical Informatics Training Program Handbook

Guidelines and Regulations

2025-2026

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## 1. OBJECTIVES OF THE TRAINING PROGRAM

The mission of the Biomedical Informatics Training Program (BMITP) at the University of Pittsburgh is to prepare students to become outstanding leaders in biomedical informatics research, education, and practice through world-class training with a focus on artificial intelligence and computing methods for biomedical problems. To achieve this mission, the training program has been designed to accomplish the following objectives:

- To develop proficiency in fundamental biomedical informatics knowledge and skills in biomedicine, methodology, computer science, data science, and artificial intelligence.
- To gain knowledge and skills in major areas of biomedical informatics, such as health care or clinical informatics, clinical research informatics, translational bioinformatics, public health informatics, and consumer health informatics.
- To learn the fundamentals of scientific reasoning, research design, reproducibility, and project planning and execution.
- To achieve professional excellence in critical analysis of scientific literature, scientific writing and speaking, and teaching.
- To systematically identify, plan, and achieve career goals through professional development and career counseling.

The BMITP offers a range of training experiences to accommodate diverse backgrounds and aspirations, including a doctoral degree in biomedical informatics, a master's degree in biomedical informatics, a certificate in biomedical informatics, an MD/PhD in biomedical informatics, and non-degree postdoctoral research training in biomedical informatics.

## 2. PURPOSE OF THE HANDBOOK

This Handbook is intended to supplement the "Regulations Governing Graduate Study at the University of Pittsburgh," (https://catalog.upp.pitt.edu/content.php?catoid=136&navoid=11853) providing a comprehensive set of rules, expectations, and recommendations for all aspects of the BMITP. Questions about specific BMITP issues not covered in this Handbook should be directed to the BMITP Director and Coordinator.

When they begin the BMITP, each student will be given a copy of the Handbook. The Handbook will be updated yearly to ensure accuracy, and a new edition will be published at the start of each fall term. Each student should refer to the Handbook that was current when they began the BMITP as they progress through the training.

## 3. DEPARTMENT OF BIOMEDICAL INFORMATICS

The Department of Biomedical Informatics (DBMI) at the University of Pittsburgh in the School of Medicine brings together a diverse group of faculty members committed to improving biomedical research and clinical care through innovative technologies. Currently funded projects explore areas such as clinical, genomic, and proteomic data mining, artificial intelligence and machine learning, natural language processing, and biosurveillance.

## 4. HISTORY OF THE TRAINING PROGRAM

Founded in 1987, the BMITP at the University of Pittsburgh has a long and renowned history of biomedical informatics research and training. The pioneering work of Drs. Jack Myers, Harry People, Randolph Miller, John Vries, Bruce Buchanan, Gregory F. Cooper and many others established the University of Pittsburgh as an early influential leader in applying artificial intelligence in biomedical informatics. The National Library of Medicine (NLM) has continuously funded the BMITP since 1987 through the T15 training grant, which supports graduate education, postdoctoral training, and research activities.

## 5. TRAINING PROGRAM CORE FACULTY

A significant strength of the program is its large faculty of active teachers and productive researchers. The BMITP Core Faculty has grown steadily since the program's inception and now includes 28 members, with primary appointments in 12 departments of the University of Pittsburgh (Appendix A). Three of the faculty are Fellows of the American College of Medical Informatics. Others are recognized as national leaders in informatics applied to specific domains, including pathology, nursing, radiology, librarianship, anesthesiology, pharmacology, information science, biostatistics, and health services research. As a group, the BMITP Core Faculty decides all matters of program policy. As individuals, they offer core courses, oversee student research, chair thesis and dissertation committees, and serve as primary advisors and mentors to students.

## 6. BMITP LEADERSHIP

The BMITP leadership includes the Director, the Co-Director, and the Coordinator.

- BMITP Director: Harry Hochheiser, PhD
- BMITP Co-Director: Xinghua Lu, MD, PhD
- BMITP Coordinator: Toni Porterfield

## 7. FINANCIAL SUPPORT

### 7.1. Doctoral Students

Doctoral students will be financially supported by the School of Medicine or the BMITP for the first year. Tuition, medical insurance, and a stipend will be provided as part of this assistance. The BMITP is committed to providing financial assistance to all doctoral students in subsequent years of training, but such assistance is not guaranteed. Funding sources include institutional funds, faculty research grants, training grants, and fellowships. Students are encouraged to choose a BMITP-approved mentor to support them and discuss funding options with the BMITP Director and Coordinator.

Doctoral students will typically be supported in one of 4 ways:

- As a Graduate Student Researcher (GSR), funded by faculty research grants
- As a Graduate Student Assistant (GSA), funded by institutional funds
- As an NLM Fellow, funded by the NLM T15 training program
- As a Predoctoral Fellow, funded by a Fellowship award

University of Pittsburgh policies for all types of students can be found here: https://www.gradstudies.pitt.edu/about/student-policies-and-regulations. Pertinent details are included below.

### 7.1.1. National Library of Medicine (NLM) Fellows

As NIH policy dictates for all extramural training programs, NLM T15 training grant support is only available to US citizens or permanent residents. The NLM largely dictates these and other policies for NLM-funded fellows. Some details are available at https://www.nlm.nih.gov/ep/trainingdirectors.html.

### 7.1.2. Graduate Student Researchers and Graduate Student Assistants

Some students will be funded as GSRs or as GSAs. GSRs are appointed and directed by the principal investigator of the research grant that provides the funding for the GSR position. GSRs working on research that does not directly contribute to their dissertation are expected to work 20 hours per week on average on their GSR research. Time spent on the GSR work should contribute to the funded project without detracting from the timely completion of the student's degree. Ideally, GSRs will be paid to work on their doctoral or master's research, but this is not always possible.

GSAs are appointed through the School of Medicine Graduate Office and directed by the BMITP Director for their first year of doctoral training. GSAs will rotate through BMITP labs and establish a research mentor by the end of their first year.

The exigencies of research may present circumstances requiring bursts of work, particularly before major academic, publishing, or conference deadlines. It is not uncommon for students to take some time off after such milestones.

In addition to Annual Academic Assessments of PhD students, there will be an annual evaluation of student workers. Further information will be provided after the University of Pittsburgh and the Graduate Student Union have reached an agreement. Please see the University's Graduate

Student Researcher (GSR) Academic Regulations (https://www.gradstudies.pitt.edu/sites/default/files/assets/GSR-Academic-Regs-6-1-22-x.pdf) and Graduate Student Assistant Regulations (https://www.gradstudies.pitt.edu/sites/default/files/assets/TA-TF-GSA-Academic-Regs-6-1-22-x.pdf) for official policy statements.

### 7.1.3. Master's and Certificate Students

Although the BMITP generally cannot fund master's and certificate students, GSR positions are occasionally available. Many master's and certificate students are either self-funded or are funded through tuition remission associated with their employment at the University of Pittsburgh.

## 8. ADVISORS

The BMITP has established separate mechanisms for academic and research advising to guide students during the entire training period. Each student is assigned an academic advisor upon entry into the BMITP. As students advance in their research, they will choose a research advisor. In addition to academic and research advisors, the BMITP Director, Co-Director, and Coordinator serve as general advisors during the entire training period.

### 8.1. Academic Advisor

An academic advisor will be appointed for each new student. All students must complete the Academic Mentoring Contract (see Appendix B). This document outlines the academic advisor's and student's responsibilities. The academic advisor and student must sign the contract and provide the BMITP Coordinator with a copy.

The academic advisor's primary responsibility is to work with the student to select courses and plan the path toward completing coursework requirements and relevant milestones, including the preliminary and comprehensive exams. Although the role of the academic advisor may diminish as students proceed to candidacy and rely more heavily on their research advisors for ongoing guidance, the academic advisor can provide an alternative perspective on the student's progress through the program.

### 8.2. Research Advisor

The student should select a research advisor before the end of their second semester.

Master's and certificate students must complete the Research Mentoring Contract (see Appendix C), which outlines the responsibilities of the research advisor and the student. The research advisor and the student should sign the contract and provide the BMITP Coordinator with a copy.

The process is somewhat different for Doctoral students. Upon reaching an agreement to work as an advisor/student team, the doctoral student and the research mentor must complete a Dissertation Advisor Request Form. They must also complete the Advisor-Student Expectations Form describing the roles and responsibilities of both the student and the advisor. Finally, the advisor must complete a Financial Commitment Form documenting the advisor's acceptance of responsibility for supporting the student. All of these forms will be signed electronically with the approval of the BMITP Director. These forms are described in Appendix D.

The research advisor's role is to advise and guide the student through the research process, providing guidance on problem selection and definition, conducting research, writing, completing degree requirements, presenting work, and planning career options. Although each student's closest relationships are likely to be with their research advisor, there is no exclusivity implied. Students are encouraged to cultivate relationships with multiple faculty members who can provide complementary advice. Although some of these mentors may serve on doctoral and master's committees, there is no implied limitation - students should feel free to draw on others outside of their committees, or even outside of the BMITP, as they see fit.

### 8.3. Training Program Director and Co-Director

Students are also encouraged to speak to the BMITP Director and Co-Director if they have any concerns or issues if they would prefer to address with someone other than their academic or research advisors.

## 9. DOCTORAL TRAINING PROGRAM

Students admitted into the BMITP for doctoral training typically complete their PhD degree in 4-5 years and specialize in areas such as health informatics, clinical research informatics, bioinformatics, and the application of artificial intelligence to biomedical challenges.

This section describes the academic courses, teaching, research experiences, program milestones, and other requirements that the student must successfully complete before receiving the doctoral degree. A general timeline, which includes requirements and milestones, is provided. The timeline outlines the academic, research, and other requirements students should expect to complete each program year. During the annual review, any unexpected or anticipated deviations from the timeline will be discussed with the BMITP Director.

### 9.1. Overview of Requirements

To earn a doctoral degree in biomedical informatics, a student must complete a program of study that includes

(a) required coursework;
(b) a preliminary examination;
(c) a second-year evaluation;
(d) a comprehensive examination;
(e) research work leading to an acceptable doctoral dissertation; and

(f) additional non-credit requirements.

The PhD degree in biomedical informatics requires successful completion of 72 credits, including 41 credits of required courses (29 credits of core courses and 12 credits of elective courses), 3 credits of teaching, 18 credits of dissertation research, and 10 or more credits from additional courses, independent study, etc.

Program milestones include a preliminary evaluation, a second-year evaluation, a comprehensive examination, and a proposal and defense of an acceptable dissertation research project.

Additional non-credit requirements for the doctoral degree include instruction in the responsible conduct of research, attendance and participation in departmental invited lectures, regional and national symposia and conferences, attendance at the annual BMITP retreat, and yearly submission of a first-author scientific article from the second year of training.

### 9.2. Courses

All required courses must be taken for a letter grade, except the journal club, the colloquium, dissertation research, doctoral teaching practicum, and independent study. A minimum grade of B is required in all graduate courses. The BMITP can require a student to retake a core course in which a grade below B is earned. The BMITP Director may waive course requirements satisfied through prior graduate-level courses or university-level study by the Committee on Graduate Studies guidelines. In the case of course waivers, students will be expected to complete additional elective courses in place of the waived courses, as necessary to reach the coursework credit requirements listed above. A student must comply with the regulations of the University of Pittsburgh (www.gradstudents.pitt.edu/) and those regulations established by the BMITP. An average full-time student is expected to complete the PhD degree in four years.

#### 9.2.1. Core Courses

Core courses impart knowledge in key areas of biomedical informatics and data science. They also provide in-depth methodological training in algorithms, artificial intelligence, and statistics, including formalisms, methods, techniques, tools, and reproducibility approaches that apply broadly to all biomedical informatics and data science areas. Further, they teach broad foundational skills that support scientific inquiry in biomedical informatics and data science. The core courses include six 3-credit didactic courses, 2 credits (2 semesters) of the Biomedical Informatics Journal Club, 8 credits (8 semesters) of the Biomedical Informatics Colloquium, and Basics of Professionalism in Graduate Education for a total of 29 credits.

BIOINF 2070 Foundations of Biomedical Informatics 1 (3 credits) - fall term
BIOINF 2071 Foundations of Biomedical Informatics 2 (3 credits) - spring term
BIOINF 2062 Foundations of Algorithms (3 credits) - spring term
BIOINF 2105 Artificial Intelligence for Biomedical Informatics (3 credits) - fall term
BIOST 2041 Introduction to Statistical Methods (fall term), BIOST 2039 Biostatistical Methods (fall term), BIOST 2011 Principles of Statistical Reasoning (spring term), or a comparable course in introductory statistics (3 credits)

BIOINF 2134 Publication and Presentation in Biomedical Informatics (3 credits) - fall term
BIOINF 2032 Biomedical Informatics Journal Club (1 credit) - fall and spring terms for the first or second year
BIOINF 2010 Biomedical Informatics Colloquium (1 credit) - fall and spring terms for first four years
BIOINF 2000 Biomedical Informatics Laboratory Rotation (1 credit) – fall and, if needed, spring term of first year
MSCMP 2280 Basics of Professionalism in Graduate Education (1 credit) - first fall term

### 9.2.2. Elective Courses

These courses provide the means for more advanced study in methods and applications in biomedical informatics and data science. Students must take at least 12 credits from the following courses or from other graduate programs at the University of Pittsburgh (2xxx or higher), Carnegie Mellon University, or another Pittsburgh university associated with the Pittsburgh Council on Higher Education (PCHE). Examples of elective courses include:

BIOINF 2016 Foundations of Translational Bioinformatics (3 credits)
BIOINF 2018 Introduction to R Programming for Scientific Research (3 credits)
BIOINF 2019 Biomedical Data Streaming (3 credits)
BIOINF 2061 Single-Cell and Spatial Genomic Data Analysis (3 credits)
BIOINF 2125 Informatics and Industry (1 credit)
BIOINF 2132 Special Topic Seminar in Medical Informatics (1-3 credits)

### 9.2.3. Teaching Credits

Teaching is a critical component of the BMITP. As part of the graduation requirements, each student must serve as a graduate teaching assistant (TA) for one course, which provides 3 credits of teaching. Some students may elect to become more involved in teaching; such students may TA additional courses, conduct recitation sections, create course notes and assignments, and help prepare, administer, and grade examinations. No financial support is available for the one-course teaching requirement, as academic credit is given. In some cases, financial support may be available for students who serve as TAs for courses beyond the one-course requirement.

