



# **Introductory Handbook** for the Graduate Program in Biological Sciences

University of Massachusetts Lowell  
Department of Biological Sciences  
Spring 2023 onwards



## Table of Contents (TOC)

<b>Introduction to the Department of Biological Sciences</b>	3
Department statement on diversity and inclusion	4
<b>UML Administrative Staff</b>	5
<b>Expectations of Graduate Students</b>	
Academic Expectations	6
Policies for Graduate, Teaching, and Research Assistants	7
<b>UML Graduate School Academic Policies</b>	
General Admission Requirements to UML	10
BS/MS Program in the Department of Biological Sciences.	12
Graduate Certificates	13
<b>Master of Science Program</b>	
General Requirements for M.S.	14
Curriculum by Option	
General Biology	15
Biotechnology	16
Bioinformatics	18
Education, Communication, and Outreach	20
Master’s Project Option	22
Master’s Thesis Option	22
M.S. to Ph.D. program transition	26
<b>Ph.D. Program</b>	
Ph.D. programs (UMASS)	27
Ph.D. in Applied Biology (UML)	28
Curriculum Description	28
Qualifying Exam Guidelines	29
Doctoral Dissertation Research Guidelines	32
Selection of Dissertation Committee Members and Chair	32
Ph.D. Dissertation Committee Meeting Guidelines	33
Ph.D. to M.S. program transition	34
<b>M.S. Thesis and Ph.D. Dissertation</b>	
Proposal Guidelines	35
Proposal Defense Guidelines	37
PhD Dissertation Committee Meetings	39
Thesis and Dissertation Defense Guidelines	41
<b>Answers to Common Questions</b>	43
<b>Appendices</b>	
I. Applied Biology PhD Curriculum Outline	45

Suggested course load for first 2 years of PhD	. . . . .	46
II. Thesis/Dissertation Enrollment Form	. . . . .	45
III. Dissertation Committee Meeting Report	. . . . .	48
IV. Report of Examination form	. . . . .	43
Resume skills you (may have) learned while a graduate student	. . . . .	44
Cheat Sheets	. . . . .	51



## DEPARTMENT OF BIOLOGICAL SCIENCES

The Department of Biological Sciences prepares students for a variety of careers that contribute to society's understanding and advancement of health, education, and environmental issues. According to the United States Department of Labor, workers with a graduate STEM degree earn a higher median weekly salary and annual salary than those with a bachelor's degree. Students who earn their graduate degrees from the Department of Biology at UML can expect to learn skills and techniques that are broadly applicable to a wide variety of fields in the disciplines of biomedicine and environmental research. Many graduates will become employed in academic and industrial research institutions, while others will enhance biomedical research or environmental field studies. Some become science educators; others choose to continue their education in professional (medical, veterinary, dental) schools.

The Department of Biological Sciences is committed to educating its students about diverse topics pertaining to biology and their practical and ethical impact on the world we live in.

For more information about our programs, please check the website and direct any questions to our Graduate Coordinators:

**Dr. Jeffrey Moore**

Professor

Graduate Advisor

Jeffrey\_Moore@uml.edu

978-934-5337

**Function: Dr. Moore assists students with course selections, answers questions about degree requirements, and ensures students fulfill their academic responsibilities.**

**Dr. Rick Hochberg**

Associate Professor

Graduate Coordinator for Admissions

rick\_hochberg@uml.edu

978-934-2885

**Function: Dr. Hochberg assists students with graduate applications and reviews all applicants to the M.S. and Ph.D. programs. Questions about applications are directed to him.**

Further information can be found on the department webpage at:

<https://www.uml.edu/Sciences/biology/>

**Department of Biology**  
*Statement of Diversity, Equity, and Inclusion*

We welcome all who wish to study the Biological Sciences at the University of Massachusetts Lowell and support their growth as students and researchers. Our graduate program values diversity and seeks talented students from diverse backgrounds. We do not discriminate on the basis of age, race, culture, disability status, gender identity or expression, sexual orientation, religion, class, financial aid, national origin, native language, work experience, and/or veteran status. We also recognize the intersectionality of these groups and that individuals do not fall exclusively into a single category. We expect all of our students to demonstrate the same commitment to diversity, equity, and inclusion, and we do not tolerate discrimination of any kind.

## **UML Administrative Staff**

### **Biology Department**

For answers about GA/RA/TA contracts, and to schedule an appointment with the Department Chair, please contact: Irma Silva - Department Administrator  
Office Hours: Monday through Friday: 7:30 a.m. - 4:00 p.m.  
Email: [Irma\\_Silva@uml.edu](mailto:Irma_Silva@uml.edu)  
Olsen Hall 234  
North Campus  
Phone: 978-934-2661

### **Graduate Admissions Office**

For help with general graduate admission issues, contact:  
Phone: 978-934-2390  
Toll Free: 800-656-GRAD  
Fax: 978-934-4058  
Email: [Graduate\\_Admissions@uml.edu](mailto:Graduate_Admissions@uml.edu)

### **Registrar's Office**

For help with course registration, contact the solution center:  
Email: [TheSolutionCenter@uml.edu](mailto:TheSolutionCenter@uml.edu)  
Phone: 978-934-2000  
University Crossing  
220 Pawtucket St., Suite 131  
Lowell, MA 01854-5141

### **International Student and Scholars Office**

For help with visas and other questions pertaining to international student affairs, contact:  
Email: [ISSO@uml.edu](mailto:ISSO@uml.edu)  
Phone: 978-934-2383  
Office Hours: Monday through Friday: 9 a.m. - 4:30 p.m.  
Cumnock Hall, Suite 208  
31 University Avenue  
Lowell, MA 01854

## Academic Expectations of Graduate Students

You are in a unique position as a graduate student at UML. Undergraduate students look up to you for both knowledge and advice, and faculty members have higher expectations of you than undergraduate students. Therefore, graduate students are held to a higher standard of professional and ethical conduct during their academic program. We expect graduate students to maintain integrity with their research and in the lab. Below, we outline specific academic expectations for our graduate students.

