

Handbook for Students and Advisors

in the

MIT/WHOI Joint Program in  
Biological Oceanography

Prepared by the  
Joint Committee on Biological Oceanography  
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# Contents

<b>1 Introduction</b>	<b>2</b>
1.1 To the Student .....	2
1.2 To the Advisor .....	3
<b>2 General Information and Milestones</b>	<b>4</b>
<b>3 Committees</b>	<b>6</b>
3.1 Joint Committee for Biological Oceanography .....	6
3.2 Academic Advisory Committee .....	6
3.3 Thesis Committee .....	7
<b>4 Curricular Requirements</b>	<b>7</b>
4.1 Topics Courses .....	8
4.2 Scheduling & Course Load .....	9
4.3 Grades .....	9
4.4 Curriculum Design and Modifications .....	9
<b>5 The General Exam</b>	<b>10</b>
5.1 The Research Report.....	10
5.2 The Thesis Proposal Defense.....	11
5.2.1 The Thesis Proposal.....	12
5.2.2 The Thesis Proposal Defense.....	12
5.3 Evaluation.....	13
<b>6 The Doctoral Thesis and Defense</b>	<b>14</b>
6.1 The Thesis.....	14
6.2 The Thesis Defense.....	15
<b>7 Masters Degrees</b>	<b>15</b>
<b>8 Dismissal of a Student from the Program</b>	<b>16</b>
<b>9 Finances and Student Support</b>	<b>16</b>
<b>10 Memos and Petitions</b>	<b>18</b>
<b>11 Students with Disabilities</b>	<b>18</b>
<b>12 Who's Who?</b>	<b>20</b>
<b>Appendices</b>	
<b>A Student Progress Checklist</b>	<b>22</b>
<b>B Interdisciplinary Studies</b>	<b>25</b>
<b>C A checklist for completing the Ph. D.</b>	<b>26</b>
<b>D Responsibilities for Students and Advisors</b>	<b>27</b>
<b>E Curricular Tracks</b>	<b>29</b>

# 1 Introduction

## 1.1 To the Student

Welcome to the Joint Program in Biological Oceanography. In 1968 the Woods Hole Oceanographic Institution (WHOI) and the Massachusetts Institute of Technology (MIT) entered into an agreement to conduct a cooperative academic program leading to graduate degrees in oceanography and ocean engineering. Jointly constituted committees make all decisions of substance in the program from admissions to degree granting. The joint degrees awarded are single documents issued by both institutions. The Joint Program in Biological Oceanography offers a unique opportunity for training and research in areas that combine observational, experimental, and theoretical approaches to the study of biological systems. As a graduate student you have access to the facilities and expertise at both WHOI and at MIT.

You have a number of responsibilities during your graduate education that both satisfy the requirements for the degree and make the process easier for all concerned. It is essential that you and your advisor establish a good working relationship to ensure steady progress throughout the program. A summary schedule for the program and list of pertinent deadlines are included in Appendix A. You and your advisor may want to meet annually to review this list, as well as the material in Appendix D, which lists the Academic Program Office's expectations of both students and advisors.

The MIT/WHOI Joint Program's goal is for all students to achieve their full intellectual potential in their chosen area of study and research, either within the more traditional disciplines of ocean sciences and engineering or within interdisciplinary studies incorporating two or more disciplines (Appendix B). During the next five years we expect that you will fulfill the following requirements for the Ph.D. degree:

1. complete required coursework at MIT and WHOI,
2. acquire general knowledge of biology and oceanography as assessed by your Ph.D. committee,
3. pass the general exam, consisting of a written research report and a thesis proposal defense.
4. participate in at least one oceanographic cruise
5. present at least one departmental seminar in addition to the thesis defense, and
6. successfully complete and defend a thesis based on original and independent research.

## 1.2 To the Advisor

This handbook provides a framework for your supervision of graduate students in the MIT/WHOI Joint Program. It contains guidelines and suggestions for how best to serve as an advisor. A strong advisor-student relationship is central to the successful education of the student and to his or her long-term development as a productive scientist. As advisor, you bear the substantial responsibility to build a relationship that ensures success of the student in graduate school and beyond. Through interactions primarily with you, the student will gain a thorough knowledge of a specific scientific area. The student will learn from you how to identify important and tractable research problems in that area, and will develop an understanding of the research strategies and technical approaches for solving those problems. You will need to guide the student's development of knowledge in these areas, as well as actively foster growth of the student's skill in the acquisition and interpretation of research results, and in the recognition of scientific quality and rigor. As an advisor, you should make clear your expectations for progress toward the Ph.D. degree, for interactions with other scientists (e. g., via attendance and presentations at scientific meetings), and for publications and postdoctoral employment.

Each advisor-student relationship is unique. Students enter the Joint Program at different levels of academic training and personal maturity. Consequently, as an advisor you will need to work flexibly and perhaps quite differently with each student you supervise to provide the level and form of guidance appropriate for that student. Also, the nature of your guidance undoubtedly will change as the student develops intellectual and technical independence during graduate studies. Certainly, your top priority at all times is to provide to the student the highest quality science training. How you accomplish this is, to a large extent, up to you as the advisor. One vital aspect is that you communicate to the student a clear understanding of what students need to do to successfully progress in their research in the Joint Program and later as independent scientists. These efforts can take the form of periodic discussions with the student (on a semester or more frequent basis) about the requirements outlined in this Handbook, as well as more frequent meetings (perhaps on a weekly basis) to review the student's progress.

In most cases, your students will maintain normal progress toward their degrees without serious difficulty. Occasionally, however, a student's progress and performance may not meet reasonable expectations. You should be attentive to potential problems, especially early in the student's program when solving these problems can have the most beneficial effect on the student's professional development. Serious problems can usually be prevented by timely, consistent, and supportive advising on your part, with good communication of your expectations and standards. Sometimes a change in advisors is the appropriate solution for students having difficulty, and you or the student can propose this option. The Education Coordinator, members of the Joint Committee for Biological Oceanography (JCBO), members of the student's thesis committee, other faculty, the MIT Director of the Joint Program, and the WHOI Academic Programs

Office can all provide perspective, advice, and assistance if difficulties for a student arise that seem hard to resolve within the advisor-student relationship. On rare occasions the JCBO may conclude that the student has made insufficient progress to remain in the program.

## **2 General Information and Milestones**

### **Upon Arrival**

Students should go to the Academic Programs Office upon arrival in Woods Hole or to the MIT Joint Program Office if arriving directly at MIT. The staff in these offices will assist students with getting settled and officially registered. Students and advisors should then meet to arrange what the student will be doing next. Students arriving in Woods Hole during the summer months will have the opportunity to:

1. undertake or assist in a research project in advisors' labs or fieldwork,
2. attend orientation lectures (e. g. Summer Student Fellow Seminars, Biology Department Seminars) given to acquaint new and summer students with ongoing research at WHOI,
3. attend lectures and seminars at the Marine Biological Laboratory, and

As soon as possible, and before the annual August review, the student and advisor should also **set up and meet with an Academic Advisory Committee** (Sec. 3.2). At this first meeting the student and the Committee should develop a schedule of coursework, consistent with the curricular requirements found later in this Handbook (see Sec. 4), that the student will plan on completing during the first two years in the program. The plan will be presented for approval by the student to JCBO during its annual August Student Progress Review.