BIOINF 3998 Doctoral Teaching Practicum (3 credits)

### 9.2.4. Research Credits

Research includes rotations, independent study, directed study, and dissertation research. Students must take at least 18 credits of dissertation research and additional credits of independent study as needed.

BIOINF 3990 Doctoral Independent Study (1-6 credits)
BIOINF 3999 Doctoral Dissertation Research (18 credits)

### 9.2.5. Courses at Other Institutions

Carnegie Mellon University, Duquesne University, Robert Morris College, and the Pittsburgh Theological Seminary offer graduate students the opportunity for cross-registration in graduate programs in the fall and spring terms. Credits earned by cross-registration in graduate programs in these institutions, when approved in advance by the student's advisors, are accepted as University of Pittsburgh credits for the purpose of the calculation of the quality point average and the completion of degree requirements. Each program or department at each institution retains the authority to establish the prerequisites for admission and maximum enrollment in its courses and grant priority in registration to its graduate students. For details regarding cross-registration procedures, the BMITP Coordinator should be consulted to complete the form required by the Pittsburgh Council on Higher Education (PCHE). Plans to register for courses at these other institutions should be discussed with the students' academic and research advisors if those courses are not for personal development (e.g., languages, etc.). Students can obtain a cross-registration PCHE form from the BMITP Coordinator.

### 9.2.6. Course Performance Expectations

All required courses must be taken for a letter grade, except the Journal Club, Colloquium, and some Independent and Dissertation Studies (to be determined by faculty advisors). A minimum grade of B is required in all graduate courses.

All students are expected to maintain a minimum cumulative grade point average (GPA) of 3.00 on a 4.00 scale. Please be advised that a grade of B- or lower is not considered a passing grade in core courses. If the cumulative GPA falls below 3.00, the student will be placed on academic probation for the next term of registration. If the deficiency is not corrected or vastly improved in this subsequent term, the student may be dismissed at the discretion of the program. The program may also require a student to retake a major/core course in which a grade below B is earned.

### 9.2.7. Transferring or Waiving Requirements

Up to 30 credits – grade B or better – from a master's program in another institution or department within the University of Pittsburgh can be considered for transfer toward the PhD degree. In recognition of graduate study beyond the master's degree successfully completed elsewhere or within the University of Pittsburgh, no more than 12 additional credits may be accepted at the time of admission to meet the minimum credit requirement. (At least three terms, or 36 credits, of full-time doctoral study, or the equivalent in part-time study, must be successfully completed at the University of Pittsburgh.)

The doctoral committee may also waive course requirements satisfied through prior university-level study in accordance with the Committee on Graduate Studies guidelines. Waivers are usually granted when a student wishes to substitute a more advanced course for a required course.

Acceptance of transfer credit or permission to waive classes must be discussed between the student and advisor and approved by the BMITP Director. Consideration of transfer/waiver requests will usually require a review of syllabi for courses proposed for transfer or waiver.

### 9.3. First-Year Research Rotations

Each doctoral student should choose a research mentor and start working on the research that will eventually become the focus of their dissertation. Research rotations provide students and mentors with the opportunity to experience and assess potential mentor-trainee relationships by working on time-limited projects.

DBMI doctoral students must complete at least two, and possibly three eight-week rotations during their first year. following a set schedule:

- October 1 – December 15
- January – mid March (first day of semester)
- Mid-March – late May

Students should use the first few weeks of their first semester to meet with potential mentors and discuss possible rotation topics. Students should work with their academic advisors as needed to identify potential mentors appropriate for their goals and interests. Each rotation should consist of a small body of work which will likely involve background reading, exploration of tools and techniques relevant to the potential line of research, and some preliminary analyses. The specific content of the rotations, including expectations for attendance in any lab meetings, should be agreed upon by the student and the mentor prior to the start of the rotation. *However, each rotation should conclude with some sort of presentation of results to the mentor and their research group.*

Students will receive one credit for each completed rotation. Both the mentor and the student will provide the program director with a brief note summarizing and evaluating the rotation experience. These evaluations will form the basis for the grade.

As the goal of the rotation experience is to learn about new research areas and explore potential mentors, there is no expectation that the rotations will result in concrete research outcomes or deliverables. Rotation grades will be based on the trainee's engagement in the process and work with the mentor on the topic at hand.

Students should complete only one rotation at a time and must finish each rotation to gain the appropriate credits, which will be required for graduation.
At the end of the second rotation, students may either select one of the first two rotation mentors as their doctoral mentor or complete a third rotation. Students who do not feel that they are able to choose a mentor after the third rotation should notify training program leadership, who will work with the student to develop an alternative plan.

These requirements will not apply to students in the MSTP MD/PhD program, who will follow the policies of that program regarding research rotations.

More details regarding rotations can be found in Appendix E.

### 9.4. Program Milestone Examinations

The key program milestone examinations are listed in this section.

#### 9.4.1. Doctoral Preliminary Examination

##### 9.4.1.1. Overview

The preliminary examination, to be held at the spring BMITP Core Faculty meeting focused on student evaluations, will assess appropriate progress in the first year in both coursework and research.

1) The student's first-year coursework will be reviewed to ensure minimal grade requirements (3.00 GPA and successfully passing all courses) and to address any performance concerns identified by instructors.

2) The student will make a short presentation (15-20 minutes) to faculty in an open forum, introducing them to their research. The goal of this presentation will be to inform the faculty about the student's proposed project, including relevant background, and to establish that the student has the potential to succeed in graduate studies.

3) The academic advisor will provide a letter assessing the student's progress and prospects for success.

4) The student must have identified a laboratory for their dissertation research. Inability to do so could result in dismissal from the graduate program and hence the University of Pittsburgh.

Note that the short presentation (item #2 above) is the only additional item in addition to regular first-year coursework.

##### 9.4.1.2. Committee

A standing Preliminary Examination Committee will be formed and will include three BMITP Core Faculty members. Members will serve three-year terms, which are staggered, with one person rotating off and another on each academic year. A list of current members of the Committee is provided in Appendix G .

The research advisor can be present for the preliminary examination but will not participate in the voting. If the student's mentor is a member of the committee, an alternate member will be identified.

##### 9.4.1.3. Examination

For the preliminary examination, the presentation will be evaluated to ensure that the student has begun exploring research topics that may lead to a dissertation and has an initial plan for making further progress. Examination of the presentation will be based on several criteria:

- BACKGROUND KNOWLEDGE: Does the student have at least a preliminary understanding of the domain knowledge necessary to proceed with the proposed line of investigation?

- RESEARCH LITERATURE COMPETENCY: Has the student demonstrated an ability to review published work and relate it to their topic of interest?

- APPROPRIATENESS: Does the proposed line of inquiry have a strong possibility of leading to a novel contribution to biomedical informatics?

- POTENTIAL: Does the student have the potential to succeed with the proposed work?

Each committee member will evaluate the presentation, providing an acceptable or unacceptable grade on each question and an overall final grade. The committee will then discuss these results (behind closed doors) and arrive at a consensus for each question and a consensus grade.

The committee should provide the student with constructive feedback regarding their presentation. Particularly in cases where one or more of the above criteria is deficient, the student should be given clear descriptions of any gaps and suggestions as to how those gaps might be addressed.

The presentation examination results, along with course grades, comments from academic advisors and other faculty members, and the letter from the research advisor, will be discussed at the annual student assessment meeting. At that meeting, BMITP faculty members will vote on each student's status.

#### 9.4.1.4. Outcomes

The outcome of the preliminary examination will be pass, remediation required, or fail, with remediation required resulting in being placed on probation. In that case, the student will have one semester (in the case of the assessment) or until the course is next offered (for the coursework) to remedy the situation. If a result of remediation is recommended, the BMITP director will develop a specific plan detailing what must be completed and when. Students who receive a grade of fail or a grade of remediation required and fail to complete the remediation plan will not be allowed to pursue the PhD degree, but the student may choose to complete the master’s degree.

#### 9.4.1.5. Timing

The preliminary examination presentation should be completed before the end of May of the second semester of the first year.

#### 9.4.1.6. Student Support and Preparation

The BMITP will offer a workshop each spring semester to clarify expectations and help students plan for the presentation.

### 9.4.2. Second-Year Evaluation

#### 9.4.2.1. Overview

The second-year evaluation is a secondary checkpoint to be conducted at the end of the second year. This intermediate checkpoint is added by BMITP and is not required by the University will consist of:

1) Completion of two semesters of journal club that will include completion of a research review and presentation.

2) A writing skills assessment in the publication course or publication of a paper as first author.

3) Presentation of a paper to a committee of three faculty members. This paper will provide a progress update on their research and should be roughly 20 minutes long, with 10 minutes reserved for questions. This presentation will be open to the whole department. This presentation will generally occur during a class session of BIOINF 2134, Publication and Presentation in Biomedical Informatics, taken by students in the first semester of their second year.

Note that the presentation of a paper (item #3 above) is the only item in addition to regular coursework.

#### 9.4.2.2. Committee

A standing Second-Year Evaluation Committee will be formed and will include three BMITP Core Faculty members. Members will serve three-year terms, which are staggered, with one person rotating off and another on each academic year. Current Committee members are listed in Appendix G.

The research advisor can be present for the evaluation but will not participate in the voting. If the student's mentor is a member of the committee, an alternate will be identified.

#### 9.4.2.3. Evaluation

For the second-year evaluation, the presentation will be evaluated to ensure that the student has begun exploring research topics that may lead to a dissertation and has an initial plan for making further progress. The evaluation of the presentation will be based on several criteria:

- BACKGROUND KNOWLEDGE: Does the student have at least a preliminary understanding of the domain knowledge necessary to proceed with the proposed line of investigation?

- RESEARCH LITERATURE COMPETENCY: Has the student demonstrated an ability to review published work and relate it to their topic of interest?

- APPROPRIATENESS: Does the proposed line of inquiry have a strong possibility of leading to a novel contribution to biomedical informatics?

- POTENTIAL: Does the student have the potential to succeed with the proposed work?

- PROGRESS: Do the presented results suggest that the student is progressing appropriately?

Each committee member will evaluate the presentation, providing a grade of acceptable or not acceptable on each and an overall final grade. The committee will then discuss these results (behind closed doors) and arrive at a consensus for each question and a consensus grade. As with the presentation for the preliminary evaluation, students should be provided with feedback describing how any shortcomings might be resolved.

The committee will grade the second-year evaluation, providing an overall recommendation to the BMITP Director.

#### 9.4.2.4. Outcomes

The outcome of the interim evaluation will be pass/fail, with a grade of fail requiring completion of a remediation plan developed by the BMITP Director. To pass the comprehensive examination, this remediation must be completed by the end of the second year (see below).

#### 9.4.2.5. Timing

The interim evaluation presentation will be conducted in the first semester of the second year. For most students, this will be while they are taking BIONF 2134: Publication and Presentation in Biomedical Informatics, which usually includes a presentation by each student. At the discretion of the course director for BIOINF 2134, this presentation might serve to complete the requirements for the interim evaluation. These presentations will be open to any DBMI students, faculty, or staff who wish to attend.

An alternative schedule will be provided for MD/PhD students who do not take BIOINF 2134 during the fall term of their second year.

### 9.4.3. Doctoral Comprehensive Examination

#### 9.4.3.1. Overview

The comprehensive evaluation will challenge the student to demonstrate their depth of knowledge in biomedical informatics while making concrete steps relevant to their dissertation research. This examination will have two components: 1) a written document and 2) an oral examination. The written document will consist of:

1) A brief description of the proposed dissertation work, in a maximum of two pages, that consists of specific aims, significance, and innovation. This description will outline, at a high level, the questions and goals of the proposed work, as informed by the content of the literature review (see next section). The aims should be prepared without direct involvement from the research advisor and should contain a statement of the research hypotheses. Specifically, although discussion of the questions and content with the mentor is allowed, the mentor should not review any written text that might be included in this section.

2) A narrative literature review providing background sufficient for motivating subsequent dissertation research. This review should focus on the topic of the proposed dissertation research and should involve both discussion of prior work and synthesis of that work as needed to identify and frame research questions to be addressed in the dissertation work. Ideally, the literature review would provide a conceptual model of the proposed work, including contextualization in previous work. The methods that will be used should be covered in the literature review. This review should show that the student has sufficient breadth and depth to complete the proposed work. The literature review should be detailed but not overly verbose and should be between 2500 and 5000 words. The literature review should be entirely the student's own work.

Although focusing the aims and literature review on the student's planned dissertation work will usually be the best way to expedite progress, this linkage is not required. The aims are expected to evolve or, in some cases, be wholly reworked after the comprehensive examination.

As this examination's goal is to show the student's fitness for completing doctoral work, input from others should be minimal. As discussed above, the research advisor should not comment on written text that might be submitted in the brief proposal (item #1 above). Students are welcome to discuss the aims and the literature review with their peers, but such discussions should be limited to oral conversations, with no peer review of drafts of either the proposed work or the literature review.

#### 9.4.3.2. Committee

The examinations will be conducted by a standing Comprehensive Examination Committee of 3 BMITP Core Faculty members (Appendix E). Members will serve three-year terms, which are staggered, with one person rotating off and another on each academic year.

The research advisor can be present for the comprehensive examination, but they will not participate in the voting. An alternate will be identified for examinations where the student's mentor is a member of the comprehensive committee.

#### 9.4.3.3. Procedure

When the student is ready to complete the comprehensive examination, they will work with the chair of the Comprehensive Examination committee to schedule a date. The examination should be timed to guarantee that the review and description of the proposed dissertation work can be provided to the comprehensive examination committee members at least two weeks before the examination. Students should be aware that Comprehensive Examination members can delay the examination if materials are not provided at least two weeks before.

The comprehensive exam will be 1.5 hours long and consist of a (maximally) 30-minute presentation of their literature review and proposed work, followed by up to 45 minutes of questions and discussion from the committee and up to 15 minutes for closed-committee discussion.