**1. Show up on the first day of classes.** Missing any class at the beginning of a semester is unacceptable unless an emergency warrants it. You must notify the appropriate faculty member of any absences ahead of time. In the event that you miss the first class meeting, you are not guaranteed enrollment in the class, and you may be dropped from it at the professor's discretion.

**2. Show up for class prepared and on time.** You are a role model for undergraduate students, and arriving unprepared and/or late for any class is unprofessional and unacceptable.

**3. Graduate students must earn a grade of B (3.0) or better.** You are not allowed to count more than six credits below B towards your graduate degree (Please note that a B- is below B). Additionally, no graduate degree will be awarded to a student whose cumulative average for course work is below 3.0. Remember, as a graduate student, you are held to higher expectations by the faculty. A course grade below a 3.0 reflects poorly on your academic achievements, and may be viewed as unacceptable by a future graduate program or employer.

**4. All international students on F-1 or J-1 visas must register as full-time students (at least 9 credits).** Full time status must be maintained until the degree requirements are completed. Any variance from this policy must be approved by submitting the appropriate forms (<https://www.uml.edu/isso/reduced-course-load/how-to-apply.aspx>). Students in the final semester can petition for a reduced course load by submitting a reduced course load form.

**5. Demonstrate professional behavior** in all of your interactions with other students (graduate and undergraduate), faculty, and staff.

**6. Schedule meetings with faculty members well in advance.** It's best to make arrangements by email. For many faculty, their schedule fills up a week or more in advance. If you drop in on a faculty or staff member's office unannounced, they may not be able to drop their current schedule to accommodate your needs. Understand that faculty and staff members reserve the right to allocate their own professional time and have many commitments throughout the course of their day.

**7. Extended absences (>1 week) should be scheduled ahead of time** and brought to the attention of the faculty advisor, graduate coordinator, and/or course professor immediately. Graduate students should inform the appropriate faculty of the need for the absence and the expected date of return.

**8. Complete your program in a timely manner.** Graduate students are expected to fulfill the requirements of their program in a defined period of time. Please see your graduate program cheat

sheets for common timelines (see Table of contents). Meet with your advisor on a regular basis to ensure that you are enrolled in the appropriate courses and following the recommended guidelines for your academic program.

## **Policies for Graduate Assistants (GA), Teaching Assistants (TA), and Research Assistants (RA)**

All graduate students working for the University of Massachusetts Lowell are designated as employees and represented by the **Graduate Employee Organization Local 1596 UAW**. Students are encouraged to examine their union contract and speak with union representatives if they have questions about their employment. They are also encouraged to speak with the Graduate Advisor and the Department Chair of Biological Sciences if they have specific questions about their roles in the department.

1. Assistantships may be provided to students in good academic standing during their time in the Department of Biological Sciences. The student must be full time and registered for exactly nine credits (students or the mentor are responsible for any additional credits and a reduced course load approval must be obtained for less than 9 credits <https://www.uml.edu/graduate-student-services/ta-ra/ta-ra-forms.aspx>). In your final semester, enrollment in fewer than 9 credits is allowed with submission of a reduced course load form.
2. All students must remain in good academic standing to be awarded a GA/TA/RA during their time at UML. Good standing is defined as earning a minimum 3.0 GPA during each semester of their residence.
3. No assistantship will be awarded to a graduate student with a cumulative grade point average below 3.0 on the official transcript.
4. No assistantship will be awarded to a graduate student who has earned a grade below a C or has an INC on their transcript.
5. Level 3 teaching/research assistantships may only be awarded to graduate students who have reached doctoral candidacy (i.e. completed all coursework, oral/written and language examinations) and are enrolled in dissertation research.
6. Students are expected to work 18 hours per week for a full time assistantship, as designated in their union contract.

## **Description of the Roles and Responsibilities of GAs, TAs, and RAs.**

### **Graduate Assistantships (GA)**

**Role and Responsibility:** A Graduate Assistant or GA is a student who is enrolled full time and employed by the department for the purposes of mostly administrative activities. A GA's responsibilities may include the following:

1. Assist faculty with student orientations and department tours.



2. Administer course evaluations.
3. Assist faculty with laboratory course setup and breakdown. This includes turnover between labs, (e.g., refilling reagents, cleaning the lab).
4. Attend weekly preparation sessions.