### **Year 1**

A student's first year in the program is primarily spent taking courses (see Sec. 4) both at MIT and at WHOI. Many students have found it convenient to live in Cambridge during their first year in the program to facilitate taking courses at MIT. Students should keep in touch with their advisors and members of their Academic Advisory Committees, especially if they are having any difficulty in courses or adjusting to life as a graduate student. WHOI Biology Department Seminars are presented on Thursdays at noon; this is an excellent opportunity to be in Woods Hole on occasion during the first year. The Independent Activities Period (IAP) during January is also an ideal time to be in Woods Hole to continue research, library work, and involvement in the Woods Hole community.

During the summer, students will begin or continue preliminary work on their

thesis research (in particular the research around which the Research Report will be based) and continue to review the relevant scientific literature.

By the end of the first year, the student and advisor should have recruited a member of the JP Faculty to serve as the Chair of the student's General Exam.

## **Year 2**

By the time a student begins the second year in the program, ideas for a research program should be better defined and a research project should have begun in the laboratory of the supervisor. Students and advisors should begin to identify potential Thesis Committee members (Sec. 3.3) who can advise on additional coursework and assist in the development of the thesis proposal. Members of the Academic Advisory Committee may become members of the Thesis Committee, or different individuals may be chosen.

The second half of the second year is a critical time in a student's path through the Joint Program in Biological Oceanography. It is during the second year that students should complete all of the parts of the General Exam. The exam is designed to test skills that are essential for the successful completion of a Ph.D. By the end of IAP, students should have completed the Research Report component of their General Exam (Sec. 5.1). By the end of the Spring semester of their second year, students should have formed a Thesis Committee (Sec. 3.3) and should have defended their Thesis Proposal (Sec. 5.2). As the student's thesis proposal develops, he or she should consult with all members of the Thesis Committee on the questions to be addressed, experimental protocols, and other details pertinent to the research. Different committee members may have different views on aspects of the proposed research. It is up to the student (with assistance of the advisor) to synthesize their input and incorporate it into the final draft of the thesis proposal.

## **Years 3 and 4**

During their third year, students should continue taking any necessary courses and electives (including, e. g., Topics Courses, Sec. 4.1), and become fully engaged in their thesis research. It is extremely important that the student and advisor, with input from other Thesis Committee members, plan the research program to ensure steady progress towards meeting research objectives. As a research scientist, the student will also be expected to present departmental seminars (at least one before the end of his or her fourth year as a graduate student), attend and present papers at professional meetings, and prepare manuscripts from the results of thesis research. The ultimate goal is to complete an original piece of research that the student and the Thesis Committee agree is deserving of the Ph. D. degree.

## **Year 5**

It is the expectation of JCBO that students will complete the requirements for a Ph. D. by the end of their fifth year in the program. During this year the student should

be focused on the final analyses and writing of the Thesis and on preparing for the Thesis Defense (Sec. 6). At this point, students and their advisors should also be discussing career plans and making preparations for the student's next job.

### **3 Committees**

Students and advisors will interact principally with three committees as the student proceeds towards his or her degree: the Joint Committee on Biological Oceanography, the Academic Advisory Committee, and the Thesis Committee. Students are encouraged to ask the Education Coordinator to attend committee meetings throughout their time in the Joint Program. This is especially important for the first meetings of the Academic Advisory Committee and the Thesis Committee. Logistics for committee meetings (room reservation, contacting committee members, drafting an agenda, etc.) are generally the responsibility of the student.

#### **3.1 Joint Committee for Biological Oceanography**

The Joint Committee for Biological Oceanography (JCBO) is responsible for the oversight of all academic aspects of the Joint Program in Biological Oceanography. These responsibilities include recommendations for admissions; annual reviews of academic progress of students; approval by the committee or committee chair of the thesis advisors, thesis committees, and chairs of thesis defenses; approval of the final thesis by the Chair of JCBO on behalf of the committee; and advice about all matters of the Joint Program, particularly in Biological Oceanography, to the Co-Chairs of The MIT/WHOI Joint Program Committee.

The members of JCBO are appointed from the faculty at MIT and the WHOI Scientific Staff in the various departments at MIT and WHOI participating in the MIT/WHOI Joint Program. Appointments are by the Director of the Joint Program at MIT upon recommendation of the Department Head for faculty from appropriate MIT department(s), and by the Vice President for Academic Programs and Dean at WHOI for members of WHOI Education Assembly, upon the recommendation of the Chair of the appropriate WHOI Department(s).

#### **3.2 Academic Advisory Committee**

The Academic Advisory Committee helps the student construct an individualized curriculum that will not only prepare her or him for their thesis research but also provide a solid foundation for a career path. In addition, the AAC has the primary responsibility for evaluating the students Research Report, which is part of the General Exam.

The Academic Advisory Committee is comprised of the student's primary advisor and two other members of the Joint Program Faculty. With guidance from their

advisors, students should form their Advisory Committees during the summer before their first year. The Advisory Committee must have at least one person from MIT and one from WHOI. Students should notify the Chair of JCBO and the Education Coordinator of the members of their Advisory Committee. Given the increased role that the AAC plays in evaluating the student's progress towards candidacy, the student is strongly encouraged to meet with the members of their AAC, individually or as a group, in the fall semester of their first and second years.

### **3.3 Thesis Committee**

The responsibilities of the student's Thesis Committee pick up where those of the AAC leave off. The Thesis Committee works with the student and the advisor to design a thesis project that can be completed within the expected 5-year time frame for obtaining a Ph.D. in the Joint Program. The Committee helps to keep the student on track to meet this deadline. In addition, they administer the thesis proposal defense and the thesis defense. Frequent (at least semiannual) meetings with the Thesis Committee are encouraged.

Members of the Thesis Committee should be selected in consultation with the student's advisor. The Committee should have at least four members, including at least one from MIT and one from WHOI. Many thesis committees have five or six members. The MIT member may be from any department. The MIT members of JCBO can assist the student in identifying appropriate MIT faculty to serve on committees.

Scientists from disciplines other than biology or from institutions other than WHOI and MIT may also serve as members of thesis committees. The composition of the committee should reflect the best team available to guide the student in the thesis research, but students should be cautioned that faculty from distant locations may only be able to participate on a very limited basis. The Joint Program will [reimburse travel](#) for outside committee members only for the Thesis Proposal Defense and final Thesis Defense. Outside members can participate in committee meetings via videoconference if necessary. Approval of the Dean is required for a committee with more than 2 outside members. A proposed committee should be submitted to JCBO for approval as soon as is practical after completion of the Research Report portion of the General Exam. Any subsequent changes in membership of the thesis committee must be approved by JCBO.

## **4 Curricular Requirements**

All students are required to submit a proposed course of study to JCBO for approval before the beginning of their first semester. Students should construct their course plans in consultation with their AAC. JCBO will meet with students to approve the first two years courses at the annual student progress review in August. Each course of study should include the following:



1. course number 7.470, *Biological Oceanography*, during the first Spring semester;
2. course number 7.410, *Applied Statistics*, during the first Spring semester;
3. at least 24 additional units of graduate-level oceanography or marine science courses (see below); and
4. no less than 96 units of non-research courses within the five years expected to complete the Ph.D. degree.