Two weeks before the examination, the student will submit a literature review providing background and a specific aims page summarizing their research direction to the committee. The exam will evaluate the student's knowledge of biomedical informatics based on the curriculum in the first two years of the BMITP. Students are expected to have a strong grasp of biomedical informatics and clearly understand how their proposed research fits within and adds to existing scientific literature.

The research advisor can be present during the examination and participate in the discussion, but the results will be determined solely by the members of the Comprehensive Examination Committee.

#### 9.4.3.4. Outcomes

Potential outcomes of the examination are pass or fail, as determined by a vote of the members of the Comprehensive Examination Committee. As the comprehensive examination is the student's last general evaluation, the committee will also consider any remedial efforts that may have been required in response to the preliminary or interim evaluations. If any deficiencies remain unaddressed, they may be considered, at least in part, as the reason for failure in the comprehensive examination.

If the student fails, they can take the Comprehensive Examination again. Consistent with School of Medicine guidelines, the second exam must occur within 90 days (about 3 months) of the first Comprehensive Examination. The student may confer with their research advisor if they have to retake the comprehensive examination. If the student does not complete the second examination within the 90-day limit due to inaction on the part of the student, then the student will be dismissed from the PhD program at the end of the academic term in which the 90-day limit is reached. In unusual circumstances, exceptions to this policy can only be approved by the BMITP Director.

If the student fails the second Comprehensive Examination, they are dismissed from the PhD program, effective at the end of the academic term in which the second failed attempt occurred. If they have completed all relevant requirements, they will be eligible for an MS degree.

#### 9.4.3.5. Timing

The comprehensive examination should be completed before the end of the second year. Under unusual circumstances, the BMITP Director may relax this requirement, but the student should alert the BMITP Director as soon as possible if they require a delay.

### 9.4.4. Doctoral Dissertation

An appropriate dissertation project involves a substantive piece of original and independent biomedical informatics research, grounded in an appropriate body of literature and providing a significant contribution to the field.

#### 9.4.4.1. Overview

The doctoral dissertation consists of two evaluations. The doctoral dissertation committee must review and approve the dissertation proposal and plan in a doctoral Proposal Meeting. The completed research must be successfully defended in a public doctoral Dissertation Defense.

#### 9.4.4.2. Candidacy for the Doctoral Degree

To qualify for admission to candidacy for the doctoral degree, a doctoral student must have completed formal coursework with a 3.30 GPA or higher, passed the doctoral comprehensive examination, and received approval of the proposed subject and plan for the dissertation from their dissertation committee following a Dissertation Proposal Meeting (also called the Dissertation Prospectus Meeting). Note that 18 credits of dissertation study must be completed after completion of coursework.

#### 9.4.4.3. Doctoral Dissertation Advisor

The doctoral dissertation advisor is responsible for primary oversight of the candidate's research progress.

#### 9.4.4.4. Doctoral Dissertation Committee Chair

The doctoral Dissertation Committee Chair will arrange the dates of the proposal and meetings of the committee (at least two per year, roughly one every six months) well in advance, will oversee the submission of all documents and forms requiring committee approval and signatures, and will coordinate and communicate all other matters related to the process of the dissertation in accordance with these guidelines. The BMITP Coordinator is available to assist the Chair in this process.

#### 9.4.4.5. Doctoral Dissertation Committee

The doctoral dissertation committee is responsible for advising the student during the progress of the candidate's research and requiring high-quality research and/or the rewriting of any portion

or the entire dissertation. It conducts the final oral examination and determines whether the dissertation meets acceptable standards. Members of the dissertation committee should be chosen to ensure that the student has adequate guidance on techniques and theories relevant to the dissertation.

The doctoral dissertation committee usually includes the principal dissertation advisor and three additional members. The dissertation advisor cannot act as the Dissertation Committee Chair; another committee member must fill this position. The majority of the committee, including those members filling the roles of the dissertation advisor and the committee Chair, must have Graduate Faculty status. The majority of the committee must be members of the Biomedical Informatics Core Faculty. Committee members who have Graduate Faculty status and are members of the BMITP Core Faculty can be included in both of those majorities. At least one graduate faculty member from the university community who is not a member of the student's training program must participate in the committee. The BMITP Director must approve the dissertation committee before seeking approval from the Graduate Dean (signed nomination of a doctoral dissertation committee form). Only upon this approval may the student meet with his/her committee at their Dissertation Proposal Meeting and proceed with Admission to Candidacy.

#### 9.4.4.6. Doctoral Dissertation Proposal Meeting/Admission to Doctoral Candidacy

The committee must review and approve the dissertation proposal in the Dissertation Proposal Meeting. The proposal should be a written document detailing the background justifying the work, research aims, and proposed methods, along with a proposed timeline. There is no prescribed format for the proposal.

The proposal meeting can be held after the comprehensive examination. The student should provide committee members and the BMITP Coordinator with at least 2 weeks of advance notice before the proposal meeting. The meeting will include the presentation of background work, specific aims, and a concrete plan to accomplish those aims. The Dissertation Proposal describing these components must be provided to the committee at least two weeks before the Proposal Meeting. During that meeting, the student will spend 45-60 minutes presenting the proposed work, followed by a question-and-answer session with any attendees, a closed session answering questions from the committee, and a final session of committee members without the student to determine the outcome of the proposal meeting. The committee must approve the dissertation by completing the appropriate forms and the student will be admitted into doctoral candidacy. If the proposal is deemed insufficient, the committee can withhold approval and request a revised proposal and presentation.

#### 9.4.4.7. Interim Doctoral Thesis Committee Meetings

Students are encouraged to hold interim doctoral thesis committee meetings between their proposal meeting and their defense. Doctoral Dissertation Committee Meetings are mandatory **every six months** once admitted into doctoral candidacy. At these meetings, the students will present their progress and receive feedback from their thesis doctoral committees. Students

whose performance is not satisfactory could be placed on academic probation for a defined period with guidance on how to return to good academic standing.

#### 9.4.4.8. Doctoral Dissertation Defense

The dissertation must be successfully defended in a public oral defense. The student should provide the committee with a draft of the completed dissertation at least **two weeks** before the scheduled defense.

The dissertation process will follow the applicable regulations and procedures of the University and the School of Medicine, as described in the University's Regulations Governing Graduate Study (see www.gradstudents.pitt.edu/).

Note that the dissertation committee may, and usually does, require revision to the dissertation before final acceptance.

Students are encouraged to be aware of deadlines for dissertation submission during the semester when they intend to defend and should schedule accordingly. Specifically, a defense should be scheduled well in advance (ideally, several weeks or more) of the final deadline for submitting the dissertation to the University. Given scheduling constraints, defenses should generally be scheduled several months in advance. The BMITP Coordinator can help with deadlines and scheduling.

University policy requires submission of dissertations in electronic form for the doctoral degree.

To view format guidelines for electronic thesis and dissertation preparation at the University, visit: https://etd.pitt.edu/sites/default/files/documents/ETDformat.pdf.

### 9.5. Other Requirements

This section describes other requirements that the student must successfully complete for the doctoral degree.

#### 9.5.1. Biomedical Informatics Colloquia

Throughout the fall and spring semesters, the Department of Biomedical Informatics hosts research colloquia every Friday from 11:00 a.m. to 12:00 noon. Each fall and spring semester, all students must register for one credit in BIOINF 2010, Biomedical Informatics Colloquium (8 credits for doctoral students, 4 credits for master's students, and 2 credits for certificate students). Failure to register and attend the colloquia will be considered during end-of-semester evaluations and may contribute to disciplinary actions.

#### 9.5.2. Instruction in the Responsible Conduct of Research

The BMITP bases its plan for instruction in the responsible conduct of research (RCR) on NIH policy. Guidelines for completing the RCR modules can be found in Appendix G. All new

students must successfully complete these modules as soon as possible but no later than 6 months after enrolling in the BMITP. Some modules might need to be renewed periodically, and reminders will be sent via email when appropriate.

### 9.5.3. Departmental Events

The DBMI sponsors occasional guest lectures and all-day events, which every student is strongly encouraged to attend. Occasionally, students may be asked for help with these events as representatives of DBMI.

### 9.5.4. Local, Regional, and National Symposia and Conferences

Students are expected to actively participate in relevant academic symposia and conferences, including through the presentation of papers and posters wherever possible.

**American Medical Informatics Association (AMIA) Conferences.** AMIA conferences include the AMIA Annual Symposium in the fall, the AMIA Informatics Summit in the spring, and the Clinical Informatics Conference in the summer. See http://www.amia.org for information on AMIA conferences. NLM-funded fellows are encouraged to attend one of the AMIA conferences each year; others are strongly encouraged to do so.

**Other research meetings.** Some students may find that the AMIA conferences are not necessarily well-suited for their research topics of interest. With the approval of the BMITP Director, these students may substitute more relevant meetings.

**National Library of Medicine Informatics Training Conference.** The NLM periodically holds Informatics Training Conferences. All fellows supported by the NLM must attend these conferences when they are held. If any fellow funded by the NLM cannot attend this conference, they should discuss the issue with the BMITP Director.

There are several possible sources of funds to support conference travel, listed here in order of priority:

- Fellowships or GSR funding: NLM fellows have an annual travel allowance, which generally (although not exclusively) covers the costs of the AMIA conferences and the NLM conference. Students on GSR or other grant funding may be able to use some of that funding for travel costs.

- Research advisors: Research advisors may have funds available to cover student travel.

- Departmental funds: Departmental funds may be available to support some travel for students who want to present their work and have no other means of funding travel. Contact the BMITP Director for assistance.

**School of Medicine Annual Graduate Student Symposium.** The School of Medicine holds an annual student-led retreat featuring student talks, poster sessions (and prizes!), and keynote presentations. Students are encouraged to submit and participate in this annual symposium.

### 9.5.5. Annual Training Program Retreat

All students are required to attend the BMITP Annual Retreat. This retreat is usually held within the last two weeks of August. This is a chance to welcome new students and current students to learn the latest information about the BMITP. No student, current or new, will be excused from attending the Annual Retreat without a very good reason. As one of the Retreat's most important events is the introduction of new and current students, as well as the sharing of information about the program through the experience of current students, this requirement is considered by the faculty to be most important. Past feedback from incoming students has confirmed the importance of this requirement. If any student, for a good reason, cannot attend the retreat, they must ask for the express permission of the BMITP Director. Only extremely important events will be considered acceptable for absence. Send such requests for a waiver to either the BMITP Director or Coordinator.

### 9.5.6. Submission of Scientific Articles

Conducting novel, publishable biomedical informatics research is the core goal of the BMITP. From the second year in the BMITP, all students must submit at least one first-authored full-length article to a peer-reviewed conference or journal per year.

### 9.5.7. Other Regulations

Students must comply with the regulations of the University of Pittsburgh (https://www.gradstudies.pitt.edu/about/student-policies-and-regulations) as well as those regulations established by the BMITP Core Faculty.

We expect that the average student will complete the degree in four years.

## 9.6. Proposed 4-Year Doctoral Schedule

| YEAR 1 | | |
|---|---|---|
| **Fall** | **Spring** | **Summer** |
| BIOINF 2070 Foundations of Biomedical Informatics 1 (3 credits)<br>BIOINF 2105 Artificial Intelligence for Biomedical Informatics (3 credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>BIOINF 2000 Biomedical Informatics Laboratory Rotation (1 credit) | BIOINF 2071 Foundations of Biomedical Informatics 2 (3 credits)<br>BIOINF 2062 Foundations of Algorithms (3 credits)<br>BIOST 2011 Principles of Statistical Reasoning (3 credits)<br>BIOINF 2032 Biomedical Informatics Journal Club (1 credit)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit) | BIOINF 3990 Doctoral Independent Study (3 credits)<br>or<br>Elective course (3 credits)<br><br>**Milestone: Doctoral Preliminary Evaluation** |

| | | |
|---|---|---|
| MSCMP 2880 Basics of Professionalism in Graduate Education (1 credit) | | |
| **YEAR 2** | | |
| **Fall** | **Spring** | **Summer** |
| BIOINF 2134 Publication and Presentation in Biomedical Informatics (3 credits)<br>BIOST 2041 Introduction to Statistical Methods<br>OR<br>BIOST 2039 Biostatistical Methods (if BIOST 2011 was not taken during Year 1)<br>BIOINF 2032 Biomedical Informatics Journal Club (1 credit)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>Elective courses (3 or more credits) | BIOINF 3998 Doctoral Teaching Practicum (3 credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>Elective courses (3 or more credits) | BIOINF 3990 Doctoral Independent Study (3 credits)<br><br>**Milestone: Doctoral Comprehensive Examination** |
| **YEAR 3** | | |
| **Fall** | **Spring** | **Summer** |
| BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>BIOINF 3990 Doctoral Independent Study (3 or more credits)<br>Elective courses (3 or more credits)<br><br>**Milestone: Doctoral Dissertation Committee Nomination** | BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>BIOINF 3990 Doctoral Independent Study (3 or more credits)<br><br>**Milestone: Doctoral Dissertation Proposal** | BIOINF 3999 Doctoral Dissertation Research (3 or more credits) |
| **YEAR 4** | | |
| **Fall** | **Spring** | **Summer** |
| BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>BIOINF 3999 Doctoral Dissertation Research (9 or more credits)<br><br>**Milestone: Dissertation Committee Meeting** | BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>BIOINF 3999 Doctoral Dissertation Research (9 or more credits) | BIOINF 3999 Doctoral Dissertation Research (3 or more credits)<br><br>**Milestone: Doctoral Dissertation Defense** |

## 10. MD/PhD TRAINING PROGRAM

Students admitted into the University of Pittsburgh's Medical Scientist Training Program (MSTP) School of Medicine may choose to complete their PhD training in the BMITP. To

comply with the MSTP program's timelines, the PhD degree will typically take 4 years to complete in the BMITP.

This section describes the academic courses, teaching, research experiences, program milestones, and other requirements that the student must successfully complete before receiving the doctoral degree. A general timeline is provided, which includes requirements and milestones. The timeline outlines the academic, research, and other requirements students should expect to complete each program year. During the annual review, any unexpected or anticipated deviations from the timeline will be discussed with the BMITP Director.

