

# QBS Student Handbook

---

Revised 2023

## Table of Contents

<b>Introduction .....</b>	<b>4</b>
<b>Academic calendar .....</b>	<b>4</b>
<b>Grading and academic probation .....</b>	<b>4</b>
Grade standards .....	5
Academic probation .....	5
<b>QBS journal clubs .....</b>	<b>5</b>
<b>Independent study .....</b>	<b>6</b>
<b>Graduate student teaching .....</b>	<b>6</b>
<b>Separation from the program .....</b>	<b>7</b>
<b>QBS student grievance policy.....</b>	<b>7</b>
<b>Master of Science degree.....</b>	<b>9</b>
<b>Master of Science degree in Quantitative Biomedical Sciences with concentration in Health Data     Science.....</b>	<b>9</b>
Requirements .....	9
<b>Master of Science degree in Quantitative Biomedical Sciences with a Concentration in Epidemiology     .....</b>	<b>10</b>
Requirements .....	10
<b>Master of Science degree in Quantitative Biomedical Sciences with a Concentration in Medical     Informatics.....</b>	<b>11</b>
Requirements .....	11
<b>4+1 program.....</b>	<b>12</b>
<b>Master’s degree students transferring to the PhD program .....</b>	<b>13</b>
<b>Internal QBS Master’s program.....</b>	<b>14</b>
<b>PhD degree.....</b>	<b>15</b>
<b>Core course requirements .....</b>	<b>15</b>
<b>Electives.....</b>	<b>15</b>
Elective Limitations .....	16
<b>Required research rotations .....</b>	<b>16</b>
<b>Dissertation advisor and Dissertation Committee.....</b>	<b>17</b>
Functions of the Dissertation Committee .....	18
Changes to the Dissertation Committee .....	19
When a student’s advisor leaves Dartmouth.....	19

<b>Research in Progress presentations.....</b>	<b>20</b>
<b>The qualifying examination .....</b>	<b>20</b>
Timeline.....	21
The Qualifying Examination Committee and topic development.....	21
The written research proposal.....	23
The Qualifying oral examination .....	27
Final evaluation of the qualifying examination.....	28
<b>Dissertation and dissertation defense .....</b>	<b>30</b>
<b><i>Appendix</i>.....</b>	<b>33</b>
<b>Teaching assistant positions .....</b>	<b>33</b>
TA responsibilities and expectations.....	33
<b>QBS faculty .....</b>	<b>34</b>
Becoming QBS faculty .....	34
Rotation and dissertation students.....	34
Committees .....	35
Other responsibilities .....	35
<b>QBS administration .....</b>	<b>35</b>
Advisory Committee.....	35
QBS Curriculum Committees.....	36
<b>CT/NC courses.....</b>	<b>36</b>

## Introduction

The Quantitative Biomedical Sciences (QBS) graduate program at Dartmouth trains students across the disciplines of Biostatistics, Bioinformatics, Epidemiology, Health Data Science, and Medical Informatics, producing graduates who are highly qualified for productive careers in industry, research, and academia in a broad range of quantitative and investigative areas.

In this handbook, *first-year student* is used to describe a student entering the program. The word *faculty*, where not specified otherwise, refers to QBS program faculty.

All students are expected to adhere to the Honor Principle and the Student Code of Conduct as described in the [Guarani School of Graduate and Advanced Studies Academic Policies](#).

Students who matriculate Fall 2021 or later may not take more than four units of course work per quarter unless approved by the QBS administration and leadership. In the Fall quarter, this unit limit does not include pre-term courses QBS 103 Foundations of Data Science, QBS 700 Responsible and Ethical Conduct of Research, or QBS 110 Integrative Biomedical Sciences Seminar.

Throughout this handbook, required courses are also referred to as core courses.

## Academic calendar

The QBS Master's and PhD programs follows Dartmouth College's [Academic Dates Calendar](#) for holidays and institutional breaks.

The QBS Master's degree program is designed to be completed in 15 continuous months, starting the Summer of the academic year of matriculation, and ending after the Summer term of the following academic year.

It is the expectation that students will complete the program within this time; however, in cases where a student needs to take a medical or personal leave of absence, they should seek approval from the QBS administration. Students seeking a leave should adhere to term check-in guidelines as established by the Registrar of the Guarani School of Graduate and Advanced Studies. Leaves of absence will follow the refund policies set forth by the Financial Aid Office and Student Financial Services.

In cases of financial hardship or approved leaves of absence, MS students will have three years from the date of matriculation to complete the degree requirements for their concentration.

## Grading and academic probation

All grading will be in accordance with the [Guarani School of Graduate and Advanced Studies Satisfactory Progress](#) guidelines.

QBS core, capstone, and elective courses are graded as HP (High Pass), P (Pass), LP (Low Pass), or NC (No Credit). QBS journal clubs are graded either CT (Credit) or NC (No Credit). For the complete list of QBS courses that receive grades of CT/NC, see the [Appendix](#).

### Grade standards

The following statements describe the policies and procedures that apply to students in the QBS MS and PhD programs whose academic performance is unsatisfactory.

Grades of LP or NC in core courses have serious consequences. Students who receive more than one NC, or more than two LPs, during one term or over multiple terms, may be suspended or dismissed from the program after an assessment hearing by the QBS Advisory Committee.

Unless otherwise approved by the QBS Advisory Committee, students cannot graduate with three or more LPs on their transcripts without retaking one or more of those courses, regardless of the number of units a course is assessed. The NC or LP grade remains on a student's academic record, regardless of the grade received in a course that is retaken, and is counted toward any future probationary, suspension, or dismissal actions. If a student retakes an NC course and receives a second NC, the student may be dismissed from the program.

### Academic probation

1. A student who receives one NC grade or one LP in their courses will automatically be placed on academic probation during the following term, and their performance will be assessed by the Advisory Committee. The term *course* includes an outcome obtained in the PhD qualifying examination.
2. At the end of a term during which a student has been on probation, the Advisory Committee will review the student's progress. If academic progress is judged to be satisfactory, the student will be removed from probation. Normally, satisfactory academic progress will mean a Pass grade or equivalent in current courses and fulfillment of any requirements that were recommended in the assessment hearing for removing deficiencies, but the Committee may require other evidence, such as a report on research performed. If progress has not been satisfactory, the Advisory Committee may recommend the student remain on probation or be dismissed from the program.
3. If after being removed from probation a student receives a grade of LP or lower, the Advisory Committee will review the student's progress and will either place them on probation or recommend to the Director that the student be separated from the program.
4. Students who are suspended for academic reasons, who withdraw in questionable academic standing, or who withdraw while on academic probation must present positive evidence of the ability to resume satisfactory progress when applying for readmission.
5. Students subject to an assessment by the Advisory Committee are permitted to prepare a statement describing circumstances that may account for their poor grades.

### QBS journal clubs

The QBS program offers a wide variety of journal clubs. Master's students may fulfil elective credit requirements by taking up to three journal club courses. All QBS journal clubs are 0.5 units.

Attendance at an approved QBS or equivalent journal club is required for PhD students, who must take nine journal club courses over the course of their program. In years that QBS 102 Scientific Writing is offered, this may substitute for one journal club course.

All students may pursue an independent journal club option. Students must identify a faculty member as an instructor and send the QBS administration a description of the theme and material to be covered during the course. This does not have to include specific papers that will be studied, but it should outline a weekly schedule and state how often the student and instructor will meet and review the literature. Meeting time should be at least one hour per week, in addition to at least three hours per week of work outside meetings. No more than one independent journal club may count toward elective credit. All proposals are due by a given deadline before the end of the add/drop period for that quarter. Students register for QBS 193 Independent Journal Club upon approval of their proposed theme and material.

If multiple students are interested in the same independent journal club, students should inform the QBS administration of their intentions, and only one description and syllabus need to be submitted for approval.

All QBS journal clubs are equivalent to 0.5 units, but units may differ for journal clubs offered through other departments and programs. QBS 193 does not count toward Epidemiology Master's concentration elective credit.

All first-year QBS PhD students register for QBS 270 Quantitative Biomedical Sciences Journal Club in each quarter of their first year for the Fall, Winter, and Spring. With approval from the QBS administration, QBS 193 Independent Journal Club can count as a required journal club requirement but cannot substitute for QBS 270 in the first year.

### Independent study

Students may opt to pursue QBS 195 Independent Study as an elective credit. Independent study in QBS is structured to allow students to explore subject matter and enhance their knowledge in QBS-related fields. The arrangement and a course outline are to be developed between the student and a QBS faculty member prior to the start of the quarter and submitted to the QBS administration before the end of the add/drop period for approval. The proposal should reflect 3.3 hours of instruction per week, and at least 6.6 hours of student work per week throughout the term.