The 24 additional units of oceanography or marine science courses are broadly defined. Additional courses may be approved through petition to JCBO. Up to 12 of the 24 units may come from *Topics Courses* (see section 4.1).

It is strongly recommended that students take at least 96 units in science, mathematics and/or engineering. Students are also encouraged to exceed the minimum of 96 units and incorporate complementary topics into their training. These may include, but are not limited to science communication, teaching, scientific writing, science policy, and other science electives.

#### **4.1 Topics Courses**

Students are encouraged to include Topics Courses among their non-research course credits. Topics Courses are advanced courses in specific areas of biological oceanography. They are 1.5 h/wk lecture and discussion courses on fairly specific topics, and they frequently involve reading the primary scientific literature. Assignments may include oral presentations, term papers, or homework sets. Topics Course offerings will be different each semester.

Depending on what is offered, students may at times take a course within their general fields of study (e. g., phytoplankton biology, animal behavior, etc.), adding depth to knowledge of their specialty. At other times they will take courses in topics outside their general fields, adding breadth to their understanding of biological oceanography as a whole. Participation in the Topics Courses also strengthens scholarly interaction among students and faculty in the department. Students interested in a particular subject are encouraged to request faculty to offer a Topics Course in that area. Topics Courses are not intended to provide highly specialized training appropriate only to individual thesis projects.

Students in residence at MIT are encouraged to take as many WHOI Topics Courses as possible, but may also choose to enroll in comparable advanced seminar courses at MIT or Harvard.

The following general Topics courses are offered, but specific courses and topics will change from semester to semester. Topics courses may be repeated for credit with

permission of the instructor.

*Topics in Quantitative Marine Science*  
*Topics in Marine Ecology*  
*Topics in Marine Physiology and Biochemistry*  
*Topics in Biological Oceanography*  
*Topics in Zooplankton Biology*  
*Topics in Benthic Biology*  
*Topics in Phytoplankton Biology*  
*Topics in Molecular Biological Oceanography*  
*Topics in the Behavior of Marine Animals*  
*Topics in Marine Microbiology*

## **4.2 Scheduling & Course Load**

Students should expect to fulfill their Biological Oceanography and Applied Statistics requirements during the spring semester of their first year. Exceptions to this schedule must be approved by JCBO. Students should register for a minimum of 36 units for fall and spring semesters; a typical course load for the first year is three or four courses per semester (approximately 36–48 units). Students should plan to complete the core coursework needed for a solid foundation in their area of research by the end of their second year in the program, by which time they should have completed the Thesis Proposal Defense.

## **4.3 Grades**

Students are expected to achieve a grade of B- or higher in each of their courses. A student who does not earn a grade of B- or better in course 7.47, *Biological Oceanography*, will be considered as not making satisfactory progress in the graduate program. Receipt of a lower grade in as many as two other courses is allowable (course credit will be granted), but receipt of more than two low grades is cause for serious concern and could lead to a Dean's Warning as well as possible termination in the program. JCBO will evaluate poor grades on an individual basis and will make recommendations as appropriate.

## **4.4 Curriculum Design and Modification**

Students develop individualized curricula in consultation with the AAC and with the approval of JCBO. All parties recognize the importance of flexibility in curriculum design especially for students interested in interdisciplinary studies (Appendix B).

Students are encouraged to discuss curriculum changes that they feel are appropriate, first with their advisors and Academic Advisory Committees, and then with representatives of JCBO, when planning coursework. Changes to a student's curriculum

must be approved by JCBO, and students who wish to change their curricula must make a written request to the JCBO Chair, with a copy to the Education Coordinator, giving the reasons for the change and accompanied by a supporting memo from the advisor. Whenever possible, requests for curriculum changes should be made at least two weeks prior to the semester in question. JCBO will review each student's progress towards completing their approved curriculum at the annual review of student progress in August.

## **5 The General Exam**

The purpose of the General Exam is to determine whether the student is ready to begin Ph.D.-level thesis research. The exam is designed to test the student's general scientific knowledge as well as topics specific to the proposed research area. The exam consists of two parts: a written report on a research project (the *Research Report*), and a written *Thesis Proposal* that the student defends orally.

At the end of their first year, the student and advisor should find a JP Faculty member who will agree to serve as the Chair of the student's General Exam. Exam chairs can be a member of the student's AAC and/or thesis committee, or they can be from outside either of those groups. The exam chair is expected to participate in both parts of the exam in order to provide a summary memo of the process for JCBO. The student should notify the Chair of JCBO and the Education Coordinator of their choice.

### **5.1 The Research Report**

In the Research Report, the student should summarize a research project that they have undertaken at some point during their first 1.5 years in the program. It should be written in the form of a short scientific paper. The report should not exceed 20 double-spaced pages, including tables and figures.

JCBO recognizes that much pre-thesis research is exploratory in nature and takes place over a short time period. For these reasons, it is not expected that the Research Report will be ready for submission to a journal for publication; rather, it is to be a research paper of high quality that demonstrates the student's ability to conduct research and present the results. It is expected that the Research Report will present the results of a collaborative effort by the student and the scientist in whose lab the research took place. However, it is important that the Report represent the work of the student. For that reason, the advisor's input into the final product is to be limited in the following way. The student will prepare a draft of the Report, which will be given to the advisor for review. Upon receiving the advisor's comments on the first draft, the student will complete the Report independently.

The student must complete the Research Report by the end of the IAP of the student's second year (typically at the end of January). Copies of the final version of the Report should be provided to the Chair of the student's General Exam, the student's

AAC, the Chair of JCBO, the Education Coordinator, and the registrar in the Academic Programs Office.

Because of the wide variety of research areas and approaches taken by the faculty and students in our program, JCBO expects variety in the nature of the Reports as well. For that reason, they will rely on the student's AAC and General Exam Chair to evaluate the Report. JCBO suggests that the AACs ask themselves the following questions when evaluating a Research Report:

1. Has the student asked a well-defined and reasonably interesting question?
2. Has the student clearly described how the research would complement previous research?
3. Has the student (with guidance from his or her advisor) approached the question in a reasonable way?
4. Has the student described clearly what they did, and the results?
5. If the approach was not successful, has the student described where they think the problem lies and how it might be corrected?
6. If the approach was successful, has the student demonstrated that they have thought about the limits to the conclusions that they have drawn?

Note that there are many ways—in addition to doing a traditional experiment—for a student to conduct a research project that would meet these standards. The student could use previously collected data from the literature in a statistical analysis, they could build and analyze a mathematical model, etc. The major requirement is that the student has asked an original question and tried to address it in a reasonable way. Note that a literature review that describes how other people have thought about some scientific issue, while ultimately necessary and extremely useful, in and of itself would not be sufficient as a Research Report.

## **5.2 The Thesis Proposal and Thesis Proposal Defense**

The second part of the General Exam is the defense of a Thesis Proposal. The Thesis Proposal Defense will normally be completed by the end of the student's fourth semester in the Ph. D. program (by the end of June). In the absence of extenuating circumstances, JCBO will consider students who fail to successfully complete the entire General Exam by the end of their 24rd month in the program to be making insufficient progress toward their degree.