### **Teaching Assistantships (TA)**

**Role and Responsibility:** A Teaching Assistant or TA is a student who is enrolled full time and employed by the department for the purposes of assisting professors in lecture and laboratory courses. A TA's responsibilities may include the following:

1. Assist or help coordinate activities such as exams, quizzes, and problem sessions.
2. Tutor students enrolled in the TA's course. This includes making yourself available in person or via email.
3. Lead instructional activities in laboratory courses including the setup, coordination, and dismantling of experiments and other laboratory activities such as dissections.
4. Assist in grading and proctoring activities.
5. Other professional activities designated by the course instructor (see below)

**In addition to these union-prescribed duties, all TAs must be aware of specific departmental regulations concerning their TA functions. These regulations include:**

6. TAs must attend weekly preparation sessions.
7. Grading must not be delayed; this includes individual assignments as well as posting final grades.
8. Classes cannot be canceled without your supervisor's approval. You must speak to your supervisor ahead of time if you expect an interruption in your TA responsibilities.
9. TAs must never leave their classroom unattended while a class is in session. Exceptions include brief bathroom breaks. For extended absences while a course is in session, the TA must notify the instructor and obtain permission and assistance.

### **Research Assistantships (RA, Funded by Research Advisors)**

**Role and Responsibility:** Research assistantships are only available through special arrangements with individual faculty research advisors. Students who are interested in research assistantships should contact departmental faculty members concerning the availability of this form of financial aid. It should be noted that the granting of such assistantships is at the discretion of individual faculty members, each of whom may have their own specific requirements that students must fulfill. Working in a research laboratory is not a guarantee of being granted a research assistantship. An RA's responsibilities may include the following:

1. Gathering and analysis of data for the benefit of the student's or faculty's research
2. Development of models for theoretical analysis
3. Production of research publications
4. Production of research reports (e.g., local and national conference presentations)

**Additional activities may vary by research advisor and include the following:**

5. Attend laboratory meetings, which are important for evaluating data and obtaining feedback.
6. Attend journal clubs to improve knowledge in your chosen discipline

7. Attend departmental seminars to broaden your perspective of the breadth of biology and support the department

## UML Graduate School Academic Policies

### General Requirements for Admission to Graduate Study

1. The applicant must show official evidence of having earned a baccalaureate degree or its U.S. equivalent from an accredited college or university. If an international transcript does not adequately demonstrate that an applicant has the equivalent of an American bachelor's or master's degree, the Graduate School will require such verification by an independent service such as the Center for Educational Documentation, Boston, MA (617-338-7171).
2. The degree must have been earned with a satisfactory scholastic average to demonstrate that the applicant has had adequate preparation for the field in which graduate studies are to be undertaken.
3. The applicant must have obtained a satisfactory score on the appropriate entrance examination required for admission by the program or department to which admission is sought. The official score report must be submitted; a photocopy of the applicant's report is unacceptable. Unless otherwise stated under a specific program description, the required examination is the Graduate Record Examination General Test.
4. The Commonwealth of Massachusetts requires that all full-time graduate students (9 or more credits) must be immunized against measles, mumps, rubella, tetanus, and diphtheria. In addition, all students in programs in the health professions, regardless of age or enrollment status, must show proof of immunization. Students will not be permitted to register for courses at the University unless proof of immunization has been sent directly to the Director of Health Services, University of Massachusetts Lowell, Lowell, MA 01854 (978-934-4991). Adherence to university public health guidelines is required. Please see:  
<https://www.uml.edu/alert/coronavirus/returning/community-agreement.aspx>

**IMPORTANT:** *The rules, regulations, and policies delineated by the Graduate School constitute only the minimum requirements for admission, retention, and graduation. Each department may have additional requirements mandated by the unique nature of its programs. It is the responsibility of the graduate student to be aware of the minimum requirements of the Graduate School and, in addition, to fulfill the special requirements of the particular program in which he or she is enrolled.*

## **Application Procedure for Graduate School at UML**

### **Domestic Applicants**

Application procedures, deadlines and materials for admission may be found on the web at the following address: <https://www.uml.edu/Grad/>

### **International Applicants**

Application procedures, deadlines and materials for admission may be found on the web at the following address:

<https://www.uml.edu/International-applicants/Application-Requirements/international-undergrad-admissions.aspx>

International students must have graduated overall in either the “First Class with Distinction” or “First Class” (the equivalent of our 4 and 3 point GPA).

### **TOEFL/IELTS**

All international applicants are required to submit results of the Test of English as a Foreign Language (TOEFL), Duo Lingo, or the IELTS (International English Language Testing System) exam except citizens of Australia, Canada (except Quebec), United Kingdom, Ireland, New Zealand, Guyana and English Speaking countries of Africa and West Indies. You are responsible for making arrangements to take the test.

**Personal Statement:** An applicant to the M.S. program must submit a personal statement that describes the student’s educational background, research experience, and career goals. Applicants to the Ph.D. program will have additional requirements. Please see more below.