The student and faculty will work together to structure the study program and set goals that are to be met by the end of the course. The course of study may include, but is not limited to, literature review, seminar attendance, online course material, small projects, and presentations related to the specific field being studied. The faculty member is responsible for tracking and evaluating the student's progress and reporting a grade to QBS administration at the end of the term. No more than one independent study may count toward elective credit.

Students may use QBS 195 to earn credit for approved online courses.

### Graduate student teaching

Teaching is not required of Master's degree students, and undertaking a teaching assistantship will not directly waive tuition or fees. However, students have the option to pursue available teaching assistantship positions posted through Dartmouth College. QBS offers paid teaching assistantships, and QBS administration will notify students of the availability of these positions.

An essential element of doctoral education at Dartmouth is the experience gained in teaching. At least one quarter of teaching is required of all PhD students. In the student's second or third year of study, they will TA one QBS course unless another course has been approved by the QBS administration. *Under no circumstances may students opt out of this requirement.* PhD students must attend [DCAL TA Orientation and Training](#) prior to the quarter in which they will TA unless otherwise approved by QBS administration.

For more information about [teaching assistantships](#), including [responsibilities and expectations](#), see the [Appendix](#).

### Separation from the program

If a student faces potential separation from the program due to course grades or other reasons that conflict with the [Graduate Student Nondiscrimination Grievance Procedures of the Guarini School of Graduate and Advanced Studies](#), the QBS Advisory Committee will be convened to review the student's overall record and the pending separation prior to final action. The QBS Director will serve as chair of the meeting unless there is a conflict of interest. In such case, a senior member of the QBS Advisory Committee will serve as chair. Faculty members who feel they might have a conflict of interest that would compromise their ability to make a fair and impartial decision should remove themselves from associated meetings. The Advisory Committee will function as a democratic committee with a single vote for each faculty member present and the final decision will be arrived at by a majority vote.

The overall performance of the student will be reviewed with respect to whether the student is qualified for a productive scientific, or related, career and as to their potential capacity for achieving a MS level of scientific expertise within a reasonable timeframe. The Advisory Committee will also consider any extenuating circumstances brought to their attention by the student or other informed party that may have contributed to the poor performance. In extraordinary instances, the Advisory Committee may recommend an alternative course of action to that which would normally be stipulated by the QBS rules and regulations for the circumstances that prompted the review process. Such a recommendation requires a two-thirds majority vote of the Advisory Committee.

In cases where financial hardship is the reason for separation, the student will have three years from the date of matriculation to complete the MS Degree requirements for their concentration.

### QBS student grievance policy

The process for guiding graduate student progress in QBS, while primarily designed to oversee scientific progress and direction, is also intended to guard against biased treatment of any individual. The program has established a grievance process consisting of multiple stages, to ensure that student grievances will be investigated fully and fairly, treated confidentially, and resolved in a timely manner. With an effective oversight and grievance committee structure, few grievances or disputes will reach the stage where they require formal resolution from the Guarini Graduate School offices. However, when resolution is not feasible or successful at the program level, the Guarini Graduate office is the next place to turn. A grievance may be handled as appropriate in the following stages.

1. When possible, the student speaks directly to the person who bears responsibility for the complaint or who is the alleged cause of the complaint.
2. The student speaks to the research advisor and members of the Dissertation Committee.
3. The student speaks to the QBS Director or administration.
4. If a satisfactory resolution cannot be reached within the department or program, the student may request a meeting with the Dean of Graduate Studies to discuss the issue.
5. If the Dean, working together with the student and appropriate faculty member(s), or representatives of the QBS program is unable to reach a satisfactory resolution, the student may request in writing a formal hearing and ruling by the Dean of Graduate Studies and the Committee on Student Grievances.

Allegations of scientific misconduct, violations of the academic honor principle, and certain issues of professional and personal conduct (sexual harassment, discrimination, and others described in the graduate handbook under code of conduct - non-academic regulations) must be reported to and handled by the Graduate office. Additional information about Guarini Policies and Procedures can be found in the [Guarani School of Graduate and Advanced Studies Academic Policies](#).



## Master of Science degree

The Master's degree program offers three concentrations: Health Data Science, Epidemiology, and Medical Informatics. The program is designed to be completed in 15 months, starting the Summer of the academic year of matriculation, and ending after the Summer of the following academic year. The Master's degree requires completion of 18 units of coursework, comprised of core courses and approved elective courses. Students declare their choice of concentration at the beginning of the first term of the Master's program.

Students entering the program are expected to have coursework in calculus, statistics, and programming, or to have demonstrated their experience in these areas. They are expected to be ready to use techniques of calculus, including differentiation and integration of multivariable functions, and to be comfortable with programming and scripting languages, both procedural and objected-oriented, such as R and Python. Students who lack these skills are strongly encouraged to acquire them before the start of the program. All Master's degree students take an introductory R programming course in their first Summer quarter.

## Master of Science degree in Quantitative Biomedical Sciences with concentration in Health Data Science

The QBS Master of Science degree with concentration in Health Data Science provides training in data wrangling, exploratory data analysis, statistical modeling, machine learning, data visualization, and communication. Graduates acquire competencies in the management, analysis, and interpretation of data from health care, medicine, computational biology, pharma, and genomics. Health Data Science students take interdisciplinary courses that position them with competitive advantages for careers in biostatistics, epidemiology, and data science, including artificial intelligence, with specific emphasis on problems in healthcare and biomedicine that translate to academia and industry. Students complete 14.5 required units of coursework, including a capstone experience, and 3.5 units of electives during the five quarters in residence. Students also have the option to pursue an internship during the Summer as their capstone experience.

### Requirements

1. Satisfactory completion of the following courses.
  - QBS 101 Foundations of Programming for Data Scientists
  - QBS 103 Foundations of Data Science
  - QBS 108 Machine Learning
  - QBS 119 Applied Biostatistics or QBS 120 Foundations of Biostatistics I
  - QBS 121 Foundations of Biostatistics II
  - One of the following:
    - QBS 122 Biostatistics III Modeling Complex Data
    - QBS 124 Advanced Biomedical Data Analysis
    - QBS 126 Analysis of Densely Collected Longitudinal Data

- QBS 146 Bioinformatics I
  - QBS 130 Foundations of Epidemiology I
  - QBS 177 Methods of Statistical Learning for Big Data
  - QBS 181 Data Wrangling
  - QBS 180 Data Visualization
  - QBS 185.5 Capstone Preparation Course
  - QBS 185 QBS MS Capstone Experience
  - QBS 194 or QBS 270 Biostatistics Journal Club
2. Satisfactory completion of 3.5 units of approved graduate level elective courses.
  3. Completion of QBS 700 Responsible and Ethical Conduct of Research is required of all first-year graduate students but does not count toward core or elective degree credit.

## Master of Science degree in Quantitative Biomedical Sciences with a Concentration in Epidemiology

The QBS Master of Science degree with concentration in Epidemiology provides advanced training in epidemiologic methods and supporting training in biostatistics, bioinformatics, data analysis, and translational research. Graduates acquire competencies in the theory and application of epidemiologic methods to complex problems in population health. Epidemiology students receive interdisciplinary training for careers in biomedical research, government agencies, private industries, and nonprofit health organizations. Students complete 15 required units of coursework, including a capstone experience, in which students will develop and complete a research project with a faculty advisor. They also have the option to pursue an internship during the Summer as their capstone experience. At least 3 units of elective courses are required during the five quarters in residence.

### Requirements

1. Satisfactory completion of the following courses.
  - QBS 101 Foundations of Programming for Data Scientists
  - QBS 103 Foundations of Data Science
  - QBS 119 Applied Biostatistics or QBS 120 Foundations of Biostatistics I
  - QBS 121 Foundations of Biostatistics II
  - QBS 130 Foundations of Epidemiology I
  - QBS 131 Foundations of Epidemiology II
  - QBS 132 Molecular Biologic Markers in Human Health Studies
  - QBS 133 Clinical Epidemiology
  - QBS 136 Applied Epidemiological Methods
  - QBS 146 Foundations of Bioinformatics I
  - QBS 185.5 Capstone Preparation Course
  - QBS 185 QBS MS Capstone
  - QBS 270 QBS Journal Club (Epidemiology)

2. Satisfactory completion of 3 units of approved graduate level elective courses.
3. Completion of QBS 700 Responsible and Ethical Conduct of Research is required of all first-year graduate students but does not count toward core or elective degree credit.