### 5.2.1 The Thesis Proposal

The Thesis Proposal presents the development of a likely thesis topic. It should include the following sections:

1. an abstract,
2. an introduction to the problem,
3. a summary of hypotheses and/or objectives,
4. a detailed plan of research,
5. a time-line designed for completion of the degree within five years,
6. cited references.

The combined length of Sections 1–5, including tables and figures, should not exceed 15 pages. Margins, fonts and font sizes should be chosen with readability and the good will of committee members in mind. The final version of the Thesis Proposal should be provided to the Chair of the General Exam, the Thesis Committee, the Chair of JCBO, the Education Coordinator, the Academic Programs Office at WHOI, and to the MIT Joint Program Office at least two weeks prior to the scheduled defense.

The Thesis Proposal must convince the Thesis Committee that the student can formulate scientific questions that can be answered and that plans for answering them are sound. Inclusion of preliminary results relevant to the thesis topic is desirable to demonstrate the student's ability to address the appropriate research questions. Some of these results may also appear in the Research Report.

### 5.2.2 The Thesis Proposal Defense

The Thesis Proposal Defense is attended by the student, the Chair of the General Exam and the Thesis Committee. The Education Coordinator may attend as an observer.

The Defense will begin with a brief oral presentation consisting of an overview of the Thesis Proposal. The presentation will be followed by questions from the Thesis Committee on the proposed research and any relevant background material. **The discussion will not be limited to the student's specific topic. The Thesis Committee is expected to take the discussion away from the project itself and into related areas of basic scientific knowledge.** The Chair of the General Exam will moderate the discussion as necessary, and may ask questions. At the end of the Defense the student will be dismissed for a short period while the Chair and the Thesis Committee discuss the student's performance.

The thesis proposal defense is to be completed by the end of June in the student's second year. It is important for the thesis committee to remember that this is an evaluation of the student's ability to propose research, there is not a need for substantial preliminary data and the plans may actually evolve as the student proceeds through the research. The thesis proposal must be submitted at least two weeks before the exam date.

The exam is expected to take at least two hours. The student should give a talk of ~20 minutes that should include an introduction, outline the major hypotheses, and discuss the proposed research including any preliminary results. This is followed by proposal-specific questions from the committee (about 45 minutes). In addition, the committee should devote at least 45 minutes to questions exploring the student's mastery of general concepts in biological oceanography, ecology, and any other fields considered essential for the thesis research.

To minimize overlap and ensure that diverse topics are covered, each committee member is to submit at least one general oceanography question to the exam chair prior to the defense. To help the committee develop these questions, the exam chair may wish to circulate the student's course list (available from WHOI APO or MIT JP Administrator), a list of core concepts in Biological Oceanography compiled by JP faculty, and example questions from prior exams. The core concepts and old exams are also made available to the students. Detailed discussion about specifics of experimental design, methods, or analyses should be saved for a follow-up committee meeting soon after the defense (1-2 months).

### **5.3 Evaluation**

It is the responsibility of the Chair of the General Exam to relate the findings of the AAC with respect to the student's performance on the Research Report to JCBO. The Chair will also summarize the proceedings of the Thesis Proposal Defense. Each of these evaluations should be written in separate memos to the Chair of JCBO, with copies provided to the Education Coordinator, the Academic Programs Office, the student, the advisor and members of the AAC and Thesis Committees.

The Chair should report a grade of "High Pass," "Pass," "Low Pass," or "Fail" for the student's performance on each component of the exam (Report, Thesis Proposal, and Thesis Proposal Defense). For evaluation of the Research Report, the committee may provide written comments to the exam chair, or the committee may meet (physically or electronically) to discuss their comments and opinions. The exam chair summarizes the opinion of the AAC and their vote on whether the student has passed this portion of the exam in a memo to JCBO. The AAC and exam chair may determine that a student should perform remedial activities if aspect(s) of the research report were below expectation. These activities might include, but are not limited to, enrollment in a scientific writing course, revision of the report, or demonstrating mastery of a particular scientific topic.

The exam chair provides a summary memo to JCBO regarding what occurred at

the thesis proposal defense, explicitly discussing the areas of general scientific knowledge in which the student was examined, provide information on the depth and breadth of questions, the discussion of the committee and whether the student passed. If the Thesis Committee identifies any weaknesses in the student's preparation, suggestions for remedial activities should be proposed. The final vote is ultimately to proceed to candidacy or not, with remedial activity again at the discretion of the committee. Some options for the outcome include pass, a pass with certain conditions requiring further study, a fail with recommendation that all or part of the exam be repeated, or a fail.

JCBO makes the final decision regarding the outcome of the General Exam. Possible outcomes include: (1) passing, (2) passing with certain conditions for required further study, (3) failure, with the recommendation that all or part of the exam be repeated, and (4) failure.

In the event of a failure on the General Exam, JCBO will consult with the student's advisor, Academic Advisory and Thesis Committees, the Chair of the Exam, and the instructors of course 7.47 to determine whether the student will be allowed to remain in the program, and if so what remedial work will be necessary. This group will consider all aspects of the student's performance to date, (including, for example, exam results, course grades, and the advisor's evaluation). If JCBO reaches the conclusion that the student should not remain in the Joint Program, it will also decide whether the student will be allowed to pursue a Masters Thesis.

Once JCBO has made a final decision on the outcome of the General Exam, the Chair of JCBO will send a memo to the student communicating the official result, and the Exam Chair can forward a memo to the student (with copies to Chair of JCBO and the Education Coordinator) summarizing the overall exam. This memo may be the same one sent to JCBO, or it can be a less detailed summary. Any remedial work should be described in both of the memos.

## **6 The Doctoral Thesis and Defense**

### **6.1 The Thesis**

The final steps for completion of the Ph.D. degree are to finish writing a thesis to the satisfaction of the thesis advisor and Thesis Committee and to defend the thesis in a public presentation and in a private review by committee members and other interested faculty. A check-list and schedule for this process is attached as Appendix C, and detailed requirements for the preparation and submission of the thesis can be found in the WHOI Specifications for Thesis Preparation manual available from the Academic Programs Office or [online](#). The student must obtain copyright permission to include previously published work in the thesis, but there is no longer a requirement for letters from co-authors/collaborators indicating the student's contribution to collaborative work. The student can indicate at the end of the chapter what they contributed to the

project.

A faculty member who is not a member of the Thesis Committee must chair the defense; again, the Education Coordinator can serve in this role, if not already a member of the Thesis Committee. It is the student's responsibility to provide the entire defensible draft of the thesis to the WHOI Academic Programs Office and to all Committee members well in advance (at least two weeks) of the anticipated date for the Thesis Defense.

## **6.2 The Thesis Defense**

It is vital that the entire thesis committee has already read the thesis and given approval before the student defends the thesis. The draft defense notice form that the student must complete and submit to either the WHOI Academic Programs Office or the MIT Joint Program Office with the defensible draft must have signatures of both the student and his/her advisor(s). The student must also pick a date for the Defense and have the WHOI Academic Program Office arrange for use of an auditorium for the public presentation and a conference room for the private defense. If the defense is to take place at MIT, the student should contact MIT/WHOI JP Administrator for room arrangements.