## Dual Bachelor's/Master's Program (BS/MS)

An accelerated course of study leading to the B.S. and M.S. degrees in Biological Sciences is available to full-time students who have a grade-point average of 3.0 or above at the end of their junior year. Interested students, after evaluation and acceptance by the Department's graduate selection committee, meet with the graduate coordinator to design a plan for completion of requirements for both degrees. Up to 6 credits of graduate courses (5000 level or higher) may be used by a student in the BS/MS program for both graduate and undergraduate degrees. Course credits can not be split to reach the six transfer credits. While students may complete their combined BS and MS degrees in five years, this is not a requirement nor expected. **Graduate Record Exam scores are not required.**

The objective of these programs is to foster critical thinking and to develop the skills needed for independent laboratory study. This is accomplished, in part, by offering advanced seminar, lecture, and laboratory courses. While it is possible to complete M.S. requirements without a thesis or project option, participating in original scientific research is what most distinguishes graduate from undergraduate study. Participation in research also presents the possibility of publication, which is the foundation of all sciences and an important part of a scientist's resume. All full-time M.S. degree students are strongly urged to find labs for their thesis or project options.

### Eligibility

1. Only students who have earned a minimum of **75 credits** in the undergraduate Biology program at UML are eligible to apply for the BS/MS program. Credits from other institutions (i.e., transfer credits) do not count towards the 75-credit total.
2. Up to 6 credits of graduate coursework (at the 5000 level and above) with grades of B or better can be used toward the Bachelor's and Master's degrees (i.e., an undergraduate student who has taken a 5000 level class and received a B or better can use this credit toward both the B.S. and M.S. degrees). Please note that 4 credit courses cannot be split to smaller numbers of credits (e.g., 2 or 3) to use towards your Master's degree.
3. Students from other departments at UML may be accepted into the BS/MS Program if they have completed acceptable baccalaureate Biology or comparable course work.
  - a. At minimum, a student from another department must take the following courses at UML to be eligible for the BS and M.S. degrees: Principles of Biology I, II; Genetics; and Organic Chemistry I, II.
  - b. These students may also choose to apply 6 graduate credits towards their BS/MS degrees (see criterion 2 above).
  - c. Any deficiencies in the student's academic record will be noted by the Admissions committee. A student may still be accepted into the program, i.e., "Accepted with conditions." Additional coursework may be required.

## **Graduate Certificates**

Most graduate certificates are comprised of four courses (12 graduate credits) designed to provide specific knowledge and expertise vital to today's changing and complex needs in the workplace. In most cases, courses may be applied toward a degree program.

### **Requirements to Complete a Graduate Certificate**

Courses must be completed within a five year period with a minimum 3.0 grade point average, and with no more than 6 credits below B. Courses completed for one certificate may not be used for another certificate.

### **Certificate Application Process**

Graduate certificate programs are designed for students holding a baccalaureate degree in a field related to the certificate program. Students must pay the application fee. The graduate record exam (GRE) is not required.

### **Molecular & Cellular Biotechnology Certification**

Biological Sciences, Chemical Engineering Departments (Interdisciplinary)

The certificate in Molecular and Cellular Biotechnology provides students with training in this growing field. Over the years, an ever-increasing demand for manipulation of DNA and analysis in cultured cells in most aspects of funded research has created a growing need in the job market for trained professionals.

#### **Required Courses:**

BIOL 5670 & BIOL 5690 Molecular Biology [Lecture/Lab],  
BIOL 5760 Cell Culture Techniques [Lecture/Lab]

#### **Elective courses (choose two):**

BIOL5190 Biochemistry, CHEN 5450 Isolation & Purification of Biotech Products, CHEN 5350 Cell & Microbe Cultivation, BIOL 5410 Advanced Cell Biology

## Master's Programs in Biological Sciences

The objective of this program is to foster critical thinking and to develop skills needed for independent laboratory study. This is accomplished, in part, by offering advanced lecture, seminar, and laboratory courses. While it is possible to complete M.S. requirements without the thesis or project option, participating in original scientific research is what most distinguishes graduate students from undergraduate students. All full-time M.S. degree students are strongly urged to elect thesis or project options. If you have specific questions about our Master's Program, contact Dr. Jeffrey Moore.

## General Requirements

To be recommended for a Master's degree, a candidate must satisfy all requirements of the Graduate School and the specific requirements of the department in which he or she is enrolled. A candidate for the master's degree must complete the following within five years of matriculation in order to receive the degree:

1. A course of study designed by the department in which he or she is enrolled must be completed and approved by the Graduate School. The course of study must have a minimum of 30 credit hours of graduate work including, where applicable, a thesis or project in the student's chosen field. A maximum of 9 credits may be completed at other institutions (including those from the UMass Inter-Campus Course Exchange Program); if choosing to take classes at other institutions, the student must receive prior permission from the Graduate Coordinator.  
[https://www.uml.edu/docs/intercampus\\_course\\_exchange\\_tcm18-3533.pdf](https://www.uml.edu/docs/intercampus_course_exchange_tcm18-3533.pdf)
2. A student must successfully pass an oral or written examination on his or her complete master's program if required by the department. Satisfactory grades in all subjects offered for the degree must be earned.

## Master's Degree Program Options

There are four degree options for the Master of Science: **Biology, Biotechnology, Bioinformatics, and Outreach Communication and Education**. Within each degree there are three pathways:

**I. Coursework only** - this option is best for students who do not wish to pursue research but rather gain expertise in specific biological topics that might increase their chances for success in industry or academia.

**II. Coursework plus Project** - this option offers opportunities for students to conduct limited research in a specific field. The project is less formal than the thesis but can still provide valuable insights into particular topics. Up to 6 credits of Project can be used to substitute for coursework. You must consult with a research advisor (professor) before enrolling in project credits.