### 10.1. Overview of Requirements

BMITP training program requirements for the PhD and the MD/PhD are similar except that the MD/PhD students receive credit for medical school coursework completed before entering the BMITP. To remain in the MSTP, it is critical to complete the dissertation defense by October of the sixth year. During doctoral training, MD/PhD students are required to complete three longitudinal clinical clerkships.

To earn a doctoral degree in biomedical informatics, an MD/PhD student must complete a program of study that includes

(a) the required coursework;
(b) a preliminary evaluation;
(c) a second-year evaluation;
(d) a comprehensive examination;
(e) research work leading to an acceptable doctoral dissertation; and
(f) additional non-credit requirements.

The doctoral degree in biomedical informatics requires successful completion of 72 credits, which include 15 credits given for coursework completed in the first two years of medical school, 34 credits of required courses (that include 25 credits of core courses and 9 credits of elective courses), 3 credits of teaching, 18 credits of dissertation research, and 2 or more credits from additional courses, independent study, directed study, etc. The main distinction between PhD and MD/PhD course requirements is that an MD/PhD student is exempt from taking the core course BIOINF 2134 Publication and Presentation in Biomedical Informatics (3 credits) because an equivalent course would have been taken in medical school.

All students are expected to maintain a minimum cumulative grade point average (GPA) of 3.00 on a 4.00 scale. Please be advised that a grade of B- or lower is not considered a passing grade in core courses. If the cumulative GPA falls below 3.00, the student will be placed on academic probation for the next term of registration. If the deficiency is not corrected or vastly improved in this subsequent term, the student may be dismissed at the discretion of the program. The program may also require a student to retake a major/core course in which a grade below B is earned.

Due to MSTP's strict time constraints, MD/PhD students are highly encouraged to meet and work with BMITP faculty during their MS1 and MS2 years. MD/PhD students should ideally identify their research advisor before beginning their GS1 year in the BMITP. If this is not the

case, students can participate in the first-year research rotations identical to those completed by students in the PhD program to identify a research advisor.

Program milestones are equivalent to those of the PhD program, including a preliminary examination, a second-year evaluation, a comprehensive examination, and a proposal and defense of an acceptable dissertation research project.

Additional non-credit requirements for the doctoral degree include instruction in the responsible conduct of research, attendance, and participation in departmental invited lectures, regional and national symposia and conferences, attendance at the annual BMITP retreat, and yearly submission of a first-author scientific article from the second year of training.

Transfer/waiver of courses may be available – see Section 8.2.7 from the doctoral training program for details.

For additional details, see Section 9 for the doctoral training program.

### 10.2. Proposed 4-Year MD/PhD Schedule

| **MS 0** | | |
|---|---|---|
| | | **Summer** |
| | | GS – S1 BMI lab rotation |
| **MS 1** | | |
| **Fall** | **Spring** | **Summer** |
| Medical School Courses | Medical School Courses | GS – S2 BMI lab rotation |
| **MS 2** | | |
| **Fall** | **Spring** | **Summer** |
| Medical School Courses | Medical School Courses | GS – S3 BMI lab rotation |
| | **GS 1** | |
| **Fall** | **Spring** | **Summer** |
| BIOINF 2070 Foundations of Biomedical Informatics 1 (3 credits)<br>BIOINF 2105 Artificial Intelligence for Biomedical Informatics (3 credits)<br>BIOINF 2062 Foundations of Algorithms (3 credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br><br>Research Rotations (optional) | BIOINF 2071 Foundations of Biomedical Informatics 2 (3 credits)<br>BIOST 2011 Principles of Statistical Reasoning (3 credits)<br>BIOINF 2032 Biomedical Informatics Journal Club (1 credit)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br><br>Elective course (3 credits) | BIOINF 3990 Doctoral Independent Study (3 credits)<br>or<br>Elective course (3 credits)<br><br>**Milestone: Doctoral Preliminary Evaluation** |
| **GS 2** | | |
| **Fall** | **Spring** | **Summer** |

| | | |
|---|---|---|
| BIOST 2041 Introduction to Statistical Methods<br>OR<br>BIOST 2039 Biostatistical Methods (if BIOST 2011 was not taken during Year 1)<br>BIOINF 2032 Biomedical Informatics Journal Club (1 credit)<br>Elective courses (3 or more credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit) | BIOINF 3998 Doctoral Teaching Practicum (3 credits)<br>Elective courses (3 or more credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit) | BIOINF 3990 Doctoral Independent Study (3 credits)<br><br>**Milestone: Doctoral Comprehensive Examination** |
| **GS 3** | | |
| **Fall** | **Spring** | **Summer** |
| BIOINF 3990 Doctoral Independent Study (3 or more credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>Elective courses (3 or more credits)<br><br>**Milestone: Doctoral Dissertation Committee Nomination** | BIOINF 3990 Doctoral Independent Study (3 or more credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br><br>**Milestone: Doctoral Dissertation Proposal** | BIOINF 3999 Doctoral Dissertation Research (3 or more credits) |
| **GS 4** | | |
| **Fall** | **Spring** | **Summer** |
| BIOINF 3999 Doctoral Dissertation Research (9 or more credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit) | BIOINF 3999 Doctoral Dissertation Research (9 or more credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit) | BIOINF 3999 Doctoral Dissertation Research (3 or more credits)<br><br>**Milestone: Doctoral Dissertation Defense** |
| **MS 3** | | |
| **Fall** | **Spring** | **Summer** |
| Medical School Rotations | Medical School Rotations | Medical School Rotations |
| **MS 4** | | |
| **Fall** | **Spring** | **Summer** |
| Medical School Rotations | Medical School Rotations | Medical School Rotations |

## 11. MASTER'S TRAINING PROGRAM

Students admitted into the BMITP for master's training typically complete the MS degree in 2 years and receive comprehensive training in major areas of biomedical informatics and the application of artificial intelligence to biomedical challenges.

This section describes the academic courses, research experiences, program milestones, and other requirements that the student must successfully complete before receiving the master's degree. A general timeline, which includes requirements and milestones, is provided. The timeline outlines the academic, research, and other requirements students should expect to

complete each program year. During the annual review, any unexpected or anticipated deviations from the timeline will be discussed with the BMITP Director.

### 11.1. Overview of Requirements

To earn a master's degree in biomedical informatics, a student must complete a program of study that includes

(a) the required coursework;
(b) research work leading to an acceptable master's project; and
(c) additional non-credit requirements.

The master's degree in biomedical informatics requires successful completion of 36 credits, which includes 26 credits of required courses (including 23 credits of core courses and 3 credits of elective courses), 3 credits of master's research, and 3 or more credits from additional courses, independent study, directed study, etc.

Program milestones include the proposal and defense of an acceptable master's research project.

Additional non-credit requirements for the master's degree include attendance at the biomedical informatics colloquium, instruction in the responsible conduct of research, attendance and participation in departmental invited lectures, regional and national symposia and conferences, attendance at the annual BMITP retreat, and submission of a first-author scientific article in the second year.

### 11.2. Courses

All required courses must be taken for a letter grade, except the journal club, master's research, and independent study. A minimum grade of B is required in all graduate courses. The BMITP can require a student to retake a core course in which a grade below B is earned. The BMITP Director may waive course requirements satisfied through prior university-level study in accordance with the Committee on Graduate Studies guidelines. A student must comply with the regulations of the University of Pittsburgh (https://www.gradstudies.pitt.edu/about/student-policies-and-regulations) and those regulations established by the BMITP. An average full-time student is expected to complete the master's degree in two years.

All students are expected to maintain a minimum cumulative grade point average of 3.00 on a 4.00 scale. Please be advised that a grade of B- or lower is not considered a passing grade in core courses. If the cumulative GPA falls below 3.00, the student will be placed on academic probation for the next term of registration. If the deficiency is not corrected or vastly improved in this subsequent term, the student may be dismissed at the discretion of the program. The program may also require a student to retake a major/core course in which a grade below B is earned.

#### 11.2.1. Core Courses

Core courses impart knowledge in key areas of biomedical informatics and data science. They also provide in-depth methodological training in algorithms, artificial intelligence, and statistics,

including formalisms, methods, techniques, tools, and reproducibility approaches that apply broadly to all biomedical informatics and data science areas. Further, they teach broad foundational skills that support scientific inquiry in biomedical informatics and data science. The core courses include six 3-credit didactic courses, 1 credit (1 semester) of the Biomedical Informatics Journal Club, and 4 credits (4 semesters) of the Biomedical Informatics Colloquium for a total of 23 credits.

BIOINF 2070 Foundations of Biomedical Informatics 1 (3 credits) - fall term
BIOINF 2071 Foundations of Biomedical Informatics 2 (3 credits) - spring term
BIOINF 2062 Foundations of Algorithms (3 credits) - spring term
BIOINF 2105 Artificial Intelligence for Biomedical Informatics (3 credits) - fall term
BIOST 2041 Introduction to Statistical Methods (fall term), BIOST 2039 Biostatistical Methods (fall term), BIOST 2011 Principles of Statistical Reasoning (spring term), or a comparable course in introductory statistics
BIOINF 2134 Publication and Presentation in Biomedical Informatics (3 credits) - fall term
BIOINF 2032 Biomedical Informatics Journal Club (1 credit) - fall or spring terms
BIOINF 2010 Biomedical Informatics Colloquium (1 credit) - fall and spring terms

### 11.2.2. Elective Courses

These courses provide the means for more advanced study in methods and applications in biomedical informatics and data science. Examples of elective courses include:

BIOINF 2016 Foundations of Translational Bioinformatics (3 credits)
BIOINF 2018 Introduction to R Programming for Scientific Research (3 credits)
BIOINF 2019 Biomedical Data Streaming (3 credits)
BIOINF 2061 Single-Cell and Spatial Genomic Data Analysis (3 credits)
BIOINF 2125 Informatics and Industry (1 credit)
BIOINF 2132 Special Topic Seminar in Medical Informatics (3 credits)

### 11.2.3. Research Credits

Research includes rotations, independent study, and master's research. Students must take 3 credits for the Research Project and additional credits for independent study and directed study as needed.

BIOINF 2990 Independent Study (1-6 credits)
BIOINF 2993 Directed Study (1-6 credits)
BIOINF 2480 Research Project (3 credits)

## 11.3. First-Year Research Rotations

The BMITP does not offer a formal first-year research rotation program. Instead, students are expected to identify potential faculty members and work with them to explore potential research projects. These rotations are flexible in terms of length and timing. Ideally, students should complete 1-3 rotations throughout their first and second semesters of the master's program.

Students should review BMITP faculty profiles and work with their academic advisor and BMITP leadership to identify potential faculty mentors and to arrange rotations. These contacts may begin upon acceptance into the program.

First-year students are required to do rotations in the fall and spring semesters. Occasionally, a student may petition the BMITP Director for permission to rotate beyond the second semester's end. During this rotation, the student will be placed on academic probation. By July 15, the rotation advisor will submit to the BMITP Director an evaluation of the rotation and a recommendation as to whether the student should continue with dissertation research in their laboratory (or under their guidance). If a student matches with (a mentor) in their laboratory and passes the preliminary evaluation, the probation status will be removed, and the student will become a student in good standing. However, if this final rotation does not work out, the student's performance will be considered unsatisfactory, and the student will be subject to dismissal by the BMITP Core Faculty from the MS program and, hence, the University of Pittsburgh.

## 11.4. Master's Research Project

### 11.4.1. Overview of Requirements

The master's project consists of two evaluations. The master's research project proposal must be reviewed and approved by the master's Research Committee in a master's Proposal Meeting. The completed research must be successfully defended in a public master's Research Project Defense. The two key deliverables for the defense are: (1) the writing and submission of a paper of publishable quality based upon the research and (2) the completion of an oral examination of its contents.

### 11.4.2. Committee

A master's Research Committee will oversee all progress of student research. A minimum of three faculty members will form the committee. Two committee members must be BMITP Core Faculty members, including the chair. The student's research advisor is not eligible to be the committee chair. The student must provide the BMITP Coordinator with the names of the committee members.

### 11.4.3. Proposal and Paper

The master's research project proposal should describe the background that informs the planned work, including plans and anticipated methods. It should also provide a timeline for the work. The master's research project paper should describe the results of the work in a publishable form. There are no specific requirements for either the length or format of the proposal or the paper.

### 11.4.4. Procedure

The student should provide committee members and the BMITP Coordinator with at least 3 weeks of advance notice of both the master's Proposal Meeting and the master's Research

Project Defense. The student is also responsible for giving each committee member a copy of the appropriate document – the proposal or the paper – 2 weeks before their oral presentation for the Proposal Meeting or the Research Project Defense. The oral presentations are open to all DBMI faculty and students, and the BMITP Coordinator will send out an announcement of oral presentations. For both the proposal and the defense, a presentation of approximately 45 minutes should be given, followed by questions to the student. After all other attendees leave the room, the committee will remain to address specific issues with the student. Finally, the committee will hold a closed session without the student to determine the outcome of the examination. A final copy of the MS paper must be provided to the BMITP Coordinator. (Note: Final certification of completion of the master's requirements will not be given until the BMITP Coordinator receives the paper.)

### 11.4.5. Comprehensive Examination

Successful completion of the master's Research Project Defense satisfies the comprehensive examination requirement of the University's Committee on Graduate Studies.

## 11.5. Other Requirements

Additional requirements that the student must successfully complete for the master's degree are the same as for the doctoral degree (see section 9.5 Other Requirements).

## 11.6. Transfer of Credits

Up to 6 credits – grade B or better – from another institution or department within the University can be considered for transfer towards the master's degree. Acceptance of transfer credit must be discussed between the student and advisor and approved by the BMITP Director.