## Master of Science degree in Quantitative Biomedical Sciences with a Concentration in Medical Informatics

The QBS Master of Science degree with concentration in Medical Informatics provides students access to interdisciplinary courses, positioning individuals to have competitive advantages for data-driven careers in healthcare and biomedicine that translate to academia and industry. Students complete 14.5 units of required coursework, including a capstone that brings together data wrangling, exploratory data analysis, programming, statistical learning, epidemiology, medical informatics, health services research, data visualization and communication. At least 3.5 units of elective coursework are required during the five quarters in residence. Students are required to pursue an applied capstone project through local projects or internships.

### Requirements

1. Satisfactory completion of the following courses.
  - QBS 101 Foundations of Programming for Data Scientists
  - QBS 103 Foundations of Data Science
  - QBS 119 Applied Biostatistics or QBS 120 Foundations of Biostatistics I
  - QBS 121 Foundations of Biostatistics II
  - QBS 130 Foundations of Epidemiology I
  - QBS 139 Advanced Methods in Health Services Research
  - QBS 140 Decision and Cost Effectiveness Analysis
  - QBS 180 Data Visualization
  - QBS 181 Data Wrangling
  - QBS 185.5 Capstone Preparation Course
  - QBS 185 QBS MS Capstone
  - QBS 192 Health Informatics
  - PH 147 Advanced Methods in Health Services Research Project OR any approved QBS Journal Club
2. Satisfactory completion of 3.5 units of approved graduate level elective courses.
3. Completion of QBS 700 Responsible and Ethical Conduct of Research is required of all first-year graduate students but does not count toward core or elective degree credit.

## 4+1 program

QBS offers a 4+1 option to Dartmouth undergraduates, allowing students to complete their Master's degree in 12 months after earning their Dartmouth undergraduate degree. 4+1 students are required to complete three eligible courses toward the QBS Master's degree while they are undergraduates. The three eligible courses do not need to be complete before application submission but should be finished by completion of the undergraduate degree.

Students must satisfy the degree requirements for their declared concentration, earning a total of 18 units of coursework inclusive of the three units completed as an undergraduate student.

GRE submission requirements are waived.

Courses cross-listed at the graduate level in the Basic/Life sciences, Math, Computer Science, Engineering, Psychological & Brain Sciences, and Physics & Astronomy may qualify for the 4+1 program.

## Master's degree students transferring to the PhD program

Master's degree students may apply to the QBS PhD program in their first or second years. They must meet the same application deadlines as other applicants for the PhD program. Applications will be reviewed and measured against the quality of all applications submitted that year. No preference will be given to applications of QBS MS students.

Master's degree students who are accepted to the PhD program have several options, depending on their decision whether to complete the Master's degree, and when they intend to begin the PhD program. All students transitioning from the MS to the PhD should meet with QBS administration to discuss credit for completed courses, course selection, fulfillment of requirements, and required rotations.

Students who complete the MS degree may transfer up to six units to the PhD.

Prior to matriculation to the PhD program, tuition and fees will apply for terms when the student is enrolled.

## Internal QBS Master's program

The internal QBS Master's degree option is offered to PhD students at Dartmouth who are enrolled in a program other than QBS who have permission from their advisor and program, and to QBS PhD students in good standing who do not successfully advance to PhD candidacy or wish to leave the program under reviewed circumstances.

Interested students should submit to the QBS Director and administration a signed letter of approval from their advisor indicating they acknowledge the course load and grant permission to pursue the degree. They also need to ensure that approval from their PhD program is communicated to QBS administration either by their program director or administration. Applications to the QBS Master's program should be submitted online through the Dartmouth application system and must meet published deadlines for submission. Students are not required to resubmit transcripts from other institutes or test scores.

Students applying to the internal QBS Master's program may begin to fulfill degree requirements prior to being accepted and will receive credit for any required course with a grade of Pass or higher. They must notify the QBS administration, their program, and advisor that they intend to pursue the internal MS should they wish to take more than three QBS courses.

The requirements for the internal MS degree in Quantitative Biomedical Sciences are as follows:

Satisfactory completion of the six core course requirements listed below.

- QBS 130 Foundations of Epidemiology I
- QBS 131 Foundations of Epidemiology II
- QBS 119 Applied Biostatistics I or QBS 120 Foundations of Biostatistics I
- QBS 121 Foundations of Biostatistics II
- QBS 146 Foundations of Bioinformatics I
- One of the following:
  - QBS 108 Machine Learning
  - QBS 139 Advanced Methods in Health Services Research
  - QBS 140 Decision and Cost-Effective Analysis

One additional approved QBS elective is also required that will not count towards PhD elective requirements.

## PhD degree

Students entering the PhD program are expected to have coursework in calculus, statistics, and programming, or to have demonstrated their experience in these areas. They are expected to be ready to use techniques of calculus, including differentiation and integration of multivariable functions, and to be comfortable with programming and scripting languages, both procedural and objected-oriented, such as R and Python. Students who lack these skills are strongly encouraged to acquire them before the start of the program. All students take an R programming course in the weeks prior to their first Fall quarter.

The course requirements outlined in this handbook are considered a minimum for the PhD degree. The student's Dissertation Committee can recommend that a student take more than the minimum required number of courses to provide that student with an academic background appropriate for pursuing research in the student's chosen area of investigation. Students may also petition the QBS Director for credit for courses offered by outside institutions. If a student wishes to take a course that is not on the approved QBS course list, they must receive pre-approval from the QBS administration and Director to receive credit.

## Core course requirements

Every PhD student is required to enroll in QBS 110 Integrative Biomedical Sciences Seminar and QBS 103 Foundations of Data Science, which begin upon matriculation and prior to the start of first-year courses. Additionally, the Guarini Graduate School requires that all first-year graduate students enroll in an ethics course, QBS 700 Responsible and Ethical Conduct of Research.

There are eight core course requirements to be completed no later than the Spring of a student's second year unless otherwise approved.

1. QBS 110 Integrative Biomedical Sciences Seminar
2. QBS 103 Foundations of Data Science
3. QBS 130 Foundations of Epidemiology I
4. QBS 131 Foundations of Epidemiology II
5. QBS 119 Applied Biostatistics I or QBS 120 Foundations of Biostatistics I
6. QBS 121 Foundations of Biostatistics II
7. QBS 146 Foundations of Bioinformatics I
8. One of the following:
  - QBS 108 Machine Learning
  - QBS 126 Analysis of Densely Collected Longitudinal Data
  - QBS 139 Advanced Methods in Health Services Research
  - QBS 140 Decision & Cost-Effective Analysis

## Electives

Students who matriculate Fall 2019 or later must earn 3.5 units of elective credits approved by the QBS administration and Director. A [list of approved QBS PhD electives](#) can be found on the website. Many

additional electives in other departments and programs have been approved and students may additionally petition the QBS administration and leadership for elective approval of courses 100-level or higher that are taught through other departments.

Students may opt to pursue QBS 195 Independent Study as an elective credit. Independent study in QBS is structured to allow students to explore subject matter and enhance their knowledge in QBS-related fields. The arrangement and a course outline are to be developed between the student and a QBS faculty member prior to the start of the quarter and submitted to the QBS administration before the end of the add/drop period for approval. The proposal should reflect 3.3 hours of instruction per week, and at least 6.6 hours of student work per week throughout the term.

The student and faculty will work together to structure the study program and set goals that are to be met by the end of the course. The course of study may include, but is not limited to, literature review, seminar attendance, online course material, small projects, and presentations related to the specific field being studied. The faculty member is responsible for tracking and evaluating the student's progress and reporting a grade to QBS administration at the end of the term. No more than one independent study may count toward elective credit.

Students may use QBS 195 to earn credit for approved online courses.

#### Elective Limitations

No more than two units total of QBS 195 and QBS 123 may count towards the 3.5 units of elective units.

#### Required research rotations

During their first year in the program, students are required to perform three research rotations under the supervision of three different program faculty members. In August and September preceding the start of the Fall quarter entering students will have the opportunity to meet individually with the QBS administration and members of the QBS faculty. The purpose of these meetings is to inform the students of program expectations, regulations, and courses, and to familiarize students with faculty research to begin the process of selecting research rotations.

Each rotation lasts one academic quarter. Joint faculty rotations may be arranged with the approval of the QBS administration. Students are strongly encouraged to read papers by faculty whose research is of particular interest to them, and to contact those faculty members during the summer prior to matriculation to discuss the possibility of a fall rotation.

Before the start of each quarter, students are to submit up to three choices for research rotation advisors, in rank order of preference, to the QBS administration. Students will be matched with their research rotation advisor, with effort made to give students their first choices, subject to the following considerations.

- Students may perform research rotations only in laboratories of faculty who have made it clear that they have the appropriate research grant funds or departmental resources at their disposal



to fund the costs of the rotation and at least three years of funding to support a student stipend and dissertation research.