**III. Coursework plus Thesis** - this option is the most formal option for students to pursue detailed scientific research. This option requires strong dedication and is the best option for those considering the pursuit of a publication and/or a Ph.D. You must consult with a research advisor (professor) before enrolling in thesis credits. A summary of the thesis option is provided on the following pages.

## M.S. in Biological Science (General)

A Master's degree with the widest flexibility in course selection so students can create a program that fits their educational and employment needs. Students can choose to focus on courses in cellular, organismal, ecological, evolutionary, and physiological biology. Depending on their career goals, students may choose either course work or research options. All M.S.candidates are expected to show sufficient knowledge and skills to pursue independent and creative research.

### Course Requirements

#### 1. Required Courses:

- A. Biochemistry (BIOL 5190)
- B. Graduate Colloquium (BIOL 6010)
- C. Professional Communication (BIOL 6040)

#### 2. Course Electives:

- A. If the program is courses-only: 23 credits of BIOL 5XXX\*
- B. Project Option with 6 project credits: 17 credits of BIOL 5XXX\*
- C. Thesis Option with 12 thesis credits: 11 credits of BIOL 5XXX\*

#### 3. Project or Thesis Credits

- A. Master's Project Option: 6 max. Project credits
- B. Master's Thesis Option: 12 max. Thesis credits

<b>Biological Sciences MS</b>	<b><u>Courses option</u></b>	<b><u>Project option</u></b>	<b><u>Thesis option</u></b>
Core Requirements	7	7	7
Biology electives	23	17	11
Project or Thesis credits	0	6 (max)	12 (max)
<b>Total Degree</b>	30	30	30

\*Nine credits of approved transfer credits or nine credits of relevant graduate course work (5000 level) from other departments within the University can apply. A 3.0 GPA is required at completion of all course work. A minimum of 30 credits are required for graduation.

B.S.-M.S. applicants who have completed some core requirements (e.g., Biochemistry, Biochemistry Techniques) and received a satisfactory grade as a BS student may have those core course requirements waived; other courses may be used to substitute to fulfill the credit requirements.

*Please see the UML catalog for specific details about this option.*



## M.S. in Biological Science-Biotechnology

A Master's degree with an emphasis on the theory and techniques employed in the fields of biotechnology, biomedical, and biopharmaceutical science. Students receive advanced study and training necessary to conduct research at a professional level and to be successful in today's academic and industrial research markets. Students are encouraged to explore quantitative approaches to the solution of problems in the basic and applied biological sciences. Depending on their career goals, students may choose either course work or research options. All M.S.candidates are expected to show sufficient knowledge and skills to pursue independent and creative research.

### Course Requirements

#### 1. Required Courses:

- A. Biochemistry (BIOL 5190)
- B. Biochemistry Techniques (BIOL 5210)
- C. Graduate Colloquium (BIOL 6010)
- D. Professional Communication (BIOL 6040)

#### 2. Course Electives:

- A. If the program is courses-only: BIOL 5XXX\* distributed as:
  - Three laboratory courses (see curriculum for specifics)
  - Three elective courses (see curriculum for specifics)
  - Other electives to reach 31 credits total
- B. Master's Project Option: BIOL 5XXX\* distributed as:
  - Three laboratory courses (see curriculum for specifics)
  - Three elective courses (see curriculum for specifics)
  - Master's project credit and other electives to reach 31 credits total.
- C. Master's Thesis Option: BIOL 5XXX\* distributed as:
  - Three laboratory courses (see curriculum for specifics)
  - Three elective courses (see curriculum for specifics)
  - Master's thesis credit and other electives to reach 31 credits total.

#### 3. Project or Thesis Credits

- A. Master's Project Option: 6 max. Project credits
- B. Master's Thesis Option: 12 max. Thesis credits

<b>Biological Sciences MS Biotechnology Option</b>	<b><u>Courses only</u></b>	<b><u>Project option</u></b>	<b><u>Thesis option</u></b>
Core Requirements	9	9	9
Lab courses	12-16	12-16	12-16
Elective courses	10-12	0-4	0
Project or Thesis	0	6 (max)	12 (max)
<b>Total Degree</b>	31	31	31

\*Nine credits of approved transfer credits or nine credits of relevant graduate course work (5000-level) from other departments within the University can apply. A 3.0 GPA is required at completion of all course work. A minimum of 31 credits are required for graduation.

BS-MS applicants who have completed some core requirements (e.g., Biochemistry, Biochemistry Techniques) and received a satisfactory grade as a BS student may have those core course requirements waived; other courses may be used to substitute for those credits.

*Please see the UML catalog for specific details about this option.*

## M.S. in Biological Science - Bioinformatics

An interdisciplinary Master's degree that combines coursework in Biology and other scientific disciplines like Computer Science and Mathematics to analyze and interpret biological data. The bioinformatics option will fill a critical need due to increasing demands for big data analytics skills from the Life Sciences industry in Massachusetts and worldwide. Depending on their career goals, students may choose either course work or research options. All M.S. candidates are expected to show sufficient knowledge and skills to pursue independent and creative research.