## 11.7. Proposed 2-Year Master's Schedule

| YEAR 1 | | |
|---|---|---|
| **Fall** | **Spring** | **Summer** |
| BIOINF 2070 Foundations of Biomedical Informatics 1 (3 credits)<br>BIOINF 2105 Artificial Intelligence for Biomedical Informatics (3 credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br>MSCMP 2880 Basic Understanding of EDI as Related to Graduate Education (1 credit)<br><br>Informal Research Rotations | BIOINF 2071 Foundations of Biomedical Informatics 2 (3 credits)<br>BIOINF 2062 Foundations of Algorithms (3 credits)<br>BIOST 2011 Principles of Statistical Reasoning (3 credits)<br>BIOINF 2032 Biomedical Informatics Journal Club (1 credit)<br>BIOINF 2990 Independent Study (3 credits)<br>or<br>Elective course (3 credits)<br><br>Informal Research Rotations | BIOINF 2990 Independent Study (3 credits)<br>or<br>Elective course (3 credits)<br><br>**Milestone: Master's Committee Nomination** |

| YEAR 2 | | |
|---|---|---|
| **Fall** | **Spring** | **Summer** |
| BIOINF 2134 Publication and Presentation in Biomedical Informatics (3 credits)<br>BIOST 2041 Introduction to Statistical Methods<br>OR<br>BIOST 2039 Biostatistical Methods (if BIOST 2011 was not taken during Year 1)<br>BIOINF 2990 Independent Study (3 credits)<br>or<br>Elective course (3 credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br><br>**Milestone: Master's Proposal Meeting** | BIOINF 2480 Research Project (3 or more credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit)<br><br>**Milestone: Master's Dissertation Defense** | |

## 12. CERTIFICATE TRAINING PROGRAM

Students admitted into the BMITP for certificate training typically complete the certificate requirements of 15 credits in 1 year and are exposed to major areas of biomedical informatics and the application of artificial intelligence to biomedical challenges.

This section describes the academic courses, research experiences, program milestones, and other requirements that the student must successfully complete before receiving the certificate in biomedical informatics.

### 12.1. Overview of Requirements

To earn a certificate in biomedical informatics, a student must complete a program of study that includes

(a) the required coursework;
(b) research work leading to an acceptable certificate project; and
(c) additional non-credit requirements.

The certificate in biomedical informatics requires successful completion of 15 credits, which includes 11 credits of required core courses, 3 credits of certificate research, and 1 or more credits from additional courses, independent study, directed study, etc.

All students are expected to maintain a minimum cumulative grade point average of 3.00 on a 4.00 scale. Please be advised that a grade of B- or lower is not considered a passing grade in core courses. If the cumulative GPA falls below 3.00, the student will be placed on academic probation for the next term of registration. If the deficiency is not corrected or vastly improved in

this subsequent term, the student may be dismissed at the discretion of the program. The program may also require a student to retake a major/core course in which a grade below B is earned. Program milestones include the proposal and defense of an acceptable certificate research project.

Additional non-credit requirements for the certificate include instruction in the responsible conduct of research, attendance and participation in departmental invited lectures, regional and national symposia and conferences, and attendance at the annual BMITP retreat.

### 12.2. Courses

All required courses must be taken for a letter grade, except the certificate research and independent study. A minimum grade of B is required in all graduate courses. The BMITP Director may waive course requirements satisfied through prior university-level study, in accordance with the Committee on Graduate Studies guidelines. A student must comply with the regulations of the University of Pittsburgh (www.gradstudents.pitt.edu/) and those regulations established by the BMITP. An average full-time student is expected to complete the certificate in one year.

#### 12.2.1. Core Courses

Core courses impart knowledge in key areas of biomedical informatics and data science. They also provide in-depth methodological training in algorithms, artificial intelligence, and statistics, including formalisms, methods, techniques, tools, and reproducibility approaches that apply broadly to all biomedical informatics and data science areas. Further, they teach broad foundational skills that support scientific inquiry in biomedical informatics and data science. The core courses include three 3-credit didactic courses, 1 credit (1 semester) of the Biomedical Informatics Journal Club, and 1 credit (1 semester) of the Biomedical Informatics Colloquium for a total of 11 credits.

BIOINF 2070 Foundations of Biomedical Informatics 1 (3 credits) - fall term
BIOINF 2071 Foundations of Biomedical Informatics 2 (3 credits) - spring term
BIOINF 2062 Foundations of Algorithms (3 credits) - spring term
BIOINF 2032 Biomedical Informatics Journal Club (1 credit) - fall or spring term
BIOINF 2010 Biomedical Informatics Colloquium (1 credit) - fall and spring term

#### 12.2.2. Elective Courses

These courses provide the means for more advanced study in methods and applications in biomedical informatics and data science. Students may take elective courses as needed.

BIOINF 2016 Foundations of Translational Bioinformatics (3 credits)
BIOINF 2018 Introduction to R Programming for Scientific Research (3 credits)
BIOINF 2019 Biomedical Data Streaming (3 credits)
BIOINF 2061 Single-Cell and Spatial Genomic Data Analysis (3 credits)
BIOINF 2125 Informatics and Industry (1 credit)

BIOINF 2132 Special Topic Seminar in Medical Informatics (3 credits)

### 12.2.3. Research Credits

Research includes rotations, independent study, and certificate research. Students must take 3 credits for the research project and additional credits for independent study and directed study as needed.

BIOINF 2990 Independent Study (1-6 credits)
BIOINF 2993 Directed Study (1-6 credits)
BIOINF 2480 Research Project (3 credits)

## 12.3. Program Milestone Examination

### 12.3.1. Overview

Upon entering BMITP, students will have the opportunity to participate in numerous ongoing biomedical informatics and data science projects conducted by the BMITP Core Faculty. Further, DBMI participates in many collaborative projects across the University and nationally in which students might participate. Such educational experiences will enable students to formulate research questions and understand how to develop the right kind of collaborations necessary to develop approaches to answer them.

To complete the certificate training, a student must complete a research project and successfully present it in a certificate project presentation. There are two key deliverables: (1) the writing and submission of a paper of publishable quality based on the research and (2) the completion of an oral examination of its contents. The research advisor will oversee the student's research progress, including the deliverables.

### 12.3.2. Committee

A certificate Research Committee will oversee all progress of student research. The committee will consist of the student's research mentor and the program director or associate director.

### 12.3.3. Paper

The certificate research project paper should describe the work's results in a publishable form. There are no specific requirements for either the length or format of the paper.

### 12.3.4. Oral Presentation

The student should provide committee members and the BMITP Coordinator with at least 3 weeks of advance notice of the certificate project presentation. The student is also responsible for giving each committee member a copy of the paper **2 weeks** before their oral presentation. The student will present their work in an oral presentation to the certificate Research Committee. The oral presentation will generally last 30-45 minutes. A final copy of the paper must be provided to

the BMITP Coordinator. (Note: Final certification of completion of the certificate requirements will not be given until the BMITP Coordinator receives the paper.)

Upon successful completion, the BMITP will issue a paper certificate following the guidelines found at https://www.provost.pitt.edu/standards-issuing-physical-certificates.

### 12.3.5. Comprehensive Examination

Successful completion of the certificate project presentation satisfies the comprehensive examination requirement of the University's Committee on Graduate Studies.

## 12.4. Other Requirements

The additional requirements that the student must successfully complete for the certificate are the same as those for the doctoral degree (see Section 9.5 Other Requirements).

## 12.5. Proposed 1-Year Certificate Schedule

| YEAR 1 | | |
|---|---|---|
| **Fall** | **Spring** | **Summer** |
| BIOINF 2070 Foundations of Biomedical Informatics 1 (3 credits)<br>BIOINF 2010 Biomedical Informatics Colloquium (1 credit) | BIOINF 2071 Foundations of Biomedical Informatics 2 (3 credits)<br>BIOINF 2062 Foundations of Algorithms (3 credits)<br>BIOINF 2032 Biomedical Informatics Journal Club (1 credit)<br>BIOINF 2480 Research Project (3 or more credits)<br><br>**Milestone: Certificate Research Project Identification** | BIOINF 2480 Research Project (1 credit)<br><br>**Milestone: Certificate Research Project Presentation** |

# 13. POSTDOCTORAL TRAINING PROGRAM

Students admitted for postdoctoral training will typically spend 1-3 years and conduct research in major biomedical informatics areas and the application of artificial intelligence to biomedical challenges.

## 13.1. Postdoctoral Non-Degree Research Fellowship

The BMITP offers a traditional non-degree postdoctoral research fellowship to students with doctoral degrees.

#### 13.1.1. Eligibility

Previous training in biomedical informatics or related fields, such as computer science and data science, is highly desirable. Research fellows are expected to join an existing research project or establish a new one in collaboration with a BMITP faculty member (see the research programs or faculty interests for opportunities).

#### 13.1.2. Funding

Funding may be available through the NLM T15 training program for applicants who are US citizens or permanent residents. Funding is initially offered for one year. Students who are making satisfactory progress may be renewed for two additional years (a total of three) at the discretion of the BMITP leadership.

#### 13.1.3. Expectations

The postdoctoral research fellowship aims to prepare students for research careers as principal investigators. This will include preparing and submitting K99/R00 grant applications for many students, ideally in their second year. The BMITP will assist students with the preparation, internal evaluation, and submission of these proposals.

### 13.2. Postdoctoral Degree Fellowship

The BMITP also offers a postdoctoral degree fellowship to students who have not previously trained in biomedical informatics or related fields. Such students can pursue the BMITP doctoral, master's, or certificate training. Funding may be available through the NLM T15 training program for applicants who are US citizens or permanent residents. Students who complete their degrees may be eligible to transition to research fellowship positions.

## 14. EVALUATION OF STUDENTS

### 14.1. Individual Development Plans

Students must complete a Career Development Plan (CDP), otherwise known as an Individual Development Plan (IDP). The CDP/IDP is a structured document designed to encourage students to evaluate their goals in the context of their skills and interests. The CDP/IDP should be completed during the student's first semester in the program and updated annually, with each revision sent to the BMITP Program Coordinator. Details on the CDP/IDP can be found at the University of Pittsburgh Office of Academic Career Development, Health Sciences website: https://www.oacd.health.pitt.edu/career-development-planning-graduate-students.

### 14.2. Yearly Reports

The BMITP Core Faculty will conduct a yearly review of students in early June. The BMITP Core Faculty review will consist of:

- List of courses completed, and grades obtained
- List of research projects with descriptions of their goals
- List of completed program milestones and anticipated milestone dates
- List of manuscripts and abstracts submitted or published
- List of scientific conferences and symposia attended, and presentations given
- List of honors and awards received
- For students after their first year, reflection on the previous year, including a statement of objectives for the previous academic year, discussion of the extent to which they were met, and descriptions of any measures that will be taken to address goals that were not met.
- Statement of goals for the upcoming academic year

The training program coordinator will provide students with templates for these reports. When requested, students must complete the reports promptly.

### 14.3. Semi-Annual Student Evaluation

At the end of the fall term, students will complete a self-evaluation, provide a coursework spreadsheet, and have their academic advisor complete a form. Each student will meet with either the BMITP Director or Co-Director to review the evaluation. The student will receive a feedback letter.

At the end of the spring term, students will complete a self-evaluation, provide a coursework spreadsheet, and have their research advisor complete a form. BMITP Core Faculty will review each student evaluation and provide a feedback letter.

#### 14.3.1. Degree-seeking Students

All degree-seeking students must complete self-evaluation forms at the end of the fall term and the end of the spring term. Academic (fall term) and research (spring term) advisors will complete similar forms for each of their students. Students will meet with the BMITP Director or Co-Director for the Fall evaluation. The BMITP Core Faculty will review all student evaluations at the end of the Spring term to discuss each student based on information provided on coursework and fulfillment of BMITP requirements. The evaluation process is designed to ascertain each student's progress and identify any problems. Reviews that determine that a student has not made sufficient progress may lead to academic probation or *potentially* dismissal from the program.

#### 14.3.2. Postdoctoral Research Fellows

Postdoctoral research students must complete a Career Development Plan (CDP) at the start of their appointment. The CDP will be signed by both the student and advisor and updated annually.

At the end of their annual appointment, postdoctoral research students must complete an Annual Postdoctoral Assessment to be reappointed for the next year. The student and advisor must sign the assessment.

Additional details of the assessment requirements for postdoctoral students can be found on the OACD website: https://www.oacd.health.pitt.edu/postdoctoral-career-development-progress-assessment-process.

### 14.4. Program Probation

Students may be placed on program probation if they take longer than expected to complete their academic or research program requirements. If a student fails any milestone examinations, they will be put on probation until they successfully fulfill the requirement. When placed on program probation, students will be advised of the requirements for being released from probation and will stay on probation until they have fulfilled them.

### 14.5. University Probation

All graduate students at the University of Pittsburgh must maintain a minimum GPA of 3.00 or above to sit for the preliminary and comprehensive examinations, be accepted to candidacy for the doctoral program, and graduate. If a student's GPA is less than 3.00, they will be placed on university probation and will not be eligible for financial aid again until their GPA is 3.00 or above.

### 14.6. Termination from the Training Program

Students may be terminated from the BMITP if they fail two required courses or one of these courses on successive occasions, fail the preliminary and comprehensive examinations, fail to advance an acceptable dissertation proposal, fail to make adequate progress in research or engage in unethical behavior such as plagiarism.

### 14.7. Terminal and *en route* Master's Degree

If a student leaves the program voluntarily or otherwise after completing a set of minimum requirements, they may be eligible to receive a terminal master's degree. A student wishing to obtain a master's degree *en route* to a doctoral degree may apply for the degree through the School of Medicine. Students must also propose and defend an acceptable master's research project.

## 15. DUAL RESPONSIBILITIES FOR STUDENTS ENROLLED IN OTHER DEGREE PROGRAMS

The BMITP faculty members understand that students in degree programs other than BMITP must work in two arenas: that of the biomedical informatics community and that of their individual degree program community (e.g., the Intelligent Systems Program). The whole design

of the BMITP is one of integrated cross-training, and those accepted into the BMITP must understand this dual responsibility. Particularly, those on NLM funding must understand that the NLM has agreed to pay for training based on the student's understanding of that integrated cross-training concept. The BMITP faculty members and staff have made every effort to clarify the program requirements. No activities outside the BMITP will be accepted as an excuse for failure to fulfill all the training program requirements.

## 16. STUDENT REPRESENTATIVES

### 16.1. BMITP Student Representatives

Two student representatives to the BMITP Core Faculty Committee are elected annually among the students. Attempts are made to have one senior student and one "apprentice" student in this role. Meetings of students are held regularly, via scheduling by the senior student representative, to discuss student issues. Representatives attend and report at BMITP Core Faculty Committee meetings, although they do not participate in discussions involving student evaluations.