- Co-mentorship: Students may perform a research rotation with faculty outside QBS if a co-mentor in QBS is identified for the rotation. This external faculty member may act as a student's primary dissertation advisor so long as the co-mentor is QBS faculty.
- QBS administration will solicit information from each faculty member in the program regarding their interests in sponsoring rotation students and be guided by this input when assigning rotations.
- Realizing that ideas, impressions, attitudes, and expectations change with time, only the first rotation is to be arranged prior to the beginning of the Fall quarter. The second and third rotations in Winter and Spring quarters will be arranged during the final weeks of the preceding quarter.
- Only under approved and special circumstances are four or more rotations allowed.

It should be emphasized that neither the student nor the faculty member is to regard any of the three research rotations as permanent. Students are required to perform three such rotations before deciding on a dissertation advisor. Students and faculty are not to arrange the choice of their dissertation lab until the last two weeks of the third rotation; the precise time when it is appropriate to discuss permanent arrangements will be announced to students and faculty by the QBS administration. Once the dissertation lab arrangements are made, students and faculty will submit an agreement letter, jointly signed, to the QBS administration. A modified form will be used if the student will be co-mentored by two advisors and co-mentored students are required to also provide an outline regarding the agreed division of financial and mentoring responsibilities agreed upon by each advisor.

At the end of each rotation, the research advisor or co-mentors will submit to the QBS administration a grade of Credit (CR) or No Credit (NC) and a written summary of the student's rotation if desired. A grade of NC for the research rotation is given only if there are serious deficiencies in student performance.

### Dissertation advisor and Dissertation Committee

By the end of the Spring quarter of the first year of graduate study, approximately June 1, each student must arrange for a member of the QBS faculty to serve as their dissertation advisor and research sponsor. The dissertation advisor plus two other faculty members, chosen by the student in agreement with their dissertation advisor, will become the student's Dissertation Committee.

The Dissertation Committee is to be formed and approved no later than July 1 of the student's second year unless a valid reason for a delay is provided to the QBS administration. The first committee meeting is to be held before the beginning of the following Winter quarter unless otherwise approved. The student's dissertation advisor will serve as Dissertation Committee chair. Normally, the Dissertation Committee will be composed only of QBS faculty members; however, where appropriate, one member of the Dissertation Committee may be a non-QBS faculty member. There may be additional members added to the committee as the student's advisor determines to be appropriate, but at least two

members must be QBS faculty. In the case where a student is co-mentored by two QBS faculty, there must be at least one additional QBS faculty member on the committee.

The committee should be assembled to avoid potential or perceived conflicts of interest among faculty members, and between faculty members and the graduate student. Such conflicts would include personal or financial relationships. Final approval by the QBS Director of the composition of the Dissertation Committee is required, as are any subsequent changes in the composition of the committee.

### Functions of the Dissertation Committee

The duties and purpose of the Dissertation Committee are listed below.

- Attend annual committee meetings arranged by the student and/or meet more frequently as needed to assess student's progress and address any concerns.
- Attend the student's annual Research in Progress presentation (RIP).
- Review and sign committee meeting progress reports written by the student summarizing their performance in the program. The report should include an evaluation or outline of the student's progress in the program and their progress developing and completing a dissertation research project. This will serve as part of the formal record of the student's graduate education.
- Advise the student with suggestions for courses beneficial to their research progression.
- Ensure that the student develops the ability to communicate ideas and knowledge to others in seminar-style presentations. This will normally be accomplished through experiences gained in courses, RIP presentations, lab meetings, conference attendance, etc.
- Mediate disputes between the student and advisor. If either the student or the advisor desires to end the student-advisor relationship, the Dissertation Committee must play an active role, particularly if the decision is not a mutual one between the student and advisor.

It is the responsibility of the student to inform the Dissertation Committee about the dates of their RIP presentations, to schedule meetings with the Dissertation Committee at least once annually, and to provide a progress report summarizing their dissertation and program progress, using a template provided by the QBS administration. The student should use this progress report template as a meeting agenda outline that informs their committee of their research progress to date, classes completed, papers published or in progress, and a timeline of future plans. Once approved by the Dissertation Committee, this report should be signed by the student and all members of the Dissertation Committee and submitted to the QBS administration. If a student cannot arrange for an annual committee meeting in a timely fashion, they must provide a valid reason to the QBS administration. If no valid reason can be provided or approved, the student will be placed in unsatisfactory standing and the Graduate Studies office will be notified, and the situation will be reviewed by the QBS Advisory Committee.

Choice of a dissertation advisor may be delayed by one quarter under special circumstances in which a student requests from the QBS administration a fourth research rotation; in this case, the fourth research rotation will occur during the Summer of the student's first year in the program. It is the understanding, unless otherwise discussed with the QBS administration, that the fourth rotation is

intended to be the student's dissertation lab. QBS administration will set the timeline for this rotation and provide stipend support during this time.

If a student is not able to find a suitable or willing advisor from among QBS program faculty at the end of their research rotations, the situation will be reviewed by the QBS Advisory Committee who may allow a fifth rotation, suggest terms by which a student may leave with a QBS MS degree, or recommend separation from the program prior to the start of the Fall quarter.

### Changes to the Dissertation Committee

If either the student or the advisor desires to end the student-advisor relationship, the Dissertation Committee must play an active role advising on the situation and in subsequent matters pertaining to the student's project, particularly if the decision is not a mutual one between the student and advisor.

If either the student or advisor wants to end the relationship, then the following must occur.

1. The reasons for the action must be stated in writing and filed with the QBS administration.
2. The Dissertation Committee must be made aware of the issues.
3. The student or advisor must be given an opportunity to rectify the problems.
4. The conditions that the student or advisor must meet to rectify the problem should be approved by the Dissertation Committee and communicated in writing to the student and to QBS administration.
5. If the Dissertation Committee has not been formed, cannot reach a conclusion on the issue, or the problems cannot be rectified, the situation will be brought to the QBS Director and QBS administration for review.

### When a student's advisor leaves Dartmouth

If a student's advisor leaves the institution, the following options are available to students.

#### *If a student has successfully passed their qualifying exam*

- The student may choose to remain in the QBS program, and transfer to a new lab at Dartmouth. This option requires the naming of a new dissertation advisor from among the QBS faculty. It is up to the student and new advisor if they would like the outgoing advisor to serve on the student's Dissertation Committee.
- The student may choose to continue to work with the outgoing advisor but remain in the QBS program and work at Dartmouth. In that case, a nominal QBS advisor must be named with the original advisor remaining a member of the student's Dissertation Committee, attending Research in Progress presentations, committee meetings, and the dissertation defense.
- The student may move with the outgoing advisor to the new institution while remaining a QBS student. The student will be required to name a new QBS- and Dartmouth-based advisor to be permitted to enroll in graduate research at Dartmouth each quarter, and to meet all program requirements while studying off-site. The student will be required to return to campus for the annual RIP presentation and committee meeting and must complete all course requirements. The student may petition the QBS administration and Director to obtain permission to fulfill remaining requirements remotely or to receive a waiver of certain requirements such as journal club or teaching requirements.

- The student may leave the program with a QBS MS upon QBS Director and QBS Advisory Committee review and approval. This is contingent on satisfactory coursework completion.

*If a student has set a date for their qualifying defense and submitted a final draft of their written qualifying exam but not yet completed their oral defense*

The situation will be reviewed by the QBS Director and administration should the student want to pursue one of the options above.

*If a student has not yet successfully passed their qualifying exam*

- If the student chooses to remain in the QBS program, they must transfer to the lab of a QBS faculty member. This option requires the naming of a new dissertation advisor from among the QBS faculty. The student will work with QBS administration to ensure there is appropriate time for selecting this advisor and taking a rotation if needed. It is up to the student and new advisor if they would like the outgoing advisor to serve on the student's Dissertation Committee.
- The student may be able to leave the program with a QBS Master's upon QBS Director and QBS Advisory Committee review and approval. This is contingent on satisfactory coursework completion.
- The student may withdraw from the QBS program and follow the lab of the outgoing advisor and join the new institution's program or another program elsewhere.

## Research in Progress presentations

Students are required to present a yearly Research in Progress presentation beginning in their second year in the program. Presentations are scheduled monthly, with typically two or three students presenting their current research to faculty and peers on the same day, with the most senior QBS students presenting earliest in the year. Each student's advisor should be in attendance and their Dissertation Committee is strongly encouraged to attend. For second-year students, if the committee is not formed yet, their advisor must be present, and they may extend the invitation to their Qualifying Examination Committee. In the year that the student expects to defend their dissertation and receive their PhD, the student must present a RIP presentation unless the name of the outside examiner and the defense date have been sent to the QBS administration before the beginning of Fall RIPs.