### Course Requirements

#### 1. Required Courses:

- A. Graduate Colloquium (BIOL 6010)
- B. Professional Communication (BIOL 6040)

#### 2. Course Electives:

A. If the program is courses-only: 26 credits of BIOL 5XXX\* and other interdisciplinary courses distributed as:

- Three Bioinformatics courses (see curriculum for specifics)
- Three Biology elective courses (see curriculum for specifics)
- One interdisciplinary elective (cannot be a BIOL course)

B. Master's Project Option:

- Three Bioinformatics courses (see curriculum for specifics)
- Biology elective courses (see curriculum for specifics)
- Of these courses, at least 14 credits must be BIOL 5XXX\*
- One interdisciplinary elective (cannot be a BIOL course)
- Master's Project credit to reach 30 credits total.

C. Master's Thesis Option:

- Three Bioinformatics courses ( see curriculum for specifics)
- Biology elective courses ( see curriculum for specifics)
- Of these courses, at least 14 credits must be BIOL 5XXX\*
- One interdisciplinary elective (cannot be a BIOL course)
- Master's Thesis credit to reach 30 credits total.

#### 3. Project or Thesis Credits

- A. Master's Project Option: 6 max. Project credits
- B. Master's Thesis Option: 12 max. Thesis credits

<b>Biological Sciences MS Bioinformatics</b>	<b><u>Courses</u> <u>option</u></b>	<b><u>Project</u> <u>option</u></b>	<b><u>Thesis</u> <u>option</u></b>
Core Requirements	4	4	4
Biology electives	26	20	14
Project or Thesis credits	0	6 (max)	12 (max)
<b>Total Degree</b>	<b>30</b>	<b>30</b>	<b>30</b>

\*Nine credits of approved transfer credits or nine credits of relevant graduate course work (5000-level) from other departments within the University can apply. A 3.0 GPA is required at completion of all course work. A minimum of 30 credits are required for graduation.

BS-MS applicants who have completed some core requirements (e.g., Biochemistry, Biochemistry Techniques) and received a satisfactory grade as a BS student may have those core course requirements waived; other courses may be used to substitute from those credits.

*Please see the catalog for specific details about this option*

## **M.S. in Biological Science - Education, Communication, and Outreach**

An interdisciplinary Master's degree that combines courses in biological sciences alongside appropriate courses in education, psychology, and business that are tailored to the student's desired career. This program is a great fit for students with career interests in education and curriculum development as well as life science and sustainability training. Depending on their career goals, students may choose either course work or research options. All M.S. candidates are expected to show sufficient knowledge and skills to pursue independent and creative research.

### **Course Requirements (33 credits)**

#### **1. Required Courses:**

- A. Biochemistry (BIOL 5190)
- B. Professional Communication (BIOL 6040)
- C. Supervised Instruction (BIOL 7100)

#### **2. Course Electives:**

A. If the program is courses-only: 24 credits of BIOL 5XXX\* and other interdisciplinary courses distributed as:

- Biology Sciences coursework (18-21 credits, see curriculum for specifics)
- Electives in Departments of Business, Education, or Psychology (6-9 credits, see curriculum for specifics)
- Biology Education (3-6 credits)

B. Master's Project Option:

- Biology Sciences coursework (18-21 credits, see curriculum for specifics)
- Electives in Departments of Business, Education, or Psychology (6-9 credits, see curriculum for specifics)
- Biology Education (3-6 credits)
- Master's Project credit to reach 33 credits total.

C. Master's Thesis Option:

- Biology Sciences coursework (18-21 credits, see curriculum for specifics)
- Electives in Departments of Business, Education, or Psychology (6-9 credits, see curriculum for specifics)
- Biology Education (3-6 credits)
- Master's Thesis credit to reach 33 credits total.

### 3. Project or Thesis Credits

A. Master's Project Option: 6 max. Project credits

B. Master's Thesis Option: 12 max. Thesis credits

<b>Biological Sciences MS Education Option</b>	<b><u>Courses option</u></b>	<b><u>Project option</u></b>	<b><u>Thesis option</u></b>
Core Requirements	9	9	9
Biology electives	24	18	12
Project or Thesis credits	0	6 (max)	12 (max)
<b>Total Degree</b>	33	33	33

\*Nine credits of approved transfer credits or nine credits of relevant graduate course work (5000-level) from other departments within the University can apply. A 3.0 GPA is required at completion of all course work. A minimum of 33 credits are required for graduation.

BS-MS applicants who have completed some core requirements (e.g., Biochemistry, Biochemistry Techniques) and received a satisfactory grade as a BS student may have those core course requirements waived; other courses may be used to substitute from those credits.

*Please see the catalog for specific details about this option*

## **Master's Project Option**

This option is for students who wish to gain some hands-on research experience during their graduate program, but do not want to complete a thesis. Students interested in this option should contact an appropriate faculty member to determine if they are accepting students, and if a research project is appropriate. Only after an agreement is reached with the faculty member can a student sign up for project research credits. Students choosing this option should meet with their advisor and outline clear and defined expectations of their work on a semester-by-semester basis. It should be emphasized that project research credit should be treated as elective course work for which the student is paying tuition for the credits. Since such projects do not require the commitment necessary to complete a thesis, students should not expect to receive TA/RA support for such work.