Student representatives are also expected to organize regular brown-bag sessions with students (see section 17.1 below).

### 16.2. Biomedical Graduate Student Association (BGSA) Program Representatives

The BGSA sponsors various academic and extracurricular events for graduate students in the School of Medicine. Its goal is to promote professional and social interactions between students and faculty and provide a forum for graduate education issues. One student representative is elected annually to represent biomedical informatics in the BGSA.

## 17. PROFESSIONAL DEVELOPMENT

All students must develop professional and ethical competencies in their academic and research pursuits. These competencies extend to data collection, publication of results, and use of references to previous literature.

### 17.1. Biomedical Informatics Professional Development Seminar Series (Brown Bag Series)

Regular attendance in this seminar series is strongly encouraged (but not mandatory). The seminar series is a regular informal, "bring-your-own-lunch" interactive seminar designed to provide students with practical advice and information towards professional development. Although students are not required to attend (no attendance will be taken), faculty strongly encourage this seminar due to the nature of the discussions. This one-hour seminar covers a range of topics, including:

- Practical Advice on How to Plan, Execute, and Report on your Research
- Professional Presentations

- Grant Writing and 3-Letter Agencies
- Who's Who in Medical Informatics
- Getting the Most out of the AMIA Symposium
- Basics of Getting a Job

### 17.2. Biomedical Graduate Student Association (BGSA) Seminars

The BGSA sponsors several professional seminars for graduate students in the School of Medicine. For information, see https://experience.pitt.edu/bgsa/home/.

## 18. WORK POLICIES

### 18.1. Expectations

Although NLM Fellows and GSRs are expected to work up to 20 hours/week on their research, graduate study should be considered a full-time job. During the first two years, coursework may take up a good amount of working time. After advancement to candidacy, students with research funding (NLM Fellow or GSR) should be spending the equivalent of a full workweek on research. In rare cases of students working on GSRs unrelated to their dissertation work, this may mean splitting time between funded effort and dissertation research.

The exigencies of research work may present circumstances requiring bursts of work beyond the usual maximum of 20 hours/week, particularly before major academic, publishing, or conference deadlines. It is not uncommon for students (or faculty) to take some time off after such milestones.

There are no set policies regarding working hours. Although some students work unpredictable hours, others work set schedules. There may also be situations, including grant or paper deadlines and conferences or other events, requiring student work during evenings, weekends, or holidays. In such situations, students might take additional time off to compensate for the extra effort. More generally, students should discuss expectations with their research advisors, and expectations for unusual circumstances should be communicated well in advance. Attendance at lab meetings, departmental colloquia, and other events are expected.

### 18.2. Vacation

All students must inform their advisors before leaving on lengthy vacations and do so several weeks (or months if possible) before such plans. Vacation interrupts research, and students must obtain their research advisor's agreement to vacation time. NLM fellows are permitted four weeks' vacation time (any additional vacation must be negotiated with advisors). GSRs are expected to limit vacation time to four weeks per year. All other students, including master's and certificate students, should inform their research advisor of any time they plan to be away for more than a few days due to possible interference with research plans.

Students can find the official University of Pittsburgh's policies for GSRs at https://www.gradstudies.pitt.edu/about/student-policies-and-regulations.

### 18.3. Outside Work

Graduate study is difficult and time-consuming. These demands are often incompatible with maintaining additional paid employment, even part-time. Thus, students are discouraged from engaging in any outside employment.

### 18.4. Working Location

BMITP students and faculty work in a number of locations. Although the primary location of the BMITP is 5607 Baum Blvd, 4th and 5th floors, BMITP faculty are housed in many other buildings both on- and off-campus. Each student will be assigned a desk in the most appropriate location for their work, as determined by the student in consultation with their research advisor.

### 18.5. Working From the Office vs. From Home

As the informatics work that forms the bulk of the research work in BMITP can be done from almost anywhere with a reliable internet connection, there is a temptation for students to work primarily from home or other remote locations. While it is understandable that students may occasionally need to work from home to address personal or family matters, experience shows that they benefit significantly from the collegial interactions that can only occur in the workplace. Therefore, students are encouraged to spend as much time as possible working in the office. If a student plans to work from home, they should discuss this with their research advisor to ensure that expectations for meeting attendance and general availability are aligned.

## 19. SPECIAL STATUS

### 19.1. Leave of Absence

To handle a leave of absence (LOA), the BMITP follows the University of Pittsburgh's Regulations Governing Graduate Study. Students may request a LOA from the BMITP by writing to the BMITP Director and detailing the reason for the request, the duration, and how the LOA will be used to resolve issues leading up to it. In addition, if the student has selected a research advisor, the LOA request should confirm that the research advisor agrees to allow the student to return to their laboratory at the end of the specified LOA, and the research advisor should co-sign the request. Students are advised to also discuss a LOA with the BMITP Director before submitting the formal request. LOAs must be approved by the Associate Dean for Graduate Studies at the School of Medicine.

### 19.2. Graduate Student Parental Leave

The BMITP follows the University of Pittsburgh's Graduate Student Parental Accommodation Guidelines which assist graduate students immediately after giving birth or adopting a child. The

guidelines aim to allow students to maintain full-time student status and all its benefits while returning to full participation in courses, research, and teaching. The Parental Accommodation Guidelines apply only to full-time graduate students in good academic standing who are making satisfactory progress toward a graduate degree and who have completed at least one full-time semester of their degree program. The guidelines apply to students who have given birth, adopted a child who is not able to attend full-day public school due to age or developmental issues, or are partners of individuals who have experienced childbirth or adoption and hold parental responsibilities. Details can be found in the full policy document: (https://www.gradstudies.pitt.edu/sites/default/files/assets/GradParentalAccommGuidelines6-1-22.pdf).

## 20. ACADEMIC AND RESEARCH INTEGRITY

The BMITP strives for excellence in academic studies and research. Students are responsible for being honest and ethical while pursuing academic studies. Furthermore, all documents submitted to satisfy academic or research requirements of the BMITP should be free of plagiarism. If a student is accused of violating academic integrity, procedural safeguards, including due process provisions, have been put in place to protect their rights. The BMITP follows the University of Pittsburgh's Guidelines on Academic Integrity (https://www.provost.pitt.edu/academic-integrity-guidelines).

To achieve excellence in scholarship, all students must adhere to the highest standards of integrity in research. Misconduct in research can potentially cause serious harm to the student's career, knowledge advancement, and society. The BMITP follows the University of Pittsburgh's Research Integrity Policy (https://www.orp.pitt.edu/research-integrity).

## 21. DISABILITIES

Students with disabilities who have a letter from the University of Pittsburgh's Disability Resources and Services are encouraged to discuss their accommodation and needs with the BMITP Director. The BMITP is aligned with the University of Pittsburgh's mission to provide individuals with disabilities equal access to employment, classes, programs, and activities (https://www.wellbeing.pitt.edu/disability-access/disability-resources-services).

## 22. MISTREATMENT AND NON-DISCRIMINATION

Mistreatment of graduate students by faculty, postdoctoral researchers, staff, or other students seriously challenges students' mental well-being, may harm their career potential, and could violate their civil rights. Incidents of mistreatment may include, but are not limited to, Title IX infringements, assault, any discrimination violating civil rights, public humiliation, threatening behavior, psychological cruelty, bullying, verbal abuse, providing lower evaluations because of factors other than performance, denial of disability accommodations, ethical misconduct, experimental sabotage, or slander. The BMITP prohibits such mistreatment, and leadership will

take corrective actions upon receipt of internal mistreatment reports or those adjudicated by the University of Pittsburgh's offices.

Title IX, a landmark piece of federal civil rights legislation, prohibits sex discrimination in education. Sexual violence, sexual harassment, gender discrimination, creating a hostile environment based on sex or gender, and retaliation are all examples of Title IX violations. The University of Pittsburgh's Office of Civil Rights and Title IX Compliance protects all members of the community, including students, staff, and faculty, from such violations. Anyone in the BMITP who experiences or witnesses a Title IX violation has the right to file a report. There are several ways to report (see https://www.wellbeing.pitt.edu/civil-rights-title-ix/how-make-report/responsible-employee-program-and-reporting), and students should report to university employees they trust and feel comfortable with. Note that BMITP employees and faculty members are "responsible employees" and, therefore, are required to report incidents of sexual violence or other sexual misconduct.

All BMITP students and faculty will receive Title IX training, as arranged by program leadership or the School of Medicine.

## 23. USE OF GENERATIVE ARTIFICIAL INTELLIGENCE

Generative artificial intelligence (AI) technologies capable of drafting text, creating images, and generating computer code have significant promise and risk for education and research. Tools such as ChatGPT and DALL-E hold great promise in drafting text, figures, and computer code for research, manuscripts, poster abstracts and posters, presentations, comprehensive examination reports, theses, and dissertations. However, these technologies pose a substantial hazard to accurate and ethical scholarship because they can provide inaccurate information (so-called "hallucinations"), leak confidential or copyrighted information, and generate computer code with errors and vulnerabilities.

Such technologies may result in plagiarism since the underlying models are likely trained on data containing copyrighted and legally protected content for which sufficient authorization was not obtained. Furthermore, such technologies endanger patient privacy and other sensitive information, such as research proposals. Because prompts entered into commercial generative AI tools are likely to be integrated into the underlying models, submitting patient data (clinical data, text, and images) and research proposals to these tools is problematic. This has led to the creation of policies banning the submission of patient data and proposal research plans to these tools. Computer code created by generative AI cannot be trusted unless reviewed by experts. The desire to ensure the appropriate use of generative AI has led to an "arms race," and technology aimed at detecting generative AI usage has led to unforeseen negative consequences.

Any usage of generative AI in the BMITP must be conducted responsibly, as described in the following guidelines:

1. Sensitive materials must never be included, in part or whole, as inputs to commercial generative AI tools. This includes, but is not limited to, the following:

a. Clinical data from any source
b. Pre-publication manuscripts shared for review
c. Proposals shared for review
d. Any data governed by legal agreements such as non-disclosure or data-use agreements.

2. Generative AI should not be used in any way that might violate organizational policies. For example, NIH prohibits using generative AI in the review process (NOT-OD-23-149: The Use of Generative Artificial Intelligence Technologies is Prohibited for the NIH Peer Review Process [Internet]. [cited 2024 Apr 10]. Available from: https://grants.nih.gov/grants/guide/notice-files/NOT-OD-23-149.html.)

3. Individuals using generative AI must take full responsibility for ensuring that any outputs they use are plagiarism-free. The University of Pittsburgh's Guidelines for the Responsible Conduct of Research (Revised, January 2023, https://www.orp.pitt.edu/sites/default/files/guidelines_for_responsible_conduct_of_research.pdf) states that plagiarism can occur in as few as six or seven words if appropriate attribution is not provided. Individuals using generative AI should review any output to ensure no plagiarism. Providing any AI-generated content to a search engine to identify any matches can be useful for identifying any areas of concern.

4. The use of generative AI should be acknowledged. This might take the form of a general statement in a manuscript, poster, presentation, or other artifact indicating that generative AI was used. Alternatively, a citation specific to a given phrase or sentence might be provided. However, simply including an acknowledgment is not sufficient to avoid plagiarism concerns.

As responsible conduct of research applies to all researchers, these policies apply to both students and faculty of the BMITP.

## 24. ADMINISTRATIVE ISSUES

Contact the BMITP Coordinator for issues related to seminars and conferences, advisor assignments, course scheduling, tuition benefits and payments, health insurance, purchasing requests, travel information, reimbursement requests, memberships, and subscriptions.

### 24.1. Appointment to Training Program for Funded Students

As a rule, funded students must be appointed by the 10th of the month to register for courses by the end of the month; thus, newly funded students must be appointed by August 10 to be able to register for courses by the August 25 deadline for registration without a late fee (note: registration deadline changes yearly, but only by a day or two). Late fees of any kind are the responsibility of the student. Self-funded students do not have to undergo the appointment process; thus, the training starting date can begin as late as August 15. However, self-funded

students must meet with their advisors before registration, which should occur as early as mid-July, to discuss research directions.

### 24.2. Tuition

All matters concerning tuition and fees for funded students (e.g., NLM-funded and GSRs) should be directed to the BMITP Coordinator. As soon as a funded student receives a tuition bill, it must be given to the BMITP Coordinator to process payment. The student is responsible for all late fees (for late registration and past due tuition bills). In addition, some Schools within the University of Pittsburgh (e.g., School of Arts and Sciences) will not pay the activity fee for degree-seeking, funded students, and such students will be required to cover this fee as well. GSRs must pay the activity fee in full.

### 24.3. Health Insurance

Students who are NLM-funded will receive individual health insurance coverage. The health insurance coverage for which the student opted will be paid directly from the paycheck through the University of Pittsburgh and then reimbursed within a few weeks following each payday (the last workday of each month).

### 24.4. Travel Reimbursement

All students, staff, and faculty must adhere to specific travel rules and regulations. Neglecting to follow these rules may jeopardize reimbursement. Students traveling to conferences or other meetings as part of their training should discuss these regulations with the BMITP Director or Coordinator before their travel.
(see https://www.policy.pitt.edu/sites/default/files/Policies/05-Financial/Policy_FN_28.pdf)

### 24.5. Registration

The BMITP Coordinator will register students for their first fall term courses. After their first term, in consultation with their advisors/mentors, students will complete an Enrollment Form with their signature along with their advisors' signature and submit it to the BMITP Coordinator. The BMITP Coordinator will remove the advising hold placed by the Office of the University Registrar each term and register the student for the courses indicated on their Enrollment Forms. Students are required to be registered for each term by the designated registration deadline.

Full-time registration requires between 9-15 credits in the fall and spring terms. Full-time students are required to register for a minimum of 3 credits in the summer term and may take up to 9 credits or, for PhD students, FTDS (full-time dissertation study).