All QBS PhD students are required to attend these presentations. If a student misses more than two presentations without providing a valid reason, the situation will be reviewed by the Advisory Committee in conjunction with the student's advisor and the student may be placed on academic probation.

## The qualifying examination

Each student enrolled in the PhD program must pass a qualifying examination to be formally advanced to candidacy for the PhD degree. This exam has two components: a written research proposal, and an oral exam that uses the written proposal as its focus. Deadlines will be communicated to students during the end of Summer or early Fall of the student's second year, and students will be provided with a document to share with their committee that outlines committee responsibilities. The qualifying

examination topic will be based on the student’s proposed dissertation project or an approved topic of their choice.

### Timeline

Submit first draft of aims	Mid-December
Committee provides aims revisions	Early January
Submit final revision of aims	Mid-January
Submit first draft of written proposal	Mid-February
Committee returns revision comments	Mid-March
Submit final revision of written proposal	Early April
Committee approval or failure of final proposal	Early April
Oral defense	Early May

### The Qualifying Examination Committee and topic development

The Qualifying Examination Committee will be composed of three faculty members who serve as the examining and voting members of the committee. At least two members of the Qualifying Examination Committee must be members of the QBS program faculty. A third committee member may be Dartmouth College or Dartmouth-Hitchcock research faculty, but otherwise cannot be external. The student and dissertation advisor will jointly choose two members of the examination committee. They should be chosen based on their expertise in the content areas of the written proposal and for their willingness to interact with the student throughout the process.

The Qualifying Examination Committee should be assembled to avoid potential or perceived conflicts of interest between all parties. Such conflicts include personal or financial relationships. This committee is not intended to be the student’s Dissertation Committee, but if suitable, all members would be allowed to be on the student’s Dissertation Committee if approved by the program. As the aims evolve, it may become clear that faculty members who agreed to be members of the Qualifying Examination Committee early during the process are not the best ones to serve on the committee. In these cases, the student, advisor, and Qualifying Examination Committee members should decide on a replacement.

One member of the Qualifying Examination Committee may be a faculty member who is not a member of the QBS program. The student’s dissertation advisor will not serve as a member of the Qualifying Examination Committee, but the advisor’s approval of the topic, specific aims, and the final written proposal are required. The advisor is also required to attend the oral examination. The QBS Director of Academic and Student Affairs will attend qualifying exams upon request and is available to advise the committee if the majority of committee members are unfamiliar with the QBS qualifying process. In cases when the Director of Academic and Student Affairs cannot attend, another member of the Advisory Committee will attend.

The student, advisor, and first two Qualifying Examination Committee members will agree upon one of the committee members to serve as chair. In cases where a non-QBS faculty member is serving on the Qualifying Examination Committee, that person may not serve as chair. The student is responsible for meeting all deadlines and for setting a time and place for the oral examination. The chair is responsible for the conduct of the examination, and for the preparation of any required correspondence, such as

compiling the critique of the written proposal from committee members and communicating major concerns to the QBS Director and Director of Academic and Student Affairs. The committee chair should be the main contact point for the student; however, they may seek guidance and input from individual members.

The student should develop specific aims for the research proposal. The student is encouraged to interact with their advisor and the two Qualifying Examination Committee members already selected in developing and focusing the specific aims. However, the student should be aware that the development of the scientific focus of the proposal is the responsibility of the student. The student should submit the proposal title and specific aims to the advisor and Qualifying Examination Committee members. The specific aims should contain an introductory paragraph that places the experimental aims in context. In addition to stating the aims of the proposed studies, this section should also describe briefly the experimental approaches to be used either in the introduction or under each aim. With the approval of the Qualifying Examination Committee, the specific aims may be modified as the written proposal is prepared. In its final form, the specific aims will be the first page of the written proposal.

The third committee member will be chosen after the advisor and the two committee members have approved the topic and specific aims. However, if the student, advisor, and the committee want to invite a third member prior to aim development, they may do so. The advisor and Qualifying Examination Committee members should confer and select a third member of the committee. The student may also make suggestions about the selection of the third committee member, but the ultimate decision will be between the advisor and committee members. The committee will communicate their choice to the student and the student will then contact this third member inviting them to join the committee. The student is to provide them with the guidelines regarding committee responsibilities, the qualifying timeline, and their specific aims.

The third committee member may be selected based on their ability to contribute in the following ways.

- Provide additional expertise useful for evaluating the studies proposed
- Provide new faculty with an early opportunity to participate in the qualifying examination process
- Ensure that at least one member of the Qualifying Examination Committee has extensive experience with the QBS qualifying exam

After the third member is chosen, students are required to submit the names of the entire committee to the Director of Academic and Student Affairs for approval.

During the period of topic selection and development of specific aims, students are expected to maintain full-time involvement in coursework, teaching, and normal laboratory activities.

In all cases, and no later than a deadline in December of the student's second year, the topic and specific aims must be approved by the advisor and the two Qualifying Examination Committee members chosen by the advisor and student. The committee member names, proposal title, and specific aims should be submitted to QBS administration by the deadline. The aims will be reviewed by the student's

Qualifying Examination Committee, and revision suggestions will be presented to the student. Revised aims are due by a deadline in January.

If it is found that a committee member is consistently unresponsive during the qualifying process, causing a delay in the timeline, the student is to bring this matter up with their advisor and the QBS administration to resolve the issue.

The following are the criteria for evaluation and approval of the specific aims.

- Is studying and writing about the topic of the proposal likely to be a sound educational experience for the student? The qualifying examination should enhance knowledge and understanding in fields related to the student's PhD dissertation project.
- Do the aims address important questions in the field? The aims should be hypothesis-driven rather than merely descriptive.
- Are the proposed methods reasonable and feasible using current technology? If not, has the student proposed new approaches that have a reasonable probability of succeeding?
- Can the proposed experiments be completed within the timeframe of a student's PhD candidacy?
- Is the style and level of detail of the specific aims appropriate for a grant application?

## The written research proposal

### *Preparation of the qualifying written proposal*

The written portion of the qualifying examination is a research proposal written by the student. Once the student's topic and specific aims have been approved, the student will have up to four weeks to complete the written proposal. The proposal should be written entirely by the student. The written proposal must be approved by the advisor before it may be submitted.

The advisor should not approve the proposal if it is difficult to understand because of writing style, grammatical errors, or a failure to provide sufficient background or experimental detail. The advisor should ensure that the proposal conforms to all formatting guidelines and the length requirements (not more than seven pages plus references) and that the references include all needed information (including titles). Scientific evaluation of the written proposal is the responsibility of the Qualifying Examination Committee, not the advisor.

The written proposal must be submitted to the Qualifying Examination Committee no later than a deadline in February. Furthermore, the entire examination process should be completed as close to May 1 as committee availability allows, and no later than August 1 of the student's second year of graduate work. If the exam is not completed by this time, the student will not be permitted to enroll in the following Fall quarter as a PhD student unless otherwise approved due to extenuating circumstances.

During the time when the written proposal is being prepared, students are expected to discuss their research schedule with their advisor since it is understood that writing the qualifying exam will take a considerable amount of time and effort. Students are expected to maintain their coursework and other

activities during this time. In writing the proposal, the student may not copy from grant applications or journal articles. This constitutes plagiarism and is grounds for dismissal from the program.

### *Qualifying written exam format and organization*

#### General Format

The entire research proposal is limited to seven pages, including figures and tables, and should adhere to [NIH Fellowship \(F\) format](#). The seven-page limit does not include the reference list. No materials may be included in any appendix. Proposals exceeding this page limit will be returned to the student without review.

A font size of 11 point or larger is acceptable. Use of smaller font sizes will result in return of the proposal to the student without review. There may be no more than 15 characters per inch.

The proposal should be single-spaced. There may be no more than six lines of type per vertical inch.

All pages must provide at least one-half inch margins (top, bottom, left, and right).

All pages should be numbered. The first should be numbered as page 1 and should include the abstract and specific aims.

A reference list should be included after the research description section. There is no length limit for the reference list. Citations in the reference list should be complete and contain all authors' names (if more than 10 authors, only the first 10 authors' names should be listed), full title, year of publication, journal, journal volume, and page numbers. The format of the reference list in NIH format could serve as a model, but a specific format is not required. Students are urged to cite original references rather than review articles.

Citations in the text of the proposal can either be numbered (as in a *Nature* paper) or use the author/year format (as in a *Cell* or *Genes & Development* paper). See [The NLM Style Guide for Authors, Editors, and Publishers](#) for guidance.