The Chair of the Defense will introduce the student at the public presentation and moderate the private defense as needed. When the Committee has finished its questioning in the private defense, the student will be temporarily excused so that the Committee can decide on the result. There may be suggestions for revisions to the thesis, which the student is expected to carry out before turning in the final copy. The Chair of the Defense will summarize the results of the Defense in a memo to the Chair of JCBO, with a copy to the WHOI Academic Programs Office.

Unless major revisions are required, the thesis must be submitted to the MIT Education Office and the WHOI Academic Programs office no later than two weeks after the defense. If major revisions are required, the student's Thesis Committee, through the Chair of the Defense, will make a recommendation to the Chair of JCBO for the deadline by which the final revised thesis must be submitted. The JCBO Chair has the responsibility to seek advice as rapidly as practicable from the JCBO and then set a deadline, communicate that deadline to the student, the thesis committee, the Joint Program Director at MIT, and the Dean at WHOI. Failure to meet the deadline can result in denial of further stipend and tuition support by either the Director of the Joint Program at MIT in consultation with the Department Head at MIT or by the Dean at WHOI in consultation with the Department Chair at WHOI. All other MIT policies and Joint Program policies with respect to continued registration also apply.

## **7 Master's Degrees**

In some situations, a student may choose to complete a Master's degree, or



completion of a master's degree may be recommended by the student's advisor or by JCBO. In such a case, the student should convene a Master's Thesis Committee consisting of two or three members, including at least one each from WHOI and MIT. The student should submit the Master's Thesis to the thesis committee members at least two weeks prior to the deadline for the desired degree list. The committee members may suggest revisions to the thesis prior to final approval. A formal defense is not required, but the committee may request an oral examination. The final copy of the thesis, signed by all committee members, should be submitted to the WHOI Academic Programs Office and to the Biology Department at MIT (or other department at MIT in which the student may be enrolled).

## **8 Dismissal of a Student from the Program**

Dismissal from the Joint Program for academic reasons is a rare measure to be considered only when all reasonable alternatives have been explored. If an advisor feels that a student does not show sufficient progress or promise to succeed in the Joint Program, the matter should be brought to the JCBO, which may recommend a change of advisors, of Thesis Committee members, or a change in research plans. If these options are exhausted or clearly unworkable, the JCBO may recommend that the Dean deny further registration of the student in the program. In some cases, the JCBO may recommend the conferral of a terminal Master's degree based on course work and a Master's Thesis. Both WHOI and MIT have the right to dismiss a student for criminal or ethical offenses.

## **9 Finances and Student Support**

Joint Program students are supported (tuition and stipend) in one of several ways. All student support, regardless of source is administered through the WHOI Academic Programs Office or the appropriate department at MIT. The source of the support has no effect on academic standards and responsibilities, and in most circumstances has little effect on the schedule of progress towards the degree. In cases where support-related responsibilities are extensive, they will be considered when evaluating the student's progress. Both advisors and students should understand the nature of the support that is available and come to a clear understanding, preferably prior to admission, of the obligations that financial support entails. Mechanisms of student support include:

1. Fellowships from outside agencies (e. g., NSF, NDSEG, Howard Hughes, EPA, private foundations, foreign governments). These fellowships, often awarded prior to a student's entry into the Joint Program, usually pay part of the total cost of tuition and stipend for a fixed period of time. The balance of the support costs may be provided by the Academic Programs Office or through the advisor's research program. Fellowships

may have particular requirements for eligibility, area of research, or reporting of progress, and it is the responsibility of the student to meet these requirements. Most outside fellowships are intended to support students while doing both coursework and thesis research and do not involve an obligation for the student to work on anything else.

2. WHOI-administered or MIT-administered Traineeships. These are generally derived from a grant to the respective institution, and are given to incoming or resident students based on criteria of the granting agency and/or the institution. Such traineeships may be used to support research in specific disciplines or sub disciplines (e. g., Coastal Research Traineeships), but, like outside fellowships, generally do not oblige the student to spend significant time on work other than his or her courses and research.

3. WHOI or MIT Teaching Assistantships. Although teaching assistantships are a common source of graduate student support in most universities, including MIT, they are not commonly available to Joint Program students, especially those in residence in Woods Hole. The Academic Programs Office has limited funds to support one or two students per semester as teaching assistants. These students are expected to work half time (20 hours per week) as teaching assistants, under the supervision of the course instructor(s). Specific duties will vary depending on the size and nature of the course. Teaching assistantships should be undertaken only after consultation with the advisor to be sure that the time commitment will not adversely affect progress toward completion of the degree.

4. WHOI Academic Programs Office. In addition to helping to supplement outside fellowships, the WHOI Academic Programs Office, through its endowment income and occasional gifts designated for student support, administers funds that can be used for graduate fellowship support, but only after all other support sources have been exhausted. The most common use of these funds is for students whose GRA funding has ended prior to completion of their theses or when there is a short funding hiatus between grants or contracts. Student responsibilities to the advisor are the same as those expected with other funding sources.

5. Graduate Research Assistantships (GRA) on Grants and Contracts.

This is the most common source of student support for Joint Program students. It differs in some important aspects from the other sources of funding described above. Advisors may have GRA support in advance of accepting a student or may secure it sometime after the student has entered the program. In some cases, the student may actually write all or part of a grant proposal for his or her support, with the advisor as the official principal investigator. In any of these cases, a student supported as a GRA is expected by the funding agencies to work half time on the grant project, whether or not it is related to his or her thesis research. For their part, advisors must recognize their responsibility to try to obtain continuing grant support for students who are on GRAs or

will need support when other sources of funding (such as fellowships) are completed. It is always desirable and usually possible to plan GRA funding such that the grant work will contribute, at least indirectly, to the student's progress. Students and advisors need to discuss this issue in advance of beginning GRA support, so that obligations and expectations are understood and accepted.

## **10 Memos and Petitions**

Memos and petitions regarding committee membership approval and deadline extensions must be submitted to the Chair of JCBO in writing (hard copy or email).

Petitions for any waiver to the degree requirements, or for an extension of time to complete degree requirements must document the justification for the requested change/extension and must be accompanied by a supporting statement from the student's Advisor(s). Requests for changes that have specific deadlines (e.g. extensions) must be received by the Chair of JCBO **at least 4 weeks** prior to the dates of the proposed change.

Petitions to extend the time for completion of an examination must include: (1) a statement of the exceptional circumstances that justify and extension, (2) a firm schedule stating when the exam will be taken, (3) the source of support during the time of extension, and (4) the approval of the student's Advisor(s) in a separate memo. Petitions to extend the time for completion of degree requirements beyond the end of the fifth full year must be submitted to both academic offices (MIT and WHOI) as well as JCBO. Petitions must include (1) a summary of progress to date, (2) justification for the delay, (3) an outline of the components of the thesis with a schedule for completion of each component, (4) the source of support during the extension, and (5) the approval of the student's Advisor(s) in a separate memo. The Advisor's memo should include a plan for funding the student during the extension period. A student should very carefully assess these factors and decide on a timetable with his/her Advisor(s).

JCBO will approve or deny petitions after careful consideration and after consultation with the student's Advisor(s). The petition may be denied and/or financial support terminated if there is inadequate justification for the extension or unsatisfactory progress toward completion of the Joint Program requirements. If the petition is denied, the student must either complete the requirements on schedule or withdraw from the program. In some circumstances, the student may be given the option of completing a Master's degree.