## 25. POLICIES AND RESOURCES FOR STUDENTS

The following policies and resources apply to ALL graduate students at the University of Pittsburgh School of Medicine. Students must familiarize themselves with these policies. Ignorance of any policy will not be accepted as an excuse for violation. Following policies and

resources can be found at https://somgrad.pitt.edu/policies-and-resources-school-medicine-graduate-students.

- Leave of Absence
- Graduate Student Parental Accommodations Guidelines
- Financial Aid
- Educational Enrichment Account (for PhD programs that offer this)
- External Support for Graduate Students
- Tuition
- University of Pittsburgh Code of Conduct
- Academic Integrity Guidelines
- Research Integrity Policy
- Bias/Mistreatment
- Office of the Learning Environment (OLE)
- School of Medicine Ombuds Office
- Title IX
- Biomedical Graduate Student Association
- Graduate Student Unionization
- Drug and Alcohol Policies and Resources
- Building Emergency or Inclement Weather Policy for Students
- University Resources

Students may use the University of Pittsburgh, School of Medicine, Office of the Learning Environment Pitt Med Professionalism Accolade and Incident Reporting (PAIR) System to report any accolade to praise highly professional behavior or incident to report unprofessional behavior or mistreatment (see https://www.ole.pitt.edu/pair).

## 26. HOUSING

Each student is responsible for their housing. Most students visit Pittsburgh to pick an apartment before they relocate here. While the University of Pittsburgh does not provide graduate student accommodation, it can provide housing assistance, particularly in areas around the University of Pittsburgh (see https://www.gradstudies.pitt.edu/student-life/housing).

For those of you moving to Pittsburgh for the first time, we recommend several neighborhoods: Squirrel Hill, Shadyside, Friendship, Bloomfield, and North Oakland. All are walkable, have frequent and convenient bus service, and have shopping areas and apartments for rent. Many DBMI faculty and students reside in these areas.

## 27. INFORMATION FOR INTERNATIONAL STUDENTS

All international students must attend the Office of International Services on their first day in Pittsburgh (see https://www.ois.pitt.edu/) at 708 William Pitt Union, 3959 Fifth Avenue. All

students are responsible for fulfilling the University of Pittsburgh's regulations for international students.

The University of Pittsburgh provides several resources for international students (see https://www.gradstudies.pitt.edu/student-life/resources-international-students) and has several special interest groups designed to alleviate the concerns of international students (see https://pitt.libguides.com/c.php?g=244134&p=8332674). All international students are encouraged to contact any of these groups for help or support regarding their transition to Pittsburgh and the University of Pittsburgh.

GlobalPittsburgh is an organization whose mission is to forge cultural, educational, and business relationships between Western Pennsylvania and the global community. GlobalPittsburgh also provides several resources to international students (see https://www.globalpittsburgh.org/).

**APPENDIX A: BMITP Core Faculty**

Murat Akcakaya, PhD, Associate Professor, Electrical and Computer Engineering
Jonathan Arnold, MD, Assistant Professor, Medicine
Michael Becich, MD, PhD, Chair & Professor, Biomedical Informatics
David Boone, PhD, Assistant Professor, Biomedical Informatics
Richard Boyce, PhD, Associate Professor, Biomedical Informatics
Rafael Ceschin, PhD, Assistant Professor, Radiology
Uma Chandran, PhD, Research Professor, Biomedical Informatics
Lujia Chen, PhD, Assistant Professor, Biomedical Informatics
Jishnu Das, PhD, Assistant Professor, Immunology
Ying Ding, PhD, Professor, Statistics
Madhavi Ganapathiraju, Associate Professor, Biomedical Informatics
Vanathi Gopalakrishnan, Associate Professor, Biomedical Informatics
Yufei Huang, PhD, Professor, Medicine
Milos Hauskrecht, PhD, Professor, Computer Science
Harry Hochheiser, PhD, Professor & Program Director, Biomedical Informatics
Xia Jiang, Associate Professor, Biomedical Informatics
Sandra Kane-Gill, PharmD, Professor, Pharmacy
Olga Kravchenko, PhD, Assistant Professor, Family Medicine
Youjin Lee, PhD, Assistant Professor, Immunology
Young Jin Lee, PhD, Associate Professor, Nursing & Medicine
Wei-Hsuan Jenny Lo-Ciganic, PhD, Professor, Medicine
Xinghua Lu, MD, PhD, Professor, Biomedical Informatics
Hatice Osmanbeyoglu, PhD, Associate Professor, Biomedical Informatics
Ryan Shi, PhD, Assistant Professor, Computer Science
Jonathan Silverstein, PhD, CRIO & Professor, Biomedical Informatics
Eric Strobl, MD, PhD, Assistant Professor, Biomedical Informatics
Srinivasan Suresh, MD, Professor, Pediatrics
Ahmad Tafti, PhD, Assistant Professor, Health Informatics & Intelligent Systems Program
George Tseng, ScD, Professor, Biostatistics
Shyam Visweswaran, MD, PhD, Professor, Biomedical Informatics
Yanshan Wang, PhD, Assistant Professor, Health Information Management
Douglas White, MD, MS, Professor, Critical Care Medicine
Qiong Wu, PhD, Assistant Professor, Biostatistics and Health Data Science
Shandong Wu, PhD, Associate Professor, Radiology
Zongqi Xia, MD, PhD, Associate Professor, Neurology
Vladimir Zadorozhny, PhD, Professor, Informatics & Networked Systems
Liang Zhan, PhD, Associate Professor, Electrical and Computer Engineering

The BMITP Core Faculty are listed on the DBMI website at
https://www.dbmi.pitt.edu/directory/?cn-s=&cn-cat=12.

## APPENDIX B: BMITP Academic Advising Contracts

**Biomedical Informatics Training Program**
**University of Pittsburgh School of Medicine**
**Academic Mentoring Contract**

**Responsibilities of the Academic Advisor/Mentor**

1. Meet with the student at least once a month during their first semester in the program, and then at least once a semester during the remainder of graduate studies.
2. Provide students with correct up-to-date academic information about departmental graduation requirements for their selected degree program.
3. Help students develop a course of study - including the selection of electives - that reflects each student's academic background, personal situation, and educational goals.
4. Assist students in finding potential research mentors and identifying career opportunities within and outside of the department.
5. Verify that students have found an appropriate research advisor and project by the end of their first semester.
6. Periodically review with the student their progress toward degree completion in order to assure early detection of problems.
7. Complete required academic evaluations at the conclusion of each semester.
8. Provide students with information about alternatives, limitations, program changes, and the consequences of academic decisions.
9. Serve as a mentor to foster students' progress in their academic pursuits.
10. Maintain open communication about the student's research experience and provide additional input and feedback on progress. Help students identify and overcome any barriers to establishing a solid research project and mentorship.

I agree to enter into an academic mentorship, accepting the responsibilities outlined above.

_____ _____
(Signature of Academic Advisor) (Date)

**Responsibilities of the Student/Mentee**

Meet with your academic advisor once a month during your first semester in the program, and then at least once a semester during the remainder of graduate studies.

Work with your academic advisor to establish course of study - including the selection of electives - that reflects your academic background, personal situation, and educational goals.

During your first semester, develop an ongoing conversation with your academic advisor regarding your research interests. Elicit advice about potential research mentors and projects. Share your initiatives to find a suitable research project, for example by describing which faculty you've met with. Ask for any help you need in the decision-making process. Inform your academic advisor of your decision before the end of the first semester.

Share your career plans, questions, concerns, and initiatives you have made on behalf of your academic training and professional development. Ask for and consider feedback from your academic advisor,

Maintain open communication about your research experience. Utilize feedback from your academic advisor to help overcome any barriers to establishing a solid research project and mentorship.

Periodically review with your academic advisor your progress toward degree completion to assure early detection of problems.

I agree to enter into an academic mentorship, accepting the responsibilities outlined above.

_____ _____

(Signature of Student) (Date)

## APPENDIX C: BMITP Research Advising Contracts (Master's or Certificate)

**Biomedical Informatics Training Program**
**University of Pittsburgh School of Medicine**
**Research Mentoring Contract**

**Responsibilities of the Research Advisor/Mentor**

1. Meet with the student at least once a week, on average.

2. Help students identify, formulate, and complete an appropriate PhD and/or MS research project.

3. Foster supportive, equitable, intellectually stimulating, respectful, and emotionally supportive environments that will encourage students' professional and personal development as researchers.

4. Assist students in finding appropriate MS and PhD committee members within and outside of the Department of Biomedical Informatics. Assist students in finding faculty members who can provide other expertise if needed.

5. Facilitate scheduling of MS and/or PhD committee meetings, ensuring that PhD committees meet at least annually (after the student's PhD proposal).

6. Provide necessary resources for completion of the research project or assist students in identifying alternatives for obtaining such resources.

7. Work with students to establish an understanding of expectations for a successful working relationship, including meeting schedules, work hours, vacations, reporting of work and updates, etc.

8. Provide guidance via standards, best practices, and expectations for management, documentation, and sharing of research data, methods, and results.

9. Set goals with the student for timely completion of intermediate milestones.

10. As soon as feasible develop with the student, a writing plan that includes planned manuscripts and anticipated dates of completion.

11. Establish fair and equitable authorship policies for publications. Discuss these policies with students.

12. Review and comment on written documents, including manuscripts, thesis proposals, and dissertation. Provide timely and detailed feedback. Assist students in developing their writing and presentation skills. Acknowledge student writing through authorship credit where appropriate.

13. Periodically review students' progress toward completing the research project and associated milestones to assure early detection of problems.

14. Discuss timelines to graduation and negotiate additional funding through the faculty's research funding or assist students in identifying alternatives for obtaining such funding.

15. Provide funding to attend professional meetings to present research or assist students in identifying alternatives for obtaining such funding.

16. Offer opportunities for senior students to assist with the preparation of grants and manuscript reviews.

17. Assist students in academic career planning, including identifying potential academic opportunities, preparing job talks, and exploring both academic and non-academic jobs.

18. Promptly notify the program director of any concerns regarding each students' progress towards completion of their degree.

I agree to enter into a research mentorship, accepting the responsibilities outlined above.

_____ _____

(Signature of Research Advisor) (Date)

**Responsibilities of the Student/Mentee**

1. Take responsibility for completion of your degree, including completion of classes, conduct of research, completion of degree requirements, selecting committees, and writing and presenting research.

2. Meet with your research advisor at least once a week, on average.

3. Work with your academic advisor to identify, formulate, and complete an appropriate PhD and/or MS research project.

4. Set goals with your advisor for timely completion of intermediate milestones.

5. Identify and request from your research advisor any resources required for completion of the research project.

6. As soon as feasible, develop a writing plan that includes planned manuscripts and anticipated dates of completion. Ask for and consider feedback from your advisor.

7. Discuss with your advisor the selection of appropriate MS and PhD committee members within and outside of the Department of Biomedical Informatics. Ask your advisor to assist in finding faculty members who can provide other expertise if needed.

8. Plan, schedule, and prepare for committee meetings, holding at least 1 meeting of your PhD committee each year (after proposing).

9. Follow best practice and standards for documenting research methods and sharing results.

10. Provide written documents, including manuscripts, thesis proposals, and dissertation to your advisor throughout the process of your research. Describe to your advisor the kinds of feedback that you find most helpful.

11. Discuss plans for submission of manuscripts to professional meetings and discuss with your research advisor any additional funding you may require to attend.

12. Discuss your timeline to graduation. If you anticipate a break in funding, negotiate further funding through your research advisor.

13. Share your career plans, questions, concerns, and initiatives you have made on behalf of your professional development. Ask for and consider feedback of your research advisor.

14. Identify opportunities for enhancing your professional development and ask your research advisor to support them (e.g. assisting in grant development or manuscript reviews).

15. Promptly inform your research mentor, academic advisor, and/or the program director of any difficulties that might interfere with your progress, including illness, personal or family problems, or other factors that might impact your ability to complete work and to meet milestones. Inform your academic advisor and/or the program director of any difficulties with your research advisor.

16. Develop your career. Work with your research mentor, academic advisor, the program director, and your thesis/dissertation committee to understand your goals and options.

I agree to enter into a research mentorship, accepting the responsibilities outlined above.

_____ _____

(Signature of Student) (Date)

**APPENDIX D: School of Medicine Declaration of PhD Dissertation Advisor(s)**

There are three forms to be completed between the student and research advisor:

- Dissertation Advisor Request Form - Documents a student's request to join a faculty advisor's lab, signed by the student, advisor, and program director.
- Advisor-Student Expectations Form - Documents expectations of advisee and advisor(s) (previously described as a mentor-mentee compact), signed by advisee (student), advisor(s), and program director.
- Advisor Financial Commitment Form- Documents the financial commitment from the advisor and advisor's department for the student the advisor has accepted to their tutelage, signed by the advisor and their department chair.

Notify the BMITP Coordinator when you are ready to document your research advisor. The BMITP Coordinator will complete the forms and obtain signatures.

## APPENDIX E: Guidelines for Faculty Regarding Research Rotations



### I. Outcomes intended from the PhD Research Rotation

Research rotations are designed to help students learn research skills while exploring potential mentors in search of building strong partnerships that will lead to successful and productive PhD research. Successful PhDs involve a problem of genuine interest to both the trainee and the mentor, and an inter-personal relationship based on mutual respect and support. As rotations are time-limited (roughly 10 weeks), there is no expectation that they will lead to publishable outcomes or useful products.

Several specific intended outcomes from successful rotation, independent of research topic, lab size, or methodological focus:

**Outcome 1: Exposure to a Well-Formulated Research Problem in Biomedical Informatics**

- By the end of the rotation, the student should have worked within a clearly defined biomedical informatics research problem or problem space, appropriate in scope for a ten-week engagement. The rotation should provide structure and focus, rather than unbounded exploration.
- The student should gain experience within the mentor's lab on how research questions in biomedical informatics are framed, constrained, and motivated.

**Outcome 2: Development of Research Reasoning and Judgment**

- The student should demonstrate growth in research reasoning, including the ability to interpret a problem, make methodological or analytical choices, and reflect on limitations, trade-offs, or unexpected outcomes. This outcome prioritizes thinking and judgment over outcomes or speed.

***Outcome 3: Gaining proficiency with research tools and approaches***

- As one of the goals is to help students gain a breadth of experience in biomedical informatics techniques, students should learn to use unfamiliar research tools, techniques, and approaches as applied to meaningful research problems.