Inclusion of relevant figures and tables is encouraged. The figures and tables can be either embedded in the text or placed together preceding the references. In either case, the research description section must not exceed seven pages including all figures and tables.

In addition to distributing a paper copy of the written proposal to each Qualifying Examination Committee member, the student should send committee members an electronic copy.

The chair of the Qualifying Examination Committee should examine the proposal for compliance with format requirements as soon as possible after receiving it. A proposal that does not adhere to all format specifications will be returned to the student without evaluation. The chair should provide written guidelines to the student describing why the proposal is being returned. The chair should also inform the student about the amount of time available for bringing the proposal into compliance with the format requirements. It is anticipated that most modifications needed to bring the proposal into



compliance can be completed in less than a week. This does not constitute the one permitted revision of the written proposal.

### Organization

The research description should contain the following subsections.

1. *Specific Aims*. An introductory paragraph should introduce the topic and provide a very brief background sufficient to place the specific aims in context. The specific aims should be listed, and the proposed experimental approaches briefly described. Suggested length is no longer than one page.
2. *Significance (background)*. This section should provide the reviewers and committee members with essential background information to allow them to understand the proposed experiments. This section is not a broad review of the field; it should instead be focused on providing information that will enhance the understanding of the proposed experiments.
3. *Approach*. This section should describe the proposed experiments, specifically the rationale, the methods to be used, and the likely outcomes and interpretations of the experiments. The experimental plan should be divided into sections that correspond to the specific aims. Students should keep in mind that applications for support from an F31 grant should propose a body of work that can be completed by a single person in a two-to-three-year period.
4. *A timetable* outlining what work will be done in each year of the proposal.

In general, the written proposal should provide experimental detail sufficient for the Qualifying Examination Committee members to understand the experimental approaches planned and possible limitations or concerns with using the planned approaches. The proposal should not contain excessive details of standard techniques and approaches. However, some experimental detail may be appropriate when the techniques and experimental approaches to be employed are novel or not widely used. Students should consult the Qualifying Examination Committee chair if they have questions about how much experimental detail to include. This section may also contain a *Preliminary Results* section since the topic may be based on dissertation research.

Suggested length for the paper is no longer than six pages for aims, significance, approach, and timeline. The members of the Qualifying Examination Committee will have up to four weeks to evaluate the written proposal but are encouraged to complete review as soon as possible and communicate their decision and critique via the committee chair to the student, which should be completed no later than a deadline in March. The Qualifying Examination Committee may either approve the proposal or may return the proposal to the student for revision.

The Qualifying Examination Committee should request a revision of the written proposal if the proposal contains significant flaws or if the committee believes that a substantially stronger proposal would result from revision. If the Qualifying Examination Committee requests revision of the written proposal, a written critique of the proposal should be prepared by the chair by combining the concerns and suggestions from individual committee members. These comments should be organized into *required*

*revisions* that must be incorporated into the proposal and *general comments* that do not need to be incorporated but may be grounds for questioning during the oral examination.

Members of the Qualifying Examination Committee should not individually communicate written critiques directly to the student. The chair of the committee will merge the individual critiques into one critique, provide committee members with the opportunity to read and comment upon the written critique, revise the critique, and forward the final critique to the student and advisor. The written critique should provide feedback to the student on specific areas where the proposal needs improvement.

The student is advised to discuss with the Qualifying Examination Committee chair how to address the concerns raised in the written critique. If the Qualifying Examination Committee feels that the written proposal is acceptable and does not need major revisions, individual committee members may communicate minor concerns to the student orally and may prepare a written critique if they so choose.

#### *Evaluation of the qualifying written exam proposal*

The criteria for evaluating the proposal are listed below.

- Does the proposal follow the stated guidelines for length and format? If not, the proposal should be returned to the student without review.
- Does the Introduction and Background section provide sufficient detail to understand and evaluate the proposed experiments?
- Is the rationale for each experiment clearly described?
- Is sufficient (but not excessive) detail on methodology provided?
- Are potential outcomes and interpretations of possible outcomes described?
- Have alternative approaches been considered if the method of choice does not work?
- Is the proposal written in a style appropriate for a research grant?
- Is the timetable for the work provided by the student realistic?

#### *Revision of the qualifying written exam proposal*

The amount of time available to the student for preparing and submitting a revised written proposal will be determined by the Qualifying Examination Committee, based on the amount of revision needed. This may be as short as three days if only minor revisions are required, and as long as three weeks if major revision is needed. The student is to prepare, in addition to their revised proposal, a response to the critique that is no longer than one page. Only one revision of the written proposal will be permitted.

The revised proposal, approved by the advisor, should be submitted to the Qualifying Examination Committee. Prior to the oral examination, the chair of the Qualifying Examination Committee should consult with the other committee members to determine whether there remain substantial deficiencies in the written proposal. If it is decided that these deficiencies can be addressed during the oral exam, the chair should inform the student in writing before the date of the oral examination and state briefly what the deficiencies are.

Alternatively, if the deficiencies are such that they would have returned the revised written report if it were the first submission, they may choose to fail the written examination. Approval or failure of the final written exam should be communicated to the student no later than one week after submission. If failure occurs, the QBS Advisory Committee will convene with members of the Qualifying Examination Committee to determine the next step. The student may be allowed to repeat the qualifying process a second and final time or may be dismissed from the program if warranted based on the student's cumulative body of work.

## The Qualifying oral examination

### *Scheduling the qualifying oral exam examination*

It is advised students begin plans to schedule their oral exam once their third committee member is chosen even if their defense will be remote. Arrangements should be made no later than approval of the first proposal submission. The student should schedule the oral examination and reserve a room with a wipe board for the oral examination, which should take place by May 1, or as soon thereafter as faculty schedules permit. If possible, a room and time should be scheduled a month in advance. A room and time for the oral qualifying examination should be reserved for at least four hours.

### *Format for the qualifying oral examination*

The student should prepare a brief presentation (no more than 10 minutes) of the background to the proposal, the aims and hypotheses to be tested. The student should consult their advisor and chair of the Qualifying Examination Committee for advice on preparation of the brief introductory presentation. The student may use no more than two overheads or slides and should provide copies of these to the Qualifying Examination Committee members in advance of the oral examination. Suggestions for the content of these slides may include an outline of their aims or research strategy or important graphs or figures that they may wish to address. *Students are not permitted to use additional slides for clarification.*

### *Guidelines to assist students in preparing for the qualifying oral examination*

The student should be familiar with the theoretical and factual background relevant to their proposal. All members of the Qualifying Examination Committee are free to ask questions broadly related to the proposal and to areas that constitute the background for the proposal. The student should be able to place the topic of their proposal in the context of the broad field of quantitative biomedical sciences. If the student has been informed by the Qualifying Examination Committee that a revised written proposal still has substantial deficiencies, the student should be prepared to address these during the oral examination.

Students should be conversant with the literature in the field(s) covered by their proposal, including those papers that deal with matters of general significance as well as those that relate directly to the proposed research. The Qualifying Examination Committee will expect the student to have an appreciation of the development of ideas (historical perspective) in this field and the potential role of current ideas in guiding the field in the future.

Students should be able to consider and generate alternative approaches and should be prepared to interpret hypothetical outcomes proposed by examiners.

Students should be thoroughly familiar with the technical aspects of their proposal. They should have a solid understanding of the approaches or techniques they propose to use. They should be aware of the advantages and limitations of these techniques. They should be prepared to defend why they have chosen a particular technique or approach rather than alternative ones that might be available.

The Qualifying Examination Committee may also test the following aspects of the student's background and ability.

- Is the student able to critically evaluate original scientific articles?
- Has the student designed experiments that address the specific aims and which aims have the potential to add new and useful information to the field of investigation?

The following describes the areas that will be evaluated during the oral examination.

#### 1. Introduction and Background

- Background knowledge in area of exam
- Familiarity with literature
- Historical perspective
- General knowledge of the basics of quantitative biomedical sciences, as covered in the core competency courses
- Ability to evaluate the literature critically

#### 2. Specific Aims

- Are the proposed experiments appropriate to answer the proposed question?
- Does the student have a theoretical and technical understanding of the approaches proposed?
- Will the results be interpretable?
- Will the results add new and useful information to the field of investigation?

#### 3. General

- Can the student answer questions that require the inclusion of new or additional information?
- Can the student incorporate information into a working model?
- Can the student propose alternative approaches in cases where the proposed approaches do not provide the information needed?

#### Final evaluation of the qualifying examination

Following the oral examination, Qualifying Examination Committee members evaluate the student's overall performance, considering both the written and oral portions of the examination. The committee should attempt to reach a consensus on the outcome of the exam, but if this is not possible, the three committee members will vote, and the vote of the majority will determine the outcome of the

examination. The only possible outcomes for the qualifying exam are *Pass*, *Conditional Pass*, and *Fail*. A Conditional Pass (a pass with conditions to remedy deficiencies) is permitted only after the first attempt at the oral exam.