## **Master's Thesis Option**

The Master's Thesis Option is a research-intensive program in which the student develops, plans, conducts, analyzes, and presents an independent, original project, under the supervision of a Principal Investigator (PI). This option is meant for self-motivated students who wish to excel in science and gain experience in all aspects of the scientific process, from becoming an expert in the scientific literature in their research area to analyzing and presenting their own work. Students gain valuable first-hand experience that will provide them with a solid foundation in the scientific research process and that is qualitatively different from coursework. Their training differs from students in the non-thesis options and, ideally, results in the publication of at least one manuscript in a peer-reviewed scientific journal. Because their program is research-intensive, they have a distinct advantage when moving on to doctoral programs or employment in scientific research-based fields. However, in order to succeed in their Master's thesis program, students must be self-motivated and committed to their project. Thesis students are given priority if funds for student support (TA or RA) are available, but do not necessarily receive funding. Students are strongly discouraged from choosing the Thesis Option solely for financial reasons, as the two are not linked.

### **Applying to Conduct M.S. Thesis research**

Acceptance to the Biological Sciences Master's Program does not ensure acceptance into a program of directed Thesis research. Because of the rigorous nature of the Thesis program, students hoping to pursue a Master's Thesis are encouraged to submit a transcript, their GREs, and a letter of intent to their prospective thesis advisor explaining why they want to pursue a thesis project.

### **Expectations/Milestones for M.S. Thesis students**

#### **I. Coursework**

Students are encouraged to focus their coursework (electives) on areas related to their research and professional goals. As much coursework as possible should be completed in their first two semesters, so that more time is available to focus on their Thesis research in their final semesters.

#### **II. M.S. Thesis Enrollment**

Students must fill out the Thesis Enrollment Form (see TOC) prior to engaging in any thesis research and writing.

### **III. M.S. Thesis Proposal and Credits**

During the first semester that a student has chosen to conduct a Thesis, students should meet with their Research Advisor to develop an outline for their thesis. This should occur as early in the program as possible. They should spend a significant amount of time becoming familiar with the current scientific literature in their research area (for example, reading 5-10 papers per week) and writing a Thesis Proposal (see TOC for page of M.S. thesis proposal guidelines). Because of the time required for conducting independent research, students are encouraged to enroll for the maximum number of Thesis Research credits (12 credits) over the course of their time at UML. Ask your research advisor if you are uncertain how many credits to enroll in for each semester. If the student makes satisfactory progress on the Thesis, students will receive a PR for “Progress” (but not credits), which is automatically converted to an S for “Satisfactory” when their completed thesis is submitted to the University. The student does not obtain these credits until the Thesis is submitted and these credits cannot be converted into any other type of credits (e.g., Project or Practicum) in the event that a thesis is not completed.

The format for the **M.S. Thesis Proposal** can be found in a separate section (see TOC).

The proposal should be submitted to the Thesis Advisor for comments and corrections (as a Word or PDF), and returned to the student within 2 weeks. Once the suggestions have been incorporated (or successfully argued against) and the Thesis Advisor has approved of the Proposal, the student should consider forming a thesis committee.

### **IV. Selection of an M.S. Thesis Committee**

The Thesis Committee consists of three faculty members (minimum): the Thesis Advisor and two faculty members with expertise in areas related to the student's project or professional interests. At least one non-Advisor member must be from the Biological Sciences department. The student may have additional Committee members from another department or institution. The Committee serves several purposes:

- 1) To provide advice and expertise to the student in order to aid them in the pursuit of their Thesis Research.
- 2) To provide balance to and review of the Thesis research, including the somewhat subjective decision of when the student has completed enough work to fairly constitute a complete Thesis.

***How to select a committee member?*** If you are familiar with the faculty, consider selecting a professor with whom you have interacted previously (e.g., in a course) and shares similar research interests. If you have not previously interacted with a professor, it is best to check the faculty webpages to determine who might be most suitable. Consider making a face-to-face appointment with the professor to determine if they will consider committee membership. Committee membership can require a substantial investment of time, so any professor who accepts the commitment will have high expectations of your research. In turn, they are likely to provide you a letter of recommendation for further graduate study or employment, so it is important that you perform at your highest level. The **Thesis Enrollment Form** (see TOC) will be used to list your committee members.



## **V. Oral Proposal Defense**

Once the student has selected the remaining committee members, the proposal defense should be scheduled. The student will provide the committee a copy of the finished proposal (generally in electronic format) at least 2 weeks prior to the defense. Committee members will edit or provide comments on the proposal. The **Proposal Defense Guidelines** (see TOC) section outlines the full guidelines and expectations. A **Report of Examination Form** (see TOC) will be provided to the student upon completion of the presentation.