**Outcome 4: Understanding of the working style and interpersonal dynamics of a mentor, and potentially the mentor's research group, as necessary for making an informed selection of a PhD research advisor**

- The selection of a PhD research mentor is based on a combination of the research problem of interest and the "fit" between the mentor and the student. The rotation will provide students with the opportunity to see how well they work with the supervisor, including enough information to determine if the advisor is a good fit.
- If the mentor has a formal lab with regular group meetings and interactions, the rotation should immerse the student in how research is conducted in the lab, including

how ideas are developed, how and how often discussions happen, hierarchy of discussions (whether mentoring 1:1 by faculty alone, or guidance by senior students/postdocs), how progress is evaluated, and how interdisciplinary considerations are integrated.

This outcome recognizes that different labs embody different research cultures and that understanding these differences is a core purpose of rotations.

**Outcome 5: Ability to Articulate and Reflect on a Research Experience:**

- At the conclusion of the rotation, the student should be able to clearly explain the problem they worked on, the approach taken, and what they learned from the experience.
- This includes articulating not only what was attempted, but also what worked, what did not, and why. The end-of-rotation presentation serves as the primary mechanism for demonstrating this outcome.

  This outcome reinforces the importance of reflection and communication as integral components of doctoral training.

## II. Faculty Activities to Support Research Rotation Outcomes

This section outlines faculty actions that help ensure rotations meet program-level outcomes. These are not mentoring norms, requirements, or expectations of style; they are structural actions intended to make the rotation productive and bounded. The following activities are suggested to faculty to achieve the outcomes described above:

**Supporting Outcome 1: Exposure to a Well-Formulated Research Problem in Biomedical Informatics:**

- Identifying or co-defining a research question, theme, or problem that is appropriate for a ten-week engagement.
- Articulating explicitly the scope and constraints of the problem, including what is *in* and *out* of scope for the rotation.
- Providing the student with sufficient background (papers, datasets, prior work, or conceptual framing) to understand why the problem exists and why it is non-trivial.
- Revisiting the problem definition multiple times early in the rotation (e.g., each week for the first 2-3 weeks) if it proves too broad, too narrow, or misaligned.

**Supporting Outcome 2: Development of Research Reasoning and Judgment**

- Discussing alternative approaches or methods and why certain choices are preferred for the rotation task/problem.
- Asking the student to explain their reasoning behind analytical or methodological decisions during check-ins.
- Encouraging reflection on intermediate results, including ambiguous or negative findings.
- Providing feedback that focuses on reasoning and judgment rather than correctness or speed.

  The emphasis is on cultivating research thinking, not on validating outcomes.

***Supporting Outcome 3: Gaining proficiency with research tools and approaches***

- Selecting problems and tasks requires use of tools, techniques, and data representative of the approaches that might be used in an eventual PhD project.
- Introducing students to the range of relevant tools and helping them understand the strengths and weaknesses of varying approaches.

Practical skills with research tools, approaches, and data will be useful in many contexts

**Supporting Outcome 4: Understanding the working style and interpersonal dynamics of a mentor, and potentially the mentor's research group, as necessary for making an informed selection of a PhD research advisor**

- Meeting at least weekly with the student, with higher-frequency meetings as desired/needed.
- Integrating the student into relevant lab meetings, project discussions, or working sessions during the rotation.
- Clarifying how progress is typically evaluated in the lab (e.g., milestones, iteration cycles, exploratory vs. hypothesis-driven work).
- Providing visibility into how uncertainty, negative results, or partial progress are handled in practice.
- Designating a point of contact (faculty or senior lab member) for day-to-day research interactions.

This outcome is about immersion, not performance or contribution.

**Supporting Outcome 5: Ability to Articulate and Reflect on a Research Experience**

- Clarifying expectations for the end-of-rotation presentation early on during the rotation, emphasizing explanation and reflection over results.
- Providing guidance on presentation structure
- Providing feedback on clarity and narrative coherence rather than technical polish.
- Having practice session (especially noting that it may be their first presentation in a graduate school) and engaging with the presentation as part of the mentoring process.

The presentation is intended to consolidate learning, not to evaluate technical performance under pressure.

## III. Faculty Self-Evaluation: Top 5 Rotation Checks

This checklist is intended for personal reflection by faculty hosting a research rotation. It is not evaluative, prescriptive, or reportable.

☐ **Clear starting point:** Was the student given a specific research question, theme, or bounded problem within the first two weeks?

☐ **Feasible scope:** Was the scope of the work realistic for a ten-week rotation without assuming continuation?

☐ **Early access:** Did the student receive access to the necessary data, tools, or resources early enough to make progress?

☐ **Appropriate communication:** Were there enough meetings with the student conducted at a pace suitable providing necessary guidance and support?

☐ **Course correction:** Were adjustments made when it became clear the project was drifting, stalled, or mis-scoped?

☐ **Meaningful synthesis:** Could the student clearly explain what they worked on and what they learned by the end of the rotation?

## IV. Evaluation Criteria

This section describes the criteria used to evaluate student performance in a research rotation. It is provided to faculty so that expectations are transparent and consistent across rotations.
There will be two deliverables from each rotation:

- A brief (10-15 minute) presentation of the rotation experience, either to the mentor and their research group, or to the entire BMI training program.
- A short (~ 1 page) student reflection on the rotation, describing the project and noting what well and what did not. This reflection will be provided to the training program leadership and not shared directly with the rotation supervisor.

### Criterion 1: Defined Research Focus

The evaluation considers whether the student's rotation work reflects engagement with a clearly identifiable research problem or problem space. Observable indicators may include:

- The student can articulate the research question, theme, or problem addressed during the rotation.
- The scope of the work is coherent across the rotation period.
- The student can distinguish between what was within scope and what was outside scope.

**Score interpretation (0-10):**

9-10: Clear and consistent research focus
7-8: Generally clear focus with minor inconsistencies
5-6: Partially defined or unstable focus
3-4: Weak or unclear focus
0-2: No identifiable research focus

### Criterion 2: Engagement with the Research Process

The evaluation considers whether the student was meaningfully engaged in the research activities associated with the rotation. Observable indicators may include:

- Participation in relevant research meetings or discussions.
- Regular interaction with faculty or lab members in a research context.
- Sustained involvement in rotation-related work across the rotation period.

*This criterion evaluates presence and engagement, not quality or volume of contribution.*

**Score interpretation (0-10):**

9-10: Consistent engagement throughout the rotation
7-8: Regular engagement with minor gaps
5-6: Intermittent engagement
3-4: Minimal engagement
0-2: Little or no engagement

**Criterion 3: Research Reasoning and Judgment**
The evaluation considers whether the student demonstrated research reasoning, including making and articulating decisions during the rotation. Observable indicators may include:

- The student can describe methodological or analytical choices made during the rotation.
- The student can explain the rationale for these choices.
- The student reflects on challenges, limitations, or changes in direction.

*Correctness of decisions is not evaluated; the focus is on reasoning.*
**Score interpretation (0-10):**

9-10: Clear and well-articulated reasoning
7-8: Reasoning evident but partially articulated
5-6: Limited articulation of reasoning
3-4: Decisions made but poorly explained
0-2: No clear evidence of reasoning

**Criterion 4: Articulation and Reflection on the Rotation Experience**
The evaluation considers whether the student can clearly explain and reflect on the rotation experience, particularly through the end-of-rotation presentation. Observable indicators may include:

- Clear explanation of the problem, approach, and experience.
- Reflection on learning, challenges, or insights gained.
- Coherent responses to questions about the work.

**Score interpretation (0-10):**

9-10: Clear, structured, and reflective articulation
7-8: Clear articulation with limited reflection
5-6: Basic explanation with minimal reflection
3-4: Unclear or poorly structured explanation
0-2: Unable to articulate the experience

**Criterion 5: Quality of the End-of-Rotation Presentation**
The evaluation considers the clarity, organization, and effectiveness of the student's end-of-rotation presentation. Observable indicators may include:

- Logical structure and flow of the presentation.
- Clear explanation of the problem and work performed.
- Effective use of visual or verbal communication.
- Ability to respond clearly to questions.

*This criterion evaluates communication quality, not research outcomes.*
**Score interpretation (0-10):**

9-10: Clear, well-organized, and effective presentation
7-8: Generally clear presentation with minor issues
5-6: Basic presentation with notable gaps
3-4: Unclear or poorly organized presentation
0-2: Presentation does not effectively communicate the work

Note: Faculty are asked to score each of the five evaluation criteria on a 0-10 scale as accurately as possible, based on observable evidence, without adjusting scores upward to soften feedback or avoid discomfort. **S**cores in the mid-range (e.g., 5-7) are expected for first-year students and reflect developing skills rather than poor performance.

## V. Final grade

**The final rotation grade should be based on the overall pattern across criteria rather than a strict numerical average, using the scores to inform a holistic judgment.** In keeping with the exploratory purpose of research rotations, most students who engage meaningfully with the experience should earn a final grade of **A or B**, while lower grades should be reserved for cases of clear disengagement or failure to participate. The student's reflection on the rotation will be reviewed before the end of the semester and any difficulties that may have arisen will be taken into account before grades are submitted.

## APPENDIX F: BMITP Standing Committees

1. Preliminary Examination Committee

This is a standing committee responsible for preliminary examination and consists of three BMITP Core Faculty members. The current members: Harry Hochheiser, Richard Boyce, and Madhavi Ganapathiraju.

2. Second-Year Evaluation Committee

This is a standing committee responsible for all second-year evaluations and consists of three BMITP Core Faculty members. This committee will be led by the course director for BIOINF 2134 Publication and Presentation in Biomedical Informatics. The other members are to be named.

3. Comprehensive Examination Committee

This is a standing committee that conducts all comprehensive examinations and consists of three BMITP Core Faculty members. The current members: Harry Hochheiser, Xinghua Lu, and an additional faculty member to be named.

## APPENDIX G: Responsible Conduct of Research Training

| Topic (# required hours) | Class, Workshop, or Activity (with *total hours*), including those REQUIRED by the program | Format and Timing |
|---|---|---|
| CITI courses (4.5 hours, required) | Responsible Conduct of Research *1.5 hours* **REQUIRED**<br>Conflicts of Interest *1.5 hours* **REQUIRED**<br>Biomedical Human Subjects Research *1.5 hours* **REQUIRED** | Online materials and test first month of training) |
| Conflict of Interest (1 optional 1-hour workshop) | RCR Workshop* Managing Conflict of Interest. *1 hour* | Workshop (Fall and Spring semesters) |
| Human Subjects Research (Optional 1-hour workshops) | RCR Workshop* Informed Consent 101 *1 hour*<br>RCR Workshop* Qualitative Research Ethics *1 hour* | Workshop (Fall and Spring semesters) |
| Mentor/Mentee Relationships (1 hour required; 1 optional 1-hour workshop) | Discussion of mentor-mentee relationships, including ethical issues. Students read and discuss BMI mentoring and advising contracts at the Annual Training Program Retreat. *1 hour* **REQUIRED**<br>**Facilitator:** Dr. Hochheiser | Face-to-face group discussion (start of Fall semester) |
| | RCR Workshop* Strategies for Effective Teaching and Mentoring of Students *1 hour* | Workshop (Fall and Spring semesters) |
| Collaborative Research (1.5 hours required; 2 optional 1-hour workshops) | BIOINF 2070 Foundations of Biomedical Informatics I<br>Team science/project management: challenges of interdisciplinary research; managing challenges; effective use of communication modalities; roles of clinical translational science institutes and related groups *1.5 hours* **REQUIRED for graduate students**<br>**Facilitator:** BMI project management staff. | Face-to-face group in-class discussion (Fall semester) |
| | RCR Workshop* Respectfully Engaging and Retaining Diverse Research Communities in Research Practices *1 hour*<br>RCR Workshop* Establishing and managing multidisciplinary research teams *1 hour* | Workshop (Fall and Spring semesters) |
| Publication and Peer Review (3 hours required, 1 optional 1-hour workshop) | BIOINF 2134 Publication & Presentation in Biomedical Informatics (core course): Lecture and Discussion on the Peer Review Process, including ICJME requirements for authorship, approaching authorship questions with mentors *1.5 hours* **REQUIRED for graduate students**<br>**Facilitator:** Dr. Hochheiser<br><br>BIOINF 2134 Publication & Presentation in Biomedical Informatics: Lecture on plagiarism, followed by small-group discussion using case examples. *1.5 hours* **REQUIRED for graduate students**<br>**Facilitator:** Dr. Hochheiser | Lecture with face-to-face group discussion (Fall semester) |

| | | |
|---|---|---|
| | RCR Workshop* Writing Manuscript Reviews *1 hour*<br>RCR Workshop* An Author's Responsibilities: Publication and Authorship *1 hour*<br>RCR Workshop* Authorship Conflict *1 hour* | Workshop (Fall and Spring semesters) |
| Data Acquisition, Sharing, and Ownership: Laboratory Tools<br>(At least 1 hour required) | RCR Workshop* Describing and Defining Your Data *1 hour*<br>RCR Workshop* Using Electronic Lab Notebooks *1 hour*<br>RCR Workshop* Crafting a Data Management Plan *1 hour* | Workshop (Fall and Spring semesters) |
| Science and Society: Ethical Issues and Societal Impact<br>(1.5 hours required) | BIOINF 2070 Foundations of Biomedical Informatics I (core course) Topical discussion of research in ethical applications of Artificial Intelligence in medicine *1.5 hours* **REQUIRED for graduate students**<br>**Facilitator**: Dr. Hochheiser | Face-to-face group in-class discussion (Fall semester) |
| | RCR Workshop* Identifying Issues in the Responsible Conduct of Research *1 hour*.<br>RCR Workshop* Communicating Science *1 hour*. | Workshop (Fall and Spring semesters) |
| Scientific Rigor, Reproducibility, Data Sharing, and Transparency<br>(1 hour required) | RCR Workshop* Best Practices for Reproducible Data *1 hour*<br>RCR Workshop* Preparing Data for Analysis *1 hour* | Workshop (Fall and Spring semesters) |

*Workshop through the CTSI RCR Center