The student will be informed whether they have passed the exam at this time; the chair of the Qualifying Examination Committee will summarize the strengths and weaknesses of the oral exam. If the student fails the exam, the chair will prepare a consensus written summary clearly enumerating the reasons for the failure. If the student passes the oral exam, no detailed written summary of the exam is required. If the student receives a Conditional Pass, the Qualifying Examination Committee may ask them to remedy deficiencies in a written document up to five pages or to redefend a specific topic of their oral exam. In both instances, this must be accomplished *no later than one month* after the oral exam.

Should the student fail after an attempt to remedy their Conditional Pass, this is considered a *first* failed attempt and the student will be given a chance to redefend in *no later than one month*. Following the oral examination, the student and Qualifying Examination Committee chair should sign the qualifying examination report and the student must submit it, along with their written proposal, to the QBS Director of Academic and Student Affairs. For Conditional Passes, this is signed when they have addressed their deficiencies as recommended by the Qualifying Examination Committee.

#### *Repeating the qualifying oral examination*

If the student fails the oral examination or their subsequent Conditional Pass, the student will have one opportunity to repeat the oral examination. The second administration of the oral defense must occur *no later than one month after the first oral examination*. If the examination is not repeated within the one-month period, or if a second failure occurs, the student will not be advanced to candidacy for the PhD degree and normally will be unable to remain in the PhD program. However, the situation will be reviewed by the QBS Advisory Committee in which the student and advisor may provide a written statement addressing circumstances that may have warranted a failure.

Recognizing extenuating circumstances, the Advisory Committee may allow the student to repeat their examination, and will determine the appropriate timeline in which to do so. Otherwise, if it is determined appropriate upon review by the QBS Advisory Committee in consultation with the Qualifying Examination Committee, the student may opt to leave the program with a Master's degree if the appropriate coursework is completed. The final determination for this will be subject to review by the QBS Advisory Committee.

#### *After passing the qualifying oral examination*

Once a student has passed the qualifying examination and advanced to candidacy, the student will continue to be graded on research performance in the laboratory by their advisor at the end of each quarter, on a Credit (CT) or No Credit (NC) scale. If the advisor feels a grade of NC is warranted, the advisor must present the details of the student's performance to QBS leadership and administration. Grades of NC for graduate research received after a student has been promoted to candidacy will be treated the same as similar grades received for research rotations or course work. A grade of NC for

research will result in the student being put on probation and may result in dismissal from the program if this causes any of the provisions previously listed in this handbook to be met.

#### *Expectations for dissertation research work during qualifying exam*

Prior to submission of the topic and specific aims, students are expected to maintain full presence in the lab, teaching, and coursework. It is not acceptable, for example, to be absent from the expected amount of time in lab for weeks or months for the purpose of generating the aims for the qualifying examination. Students are encouraged to begin the discussions and background reading needed to select a topic early in their second year of study. Once the topic and aims are approved, students have four weeks to prepare and submit the written proposal.

Prior to writing their proposal, students are expected to discuss their research schedule with their advisor, since it is understood that writing the qualifying examination will take a considerable amount of time and effort. During the weeks prior to the oral exam, the expectation for lab presence is reduced. During this time, students should maintain some presence in the lab as communicated with their advisor and must continue to fulfill coursework and teaching obligations. Departures from the timeline for the qualifying examination specified here require the prior approval of the QBS Director and administration.

#### **Dissertation and dissertation defense**

For the PhD degree, the student shall show competence in original research and shall prepare a doctoral dissertation containing the results of their independent studies. The dissertation should present a coherent investigation of an original scientific research question at a level of rigor suitable for publication in a peer-reviewed academic journal. It should also include a thorough and critical analysis of the published literature in the field and of the methodological and theoretical background of the work.

As students begin preparation for the dissertation defense, they must contact the QBS administration. This is essential to help ensure that the student and program work together to follow all graduate school policies so that the student will be able to graduate on their projected date. Administration can aid in organizing the time and location of their dissertation defense seminar, private examination, and distribution of public seminar notices if their outside examiner plans to host one. They may also aid in events surrounding their defense, such as celebrations or lunches, but QBS is not responsible for funding these events. Should the defense need to be remote, additional information regarding this format will be provided by the administration.

Students are advised to visit the [Graduate Studies website](#) for information about [dissertation preparation and formatting guidelines](#).

Before beginning to prepare the final written dissertation and scheduling a defense date, the student must obtain formal approval from the Dissertation Committee either on their latest signed dissertation progress report or in a separate signed document stating their approval of the timeline to their proposed defense date. This is to be submitted to QBS administration.

After the student has made satisfactory progress in their research following the qualifying exam, the dissertation advisor in conjunction with the student will assemble a Dissertation Exam Committee. The

Dissertation Exam Committee will consist of at least full-time Dartmouth faculty members, of which at least two must be from the QBS program. In the situation where both the advisor and co-advisor are Dartmouth faculty there must be one additional QBS faculty member. The student must also secure an external member with a faculty-equivalent research appointment outside of Dartmouth. The external member may participate in meetings in person or via videoconference and must be present for the dissertation defense either in person or via videoconference. The Dissertation Exam Committee will usually be the student's Dissertation Committee plus the fourth external member.

Additional members of the Dissertation Committee that are external to Dartmouth can serve on the Dissertation Exam Committee only with the approval of the Graduate Studies office. It is imperative that the student informs the Graduate Studies office in sufficient time to allow for approval of the composition of the Dissertation Exam Committee. The student's advisor and the QBS Director will sign the [PhD Examination Committee Approval form](#) and submit this to the QBS administration along with the expected date of defense.

Students must give each member of the Dissertation Exam Committee a copy of the dissertation at least two weeks before the date scheduled for the defense. Final copies of the written and signed dissertation must be submitted to the Graduate Studies office by the [deadlines](#) to participate in select yearly graduation dates. Therefore, it is recommended that the oral defense be scheduled at least two weeks prior to this date to allow time for the appropriate revisions to be made prior to submission. Students planning to participate in the Investiture Ceremony and Dartmouth June graduation exercises should be aware of the date assigned by the Graduate Studies office regarding the submission of the dissertation. Typically, these deadlines occur during the month of May. It is each student's responsibility to meet these deadlines to participate in commencement.

If any member of the Dissertation Exam Committee finds that the submitted dissertation is inadequate, that member must immediately communicate their concerns to the dissertation advisor and the other members of the Dissertation Exam Committee, who may opt to cancel the dissertation defense up to 48 hours before the scheduled time of the defense. Concerns from the outside examiner must be communicated up to 72 hours prior to the scheduled defense to allow the committee time to meet the 48-hour deadline.

Following a publicly announced and delivered seminar on the dissertation material, the doctoral candidate will defend the dissertation before the Dissertation Exam Committee. The dissertation advisor is responsible for promptly notifying the QBS administration of the outcome of the defense. Should this committee find the dissertation itself or the student's understanding of the dissertation subject area insufficient for the conferral of the PhD degree, the student shall be informed of the deficiencies and the areas that require modification. The dissertation may be revised, and the dissertation defense may be repeated once, and insofar as possible, the composition of the Dissertation Exam Committee shall remain unchanged. The Dissertation Exam Committee will determine an appropriate deadline for the revised dissertation to be submitted. If a student fails to satisfy the concerns of the Dissertation Exam Committee after a second attempt, the student will be immediately separated from the program.

The student dissertation can be approved provisionally, pending corrections and minor modifications recommended by the Dissertation Exam Committee. Normally, the student's advisor will monitor these changes, and upon satisfactory completion of the recommended changes permit the student to submit the finalized dissertation to the Graduate Studies office.

Upon successful completion of the private oral defense, the committee must sign the cover page of the dissertation, printed on Dartmouth bond paper available through the QBS administration office or otherwise advised for remote situations. It is recommended that the student print at least five copies of this cover page to be signed by all members.

Students may print their final dissertation on Dartmouth bond paper in the QBS administration office. Contact QBS administration regarding binding and securing additional copies of the dissertation.

Finally, a degree certification form, stating that the student has completed all program requirements, is completed by the graduating student and signed by the QBS Director. This must be submitted to the Graduate Studies office prior to graduation. This is available through the QBS administration.