## **VI. Active Research**

Students are likely to begin their research before their Committee meeting and to be actively engaged in their research by the time they have submitted the proposal for review. Research is exciting and interesting, but can also be difficult and discouraging because success usually comes only after many failures. This facet of research is to be expected and, therefore, students should plan to spend more time than they expect in the lab conducting research. While time spent in the lab does not ensure successful experiments, it makes them possible. If financial considerations require students to be employed (outside of the lab) during their research, they should realize that it is entirely likely that they will not complete their M.S. degree within two years. In addition, students should expect to continue their research activities at times when the university is not in session (i.e. winter, spring, and summer breaks). Research does not follow an academic calendar and it is unrealistic to expect success if one is going to put their research on hold for several weeks two or three times a year. Furthermore, it is at these times, when classes are not in session, that a student will have more free time to focus on their research activities without the added distraction of course work. **Although the general outline of a 30-33 credit M.S. program consists of four semesters of study over two academic years, a student should be aware that inclusion of a thesis may increase the time needed to complete the degree.**

*Important: Students should plan to meet about once per week (or more) with their Thesis advisor during active research in order to consult with them, seek advice on research problems, etc.*

## **VII. Data analysis**

Like experimental work, data analysis typically takes more time than students (or professors!) expect. Ideally, data analysis is done as results are generated. A useful goal is to generate publishable figures from experimental data as soon as the results are available. Data analysis and making figures is more efficient and easier if it is done when the results are fresh and having the figures available for interpretation can enlighten subsequent experimental work. The student should work closely with their Thesis advisor during data analysis.

## **VIII. Presentation of Research Results**

Students are expected to present their research at the University Annual Student Research Symposium. In addition, they are encouraged to present at regional or national meetings. Abstracts and presentations submitted to such meetings must be approved by the Thesis advisor.

## **IX. Writing the M.S. Thesis**

All students are encouraged to write their thesis using a university-mandated format (check UML website). The student should allow sufficient time for their advisor to edit their Thesis (2 weeks for each draft or portion) and, once a draft has been approved by their advisor, for their Committee

to review the Thesis prior to their defense (two to three weeks). Review the UML guidelines for writing and submitting Theses.

<https://www.uml.edu/catalog/graduate/policies/dissertation-thesis/>

### **X. M.S. Thesis Presentation and Defense**

The Thesis Presentation and Defense are the culmination of a student's Thesis program. The Thesis Presentation is a public event and must be announced to the University community. The presentation is a formal event that requires several weeks to prepare for. You will be summarizing your research in a slide show and presenting the talk (about 45 mins) to the community. Expect to devote at least a solid 3-4 weeks to preparation of the presentation. Most students meet with their advisors as they complete sections of the presentation (e.g., Intro, Methods, etc) so they can get feedback prior to completing the entire presentation.

The Defense follows the presentation and offers an opportunity for Thesis Committee members to address any questions or concerns about the Thesis and for the student to demonstrate their expertise in their chosen area of research. **Please see the TOC for guidelines for M.S. thesis defenses.**

A **Report of Examination Form** (see TOC) must be filled out by the student and committee upon completion of the presentation.

Graduate students who have completed all the requirements except the writing and defense of the thesis and who do not need to use university resources must register for Continued Matriculation (CONT.6010 for MS) and pay a fee each semester until they graduate. (**Note: International students on F-1 or J-1 visas must be registered for a minimum of nine credits each semester.**)

**Procedure for students accepted into a M.S. program who decide to continue on for their doctorate degree (Ph.D) but want to first complete their master's degree.**

1. The student must complete all required courses, compile a 3.0 grade point average, and successfully defend his/her thesis, if required.
2. The student must complete the Graduate School clearance process for the master's degree.
3. A student is prohibited from enrolling in doctoral research until he or she has completed the clearance process for the M.S. degree.
4. The student must then apply to the doctoral program by completing the standard application process.

Official admission into a doctoral program and receipt of a letter of acceptance are contingent upon completion of the clearance process for the M.S. degree.

## Doctoral Research (Ph.D.) in the Biological Sciences

### Ph.D. in Applied Biology

The program integrates foundational areas of biology (e.g., Biochemistry, Cell & Molecular Biology, Genetics, Developmental Biology, Evolutionary Biology, Organismal Biology) with focused interdisciplinary biological research and preparation for career advancement. It combines fundamental and rigorous training in the pursuit of new knowledge regarding the mechanisms of biological processes coupled with the skills needed to apply this knowledge in the workforce. In addition to traditional academic careers in research and education at colleges and universities and academic research hospitals and institutes, our graduates are also prepared for non-academic careers. **Consult the website regarding this program and direct any questions to:**

Dr. Jeffrey Moore  
Jeffrey\_Moore@uml.edu  
978-934-5337

<https://www.uml.edu/sciences/biology/programs-of-study/phd-applied-biology.aspx>

### Ph.D. in Biomedical Engineering and Biotechnology

The Ph.D. Program is offered jointly by the campuses at Lowell, Boston, Dartmouth, and Worcester. It brings together expertise in related fields, and emphasizes a multidisciplinary, team approach in course/seminar presentations across the campuses, laboratory rotations, and joint research projects prior to dissertation specialization. **Consult the website regarding this program and direct any questions to:**

Dr. Erno Sajo (Kennedy College of Sciences)  
Erno\_Sajo@uml.edu  
978-934-3288    <https://www.uml.edu/Catalog/Graduate/UMass-system/Biomedical-engineering-biotech/Doctoral-Program.aspx>

### Ph.D. in Biochemistry

The departments of Chemistry, Chemical Engineering, Clinical Lab Science and Biological Sciences have developed a program in biochemistry which results in the awarding of a Ph.D. in Chemistry. This program draws upon the special and diverse talents of these faculties, and provides chemistry graduate students with both in-breadth class work and in-depth thesis research. Emphasis is on the application of modern techniques and concepts of physical and chemical science to the solution of problems of current interest in biology and medicine. **Consult the website