## **11 Students with Disabilities**

Students with disabilities can receive assistance from the MIT Student Disability Services (SDS) (<http://studentlife.mit.edu/sds>). SDS has identified an individual within each academic department who serves as a logistical coordinator/Disability Services

liaison, assisting students and faculty with the implementation of accommodations. The Logistical Coordinator for EAPS is currently Megan Jordan, for Biology is currently Janice Chang, and for CEE is currently Kiley Clapper.

**A student with a disability may be entitled to receive an accommodation for course exams**, based upon the functional impact of the disability. Some examples of test accommodations include: having someone write down a student's dictated answers (using a "scribe"), accessing a written test through auditory means (using a reader, assistive technology, or a taped version of the exam), or completing the exam with an additional time allotment. To qualify for an accommodation, the student must first make a request through SDS and follow the SDS procedure: <http://studentlife.mit.edu/sds/students/procedures-requesting-academic-accommodations>

If the student qualifies, he or she will be provided with a letter specifying the accommodation(s). The student must make an appointment with each faculty member/instructor during office hours to provide them with the accommodation letter and discuss their accommodation needs. This is typically done at the beginning of the semester, but at a minimum, should be done two weeks in advance of the first test. Thereafter, students are expected to remind their faculty member and Departmental Logistical Coordinator of their accommodation needs at least two weeks before each exam date. Students are strongly encouraged to interact directly with faculty/instructor regarding their accommodation needs. Additionally, the student must deliver an accommodation letter to the Department Logistical Coordinator.

The knowledge of a student's disability is confidential. Information is provided at the student's request or with a signed consent on a "need to know" basis only. This typically means that SDS will share information related to the student's accommodations requests for reasons directly related to the request or for personal safety.

**A student seeking an accommodation as part of the General Exam** should be prepared to describe the format of the exam to SDS based upon Section 5 in this handbook. Once an accommodation is approved, the student should present the SDS-authored letter to the Education Coordinator and the Departmental Logistical Coordinator. In addition, students are strongly encouraged to inform their advisor(s) of their approved accommodations. We strongly recommend that the student initiate the accommodation request process several months in advance, as the approval process takes some time. Further, students are strongly encouraged to share their approval decision/accommodation letter with the Education Coordinator at least six weeks in advance of the date, to allow sufficient time for implementation. Once notified, the Ed Coordinator will consult with the student in order to develop a procedure by which the accommodation can be implemented and confidentiality can be safeguarded. The Departmental Logistical Coordinator is available to assist with implementation logistics. The Education Coordinator will disclose the accommodation to committee members only on a need-to-know basis.

## 12 Who's Who?

**Advisor:** The advisor is the primary person with whom a student should develop graduate career plans. Throughout his or her tenure in the Joint Program, a student should strive to establish a good working relationship with the advisor, discuss funding opportunities for the research project, plan the direction of the research project, and plan the completion of the thesis. It is the advisor's responsibility to assist the student to make satisfactory progress toward completion of the degree.

In cases where a student-advisor relationship is no longer effective because of shifts in research interests, personality conflicts, or other reasons, the student or advisor may recommend a change of advisors. Generally this will involve discussion with the Academic Advisory or Thesis Committee members. The Education Coordinator may be asked to assist in discussions or mediate if necessary. Once a new advisor has been identified, and is willing to serve, the JCBO will give official approval to the change.

**Academic Advisory Committee (AAC):** The AAC should be formed before a student begins the first semester of coursework. It is composed of three faculty members (at least one from WHOI and one from MIT). The committee will help the student plan the course of study during the first two years in the program and evaluates the student's Research Report.

**General Exam Chair:** The Chair of a student's General Exam is responsible coordinating and reporting on all aspects of the exam process (including the evaluation of the Research Report, the Thesis Proposal, and the Thesis Proposal Defense). The Chair should be chosen by the student (with considerable advice from the AAC) from the JP Faculty by the end of the student's first year in the program.

**Thesis Committee:** The Thesis Committee will oversee thesis research and should be formed at the time that a student is about to begin drafting the thesis proposal. Composition of the committee should reflect the expertise needed to conduct the research, but must include at least one faculty member from WHOI and one faculty member from MIT. This committee will be responsible for reviewing the thesis proposal, conducting the thesis proposal defense, reviewing drafts of the thesis, conducting the final thesis defense, and accepting the thesis.

**The Joint Committee on Biological Oceanography (JCBO):** The JCBO is composed of faculty from both WHOI and MIT and is responsible for oversight of all aspects of the graduate program in Biological Oceanography including admissions, reviews of student progress, acceptance of final drafts of theses. The JCBO holds an annual meeting during the summer to discuss each student's progress and to meet with students in Biological Oceanography to discuss any issues of concern to the students.

Other meetings are held as needed.

**Education Coordinator:** The role of the Education Coordinator is to strengthen the quality and continuity of the education program within each department by serving as a source of information and advice to both students and advisors. The Education Coordinator is available to talk with students and advisors about any aspect of the education program or the graduate school experience at WHOI; the Education Coordinator should be considered to be an information resource but not a substitute advisor. Some specific duties of the Education Coordinator include: (1) serves as one of two departmental members to Educational Council and as a member of JCBO; (2) serves on other education-related committees or groups convened by the Department Chair or Dean; (3) provides information to students on curriculum matters, WHOI and MIT policies and regulations, and sources of research funding; (4) acts in cooperation with advisors, JCBO and the Academic Programs Office to help resolve academic or personal problems of students; (5) recommends departmental staff members to the Dean for appointment to the Admissions and Fellowship Committees; (6) works with the Admissions and Fellowship Committee members to engage the Department in the selection process for students and fellows; and (7) works with the Academic Programs Office and JCBO to organize the annual open house for prospective students and other education-related events in the department.

**WHOI Academic Programs Office:** The Academic Programs Office is responsible for administrative details in regards to student registration, stipend support, housing, WHOI-MIT interactions, etc. The Academic Programs Office should be kept informed by copies of relevant memoranda or notices of all student progress reports, examination notices and results, advisor assignments, and any actions that pertain to a student's progress in the program. Copies of Thesis Proposals should be sent to the Academic Programs Office. All students' official records are kept in the Academic Programs Office and Department Office at MIT. The Academic Programs Office will take care of copying the materials and forwarding them to the appropriate MIT department. The Vice President for Academic Programs and Dean directs the Joint Program from Woods Hole. Other [staff](#) in the WHOI Academic Programs Office that can provide assistance are the Associate Dean, the Registrar, the Graduate Admissions and Student Affairs Officer, the Executive Assistant to the Dean, and the Housing Coordinator.

**MIT Joint Program Office:** The MIT Joint Program Office performs a function similar to that of the WHOI Academic Programs Office with the primary exception that stipend support is handled by the appropriate MIT department for MIT-based students in the Program. The MIT Joint Program Administrator can best direct the student to the appropriate MIT office for any administrative matters (i.e., registration, on campus or off campus housing) pertaining to the student's stay on the MIT campus.

## A. Student Progress Checklist

**Year 0** \_\_\_\_\_

### **Summer**

- \* Arrive in June for summer research.
- \* Participate in Jake Pierson Memorial Cruise or other activity.
- \* Form Academic Advisory Committee and report membership to Chair of JCBO and Education Coordinator.
- \* Prepare 2-year curriculum.
- \* Meet with JCBO to approve curriculum at August meeting.

**Year 1** \_\_\_\_\_

### **Fall**

- \* Coursework, typically at MIT.

### **IAP**

- \* Research in advisor's laboratory.

### **Spring**

- \* Take course 7.47 *Biological Oceanography*
- \* Take course 7.410 *Applied Statistics*

### **Summer**

- \* Choose General Exam Chair (inform Chair of JCBO and Education Coordinator).
- \* Full time research.

**Year 2** \_\_\_\_\_

### **Fall**

- \* Coursework and research.

### **IAP**

- \* Submit Research Report to Exam Chair, Chair of JCBO, Education Coordinator and APO.

- \* Form Thesis Committee (inform Chair of JCBO, Education Coordinator, and APO).

### **Spring**

- \* Complete “core” portion of curriculum.
- \* Schedule Thesis Proposal Defense.
- \* Submit final draft of Thesis Proposal to Exam Chair, Chair of JCBO, Education Coordinator and APO at least two weeks prior to Proposal Defense.
- \* Defend Thesis Proposal.
- \* Schedule next Thesis Committee meeting.

### **Summer**

- \* Hold Thesis Committee meeting before August Student Progress Review.

### **Years 3 and 4** \_\_\_\_\_

#### **Fall**

- \* Coursework and research.

#### **IAP**

- \* Thesis Committee meeting.

### **Spring**

- \* Department Seminar at WHOI or MIT.

### **Summer**

- \* Thesis Committee meeting.

### **Year 5** \_\_\_\_\_

#### **Fall**

- \* Research.

#### **IAP**

- \* Thesis Committee meeting.
- \* Schedule Thesis Defense (or request extension from Chair of JCBO).
- \* Find Chair for Thesis Defense.

### **Spring**



\* Defend Ph. D. Thesis.

## **B. Interdisciplinary Studies**

The MIT/WHOI Joint Program's goal is for each student to achieve their full intellectual potential in their chosen area of study and research, either within the more traditional disciplines of ocean sciences and engineering or within interdisciplinary studies incorporating two or more disciplines.

To guide students in this endeavor the MIT/WHOI Joint Program faculty has established five focal areas: biological oceanography, chemical oceanography, marine geology and geophysics, physical oceanography and applied ocean physics and engineering. The Joint Committee associated with each focal area provides guidance as to the course of study for incoming students who have strong interests in that focal area. Many applicants have interests, academic background, and experience that are appropriate for one of these focal areas and they will be admitted to pursue their degree in that area. It is also likely that some incoming students will have, or develop, interests that span two or more of these focal areas. These students will be admitted to the focal area that is most appropriate for their preparation and stated interests. This ensures that the student has a well defined "home" within the Joint Program.

During the first semester in the Joint Program, as early as practical, each student should assemble and meet with an academic advisory committee to discuss their research interests and formulate a tentative individual course of study. The structure of the advisory committee will be defined by the student's primary Joint Committee, but typically the advisory committee will consist of at least the student's primary research advisor (who may or may not be from the "home" focal area) and a faculty member from the other institution.

For those students whose research interests significantly overlap two or more Joint Committee focal areas this advisory committee should, at the request of the student and the principal advisor, include faculty from the related focal area(s) at one or both institutions. The individual course of study will lead to a general examination with a format and scope that are both generally consistent with the requirements of the primary focal area's Joint Committee and flexible enough to recognize the individualized aspects of the course of study. The course of study must be approved by the primary Joint Committee, preferably by the end of the first year. The format of the exam also must be determined by the primary Joint Committee, and will be set no later than early in the semester before the exam. It is expected that the advisory committee will guide the student up to and through the general exam, after which the oversight will move to the student's Ph. D. thesis committee, whose membership must be approved by the home Joint Committee. The home Joint Committee will be responsible for monitoring the student's academic progress through the thesis defense.

## C. A checklist for completing the Ph. D.

This list is quoted from the online [WHOI Thesis Information](#).

- Online application for an advanced degree must be completed during first week of term in which thesis submission is intended.
- Obtain copyright approval from journal if including published paper in thesis. There is no longer a requirement for letters from co-authors/collaborators indicating the student's contribution to collaborative work, but the student can indicate at the end of the chapter what they contributed to the project.
- Defendable draft submitted two to three weeks in advance of the defense. Copies go to WHOI Academic Programs Office and to MIT Department Headquarters (except MIT Biology). Be sure to verify with your Joint Committee Handbook and your MIT department regarding when you need to turn in your draft and how many copies are expected.
- Signed [thesis defense notice](#) submitted to MIT Joint Program Office if defending at MIT and Academic Programs Office if defending at WHOI. If you are defending at WHOI, reservation of room and request for refreshments should be arranged with the Academic Programs Office.
- Final thesis to WHOI for reproduction with original signatures on title page. Do not bind the thesis in any way that would mark the pages.
- PDF Version of thesis to WHOI Academic Programs Office.
- 200-word abstract for WHOI submission to NTIS (doctoral candidates only) electronically sent to WHOI Graduate Admissions and Student Affairs Officer.
- Reproduction sheet must be turned in with final thesis. These may be found in Appendix D of the online [WHOI Thesis Specifications](#).
- Schedule checkout appointment with APO.
- Pay MIT Library Processing Fee.
- Biology students, submit 7W Thesis Defense Form (Appendix E of [WHOI Thesis Specifications](#)) when turning in thesis to MIT Biology Department.
- Submission of final grade.<sup>1</sup> The date on Grade Sheet corresponds with date of completion of all of the above requirements. This date impacts the amount of tuition assessed, so it is extremely important that the above requirements are met in entirety

in the timeliest manner possible.

- Ensure that no monies are owed to either WHOI or MIT. If outstanding debt exists, you may not march in Commencement, nor receive your official degree.
- Arrange for Exit Interview with WHOI Dean (not mandatory).

<sup>1</sup>Grades are given by the student's advisor and reported to the MIT Registrars Office by either the WHOI Academic Programs Office or by the MIT Department Headquarters. This step is not the responsibility of the student but is necessary for graduation.

## D Responsibilities for Students and Advisors

Advisors and students should clarify expectations annually by going over the points below (when student first arrives, and then as part of annual review process).<sup>2</sup>

1. Advisor and student should be familiar with appropriate discipline handbook(s) <http://mit.who.edu/handbooks> and with the Joint Program housing policy <http://mit.who.edu/housing>.
2. When student first arrives, advisor and student should discuss what courses the student should take, and when. Advice is also available from the education coordinator and student's academic advisory committee.
3. When student first arrives, advisor and student should discuss what research project(s) the student should undertake, including expectations of when and how that research will be carried out (e. g., during first summer, semesters when classes are in session, during IAP, during subsequent summers), and balance between coursework and research. They should also discuss any upcoming fieldwork (timing and duration), and whether it is optional or required.
4. Advisors should make expectations clear to the student, including how frequently the advisor and student should meet. The advisor should be available to provide advice to the student, and clarify with student how best to set up meetings (e. g., regular weekly meetings, or meetings as needed with some amount of lead time so that the advisor can set aside time, etc.).
5. Students are expected to devote at least 50 hours per week on average to academic activities, including time devoted to classes, research activities, and any activities specific to Research or Teaching Assistant duties. If supported as a Graduate Research Assistant, the student is expected to work on the grant/contract at least 20 hours per week. Specifics of how the 20 hour per week obligation is to be satisfied should be agreed upon by advisor and student (e. g., less time devoted to grant/contract activities when classes are in session, more time during IAP and

summer). It is good to have an understanding between student and advisor about this balance (the Education Coordinator is another resource to provide advice about balance). If supported as a Teaching Assistant, the student is expected to devote 20 hours per week to Teaching Assistantship activities (10 hours/wk for half-time TA). The remainder of the 50 hours should be devoted to academic obligations, such as classes and research projects approved by academic advisors.

6. Students may take two weeks of vacation per year and should clear this in advance with advisor.
7. Advisor and student should discuss authorship protocol (e. g., when is someone an author vs. acknowledged; when is someone first author; etc.), and scientific conduct. Training in scientific conduct is now required by some funding agencies. Ethics training is available, and advisors should encourage students to take advantage of such training.
8. Advisors should make best efforts to fund students fully, and encourage (assist as needed) students to submit fellowship applications. If the student has his/her own funding through a fellowship, and wishes to pursue research not covered by existing grants, the student and advisor should openly discuss possibilities and how other costs (e. g., lab supplies and analyses) will be covered. The burden of funding the student and his/her research costs falls on the advisor.
9. Regular feedback should be provided to the student about progress, and if the student is not fulfilling the advisor's expectations, the advisor should bring that to the student's attention in a timely manner so that the student can address the concern (rather than waiting until the semesters end or as part of the annual review).
10. Advisor and student should discuss progress at annual review time and go over any issues or concerns. On all submitted memos/paperwork, copy the Joint Program Administrator at MIT and the Student Affairs Officer at WHOI (who will print the correspondence and place in the students file).
11. As students research progresses, the advisor(s) should encourage participation in scientific meetings and assist with writing and submitting abstracts, choice of sessions and travel costs, and encourage and assist with networking at meetings. Both MIT and WHOI offer funding to help with student travel to conferences when they are presenting. See <http://mit.who.edu/policies>. Advisors should introduce students to colleagues at meetings, as well as when colleagues visit the home institution.
12. Each year students and advisors should discuss career goals (which may evolve). Advisors should offer advice to students on postdoc and job opportunities, and encourage the student to think broadly about his/her career.

13. Advisors should encourage and assist with publication of results including advice on appropriate journals; structure, length and content of articles; appropriate analyses and graphics; and guidance in responding to reviewers.
14. Advisors should provide timely feedback (within a week or two, with an idea of the timing provided by the advisor) as students write up results for their theses.
15. In addition to the Educational Coordinator, Associate Dean, Dean, MIT Director of the Joint Program, and Joint Committee members, the Department Chair is a go-to person for graduate students who need advice or assistance on important professional matters such as resolving conflicts or other issues with their advisors or others in the department. MIT also has an Ombuds Office <http://web.mit.edu/ombud/>.

## E Curricular Tracks

Incoming students are encouraged to evaluate whether their proposed research direction and training needs fit into one of the tracks described below. These tracks are meant to guide curriculum development and not be restrictive. Completion of specific track requirements is not strictly required, but students are expected to articulate how proposed deviations better satisfy their training requirements and maintain equal rigor.

In each case, the curriculum includes (A) specific required courses (e.g., Biological Oceanography and Applied Statistics for all students), (B) courses that would be chosen from a pre-selected list, (C) courses that the students would justify as discipline-specific, and (D) complementary electives (described after the track outlines).

Curricular requirements for all students: 96 units, including Biological Oceanography and Applied Statistics. 96 units is a minimum requirement, and it is strongly encouraged that these be classes in science, mathematics and/or engineering. Students commonly take up to 120 units, and the additional units frequently include complementary topics (see examples, below track outlines).

### **Biological Oceanography Track**

- (1) Biological Oceanography
- (2) Applied Statistics
- (3) An approved physical oceanography course (such as 12.808 Introduction to Observational Physical Oceanography, Fall)
- (4) Chemical Oceanography (such as 12.742 Marine Chemistry, Fall) or an approved substitution

- (5) 12 additional units of specialized aspects of Biological Oceanography. These may include but are not limited to: Marine Microbial Ecology, and Topics Courses.
- (6-8) Other electives in science, engineering or mathematics. Marine Microbial Ecology, Mathematical Ecology, or topics courses could count here. Elements of Modern Oceanography could also count here, but could not substitute for courses above.
- (9-10+) Other electives in science or complementary subjects, such as teaching or writing.

### **Marine Physiology Track**

This track is broadly targeted toward student studying organismal biology, physiology, and behavior, including molecular studies.

- (1) Biological Oceanography
- (2) Applied Statistics
- (3) One class that includes another oceanographic discipline. This may include Elements of Modern Oceanography, or a more advanced/specialized course (e.g., any of the Physical or Chemical Oceanography options listed above).
- (4) An approved graduate course in Biochemistry, Genetics, Cellular Biology, or Molecular Biology. Examples include (7.50: Method and Logic in Molecular Biology, 7.51: Principles of Biochemical Analysis, 7.52: Genetics for Graduate Students, 7.61: Eukaryotic Cell Biology, 1.87: Microbial Genetics and Evolution)
- (5) One additional specialized or advanced course with a substantial emphasis on Marine Physiology or Marine Organismal Biology. Marine Microbiology and Biogeochemistry would count, as would most topics courses.
- (6-8) Other electives in science, engineering or mathematics. Any of the courses listed above could count here (but not double-count). Undergraduate courses in topics such as genetics and molecular biology could also count here.
- (9-10+) Other electives that maybe be science courses or may provide training in other subjects, such as teaching or writing.

### **Quantitative Marine Ecology Track**

- (1) Biological Oceanography
- (2) Applied Statistics
- (3) One class that includes another oceanographic discipline. This may include Elements of Modern Oceanography, or a more advanced/specialized course (e.g., any of the Physical or Chemical Oceanography options listed above).
- (4) A 9-12 credit class with a strong quantitative focus, such as Mathematical Ecology or an approved substitution.
- (5) One additional specialized or advanced course with a substantial emphasis on quantitative marine ecology, modeling of marine systems, or related topics. Examples include: 12.823: Modeling Biology and Physics of the Ocean, 12.850:

Computational Ocean Modeling. Selected topics courses related to modeling and/or quantitative analysis could also count toward this requirement (as half courses).  
(6-8) Other electives in science, engineering or mathematics. Any of the courses listed above could count here (but not double-count). Undergraduate courses in topics such as genetics and molecular biology could also count here.  
(9-10+) Other electives that maybe be science courses or may provide training in other subjects, such as teaching or writing.

**Examples of “Complementary” Electives:** 11.373: Science Politics and Environmental Policy; 12.703: Presenting Scientific Research, 12.885: Science, Politics and Environmental Policy, 12.910: Communicating Ocean Science, 15.S55: Special Seminar in Management, 15.672: Negotiation analysis, 17.310: Science, Technology and Public Policy, 17.910: Policy Bootcamp.