## Appendix

### Teaching assistant positions

In the Spring quarter of their first year, PhD students will be asked to rank their top three choices of courses to TA. After consulting with faculty, students will be assigned to TA a course by the QBS administration. To be eligible to TA a class, a student must have completed that course with a grade of CT, HP, or P, unless otherwise approved by the instructor, or have taken a similar course that provides them with sufficient background to TA the course. Students will register for QBS 196 prior to the quarter in which they are assigned to TA. A grade of CT or NC will be assigned at the end of the quarter in which they are a TA.

TAs should be in contact with the instructor regarding specific TA requirements for the course. Communication with the course instructor is important, and it is recommended that students and instructors be in communication in the weeks prior to class regarding preparation and expectations. If at any time a student feels as though they are being asked to perform duties beyond the scope of the responsibilities listed below or has concerns, they need to contact the QBS administration.

Opportunities are available for students wishing to participate in more than one quarter of teaching. This requires that adequate teaching positions are available to accommodate interested students and that their advisor agrees. Contact the QBS administration for additional details if interested.

Typically, TAs are expected to begin their duties no more than one week prior to the start of a course, and they need to be available until the final grades are submitted, normally one week after the exam period. If because of illness or other legitimate reasons students are unable to meet their teaching obligations in each quarter, they should inform the instructors and QBS administration so that adequate replacements can be found.

### TA responsibilities and expectations

1. Hold regular and consistent office hours.
  - It is recommended TAs poll students as to when they are generally available.
  - It is strongly suggested TAs do not use personal lab space or office for office hours. If a student would like to arrange a consistent space, they should contact QBS administration.
  - TAs should discuss with the course instructor what the appropriate types of questions are to address during office hours. TAs should be able to ask students who have made no attempt at a problem, come unprepared, or come seeking general information that they are capable of obtaining on their own, to return when they have made their best efforts to achieve a solution.
2. Manage the course Canvas site.
3. Grade exams and homework.
  - Solutions are to be provided by the instructor.
  - All final grades are to be reviewed by the instructor.
  - Grade grievances should be addressed by the instructor.

4. TAs are not expected to prepare or deliver lectures or design course material unless mutually agreed upon with the instructor.
5. TAs do not need to be present all lectures unless the instructors provide a valid reason for certain lectures they wish TAs to attend.
6. TAs should provide timely responses to students. Availability to students outside of office hours is at their own discretion.
7. Teamwork is an essential element as most courses will have two or more TAs.
8. Plan to have regularly scheduled meetings with the instructor to keep open communications about expectations, obtain feedback, and address any concerns or questions.
9. Instructors have been asked to provide their TAs with constructive feedback about their performance, and any student feedback that was provided on evaluations at the end of the course. TAs should follow up with their instructors to obtain their evaluations.
10. The expected weekly commitment to a course is 10 to 12 hours per week.
11. TAs for courses that are remote, or on campus with remote components, should discuss expectations with the course instructor.

### QBS faculty

Being a member of the QBS faculty carries responsibilities such as attending program seminars, participating in QBS sponsored events, taking QBS students for research rotations, supervising dissertation students, service on program committees, and helping with recruit interviews during our recruiting season.

### Becoming QBS faculty

Members of the Dartmouth community who wish to become QBS faculty must submit their Biosketch and CV and a letter of intent to the QBS administration stating why they would like to join and why they would be a good fit for the QBS program. This information is distributed to the QBS Advisory Committee who must provide a majority affirmative vote for this individual to join the QBS program.

### Rotation and dissertation students

QBS faculty join the program with the intent to sponsor rotation and dissertation students. It is recognized that this may be dependent on funding in a given academic year. When taking a rotation student, it should be made clear that the faculty member has the appropriate research grant funds or departmental resources at their disposal to fund the costs of the rotation, and at least three years of funding to support a student stipend and dissertation research. QBS administration will solicit information from each faculty member in the program regarding their interests in sponsoring rotation students and be guided by this input when assigning rotations. Faculty should expect the typical length of PhD candidacy to be at least five years. Should funding hardships be encountered after the sixth year of study, the situation is to be brought to the attention of the QBS Director and administration for review.

QBS faculty are expected to attend the following.

- RIP presentations of their own students, as well as those of students whose dissertation committee they are serving on.
- Qualifying and dissertation defenses presentations of their own students, as well as those of students whose qualifying or dissertation committee they serve on.
- Diversity and Equity training and other training that may be mandated by the QBS program.

### Committees

Faculty are expected to serve on QBS qualifying and QBS dissertation committees if their area of expertise is appropriate to do so. QBS faculty may also be approached by the chairs of their respective departments to serve on the QBS Advisory Committee. Faculty are also expected to serve as ad hoc members on admissions committees.

### Other responsibilities

- Participation in the QBS interview process: Interviewing students, providing evaluations, and attending social events
- Attending and participating in the QBS retreat and other yearly QBS community seminars, outreach, and social events

### QBS administration

QBS is overseen by the Director of the program, the Associate Director, and the QBS Advisory Committee, each position lasting for a two-year term. The QBS Director and administrative team oversee the daily activities of the program. The QBS Associate Director is second in command and petitions the Advisory Committee for election to the position. If elected, the Associate Director serves a term of two years, after which they assume the position of QBS Director. The election of the Associate Director is determined by a majority vote of the Advisory Committee. The Associate Director is effectively the director-in-training and holds distinct and shared responsibilities that aid the QBS Director and administration of the program.

### Advisory Committee

The Advisory Committee consists of seven members, two from each of the represented disciplines (Bioinformatics, Biostatistics, and Epidemiology), appointed with voting privileges by their respective department chairs. The QBS Director is the seventh member serving as the chair of the Advisory Committee, in an officiating, nonvoting role. The QBS Director will cast the deciding vote in cases of a tie or plurality vote. The Associate Director remains one of the six voting members of the Advisory Committee. The term for all Advisory Committee members is a minimum of two years. In the absence of the Director, the Associate Director will assume authority of the Advisory Committee and programmatic matters as they arise.

Intention to resign from the committee, except under unexpected personal or professional circumstances, must be expressed to the committee and their respective department chair at least two months in advance such that a suitable replacement can be found. The Advisory Committee meets at least twice per year at approximately six-month intervals or as needed. Decisions regarding major programmatic issues are put to a vote and implemented by the Director, Associate Director, program

administration, and QBS faculty where appropriate. For routine decisions, the Director and Associate Director will act in their best judgment. The QBS Advisory Committee members also serve on PhD and Master's degree admission committees in conjunction with selected QBS PhD student representatives and chair-approved ad hoc members appointed as needed.

### QBS Curriculum Committees

The QBS Curriculum Committee chairs are selected from the QBS Advisory Committee, and committee composition is established by discipline and specific departments: Epidemiology, Biomedical Data Science, and Bioinformatics. The primary responsibility of each Curriculum Committee is to oversee the quality of QBS courses. They evaluate the content and sequence of the QBS PhD and Master's program curriculum and suggest appropriate modifications to department chairs and the QBS Advisory Committee.

All QBS courses that have four or more students registered are provided course and instructor feedback through student course evaluations in Banner at the end of each quarter. Feedback is reviewed by the Director of Academic and Student Affairs, the QBS Director, and QBS Curriculum Committee chairs quarterly. Students may also express concerns about a course to the QBS administration and leadership at any time during the quarter. The Curriculum Committee chairs discuss feedback from courses with course directors after review.

When a concern is raised about a course's quality by the QBS Curriculum Committee chair, QBS leadership, or members of the QBS Curriculum Committee, the chair and the committee will provide support to the course director and department chair in creating an action plan for course improvement. The Curriculum Committee and department chairs are responsible for evaluating whether the concerns have been sufficiently addressed after the next offering of the course. Curriculum Committees may also identify scientific gaps and market competitiveness, and review syllabi, sample lecture slides, and homework assignments from each course when it is first offered by an instructor or substantially modified.

### CT/NC courses

- QBS 110 Integrative Biomedical Sciences Seminar
- QBS 110.5 Integrative Biomedical Sciences Seminar Project
- QBS 187 QBS PhD Student Internship
- QBS 193 Independent Journal Club
- QBS 194 Biostatistics Journal Club
- QBS 196 Supervised Teaching in QBS
- QBS 197 Graduate Research in Quantitative Biomedical Sciences I
- QBS 198 Graduate Research in Quantitative Biomedical Sciences II
- QBS 199 Graduate Research in Quantitative Biomedical Sciences III
- QBS 270 Quantitative Biomedical Sciences Journal Club
- QBS 271 Advanced Epidemiology Journal Club
- QBS 297 Advanced Graduate Research in Quantitative Biomedical Sciences I

- QBS 298 Advanced Graduate Research in Quantitative Biomedical Sciences II
- QBS 299 Advanced Graduate Research in Quantitative Biomedical Sciences III
- QBS 700 Responsible and Ethical Conduct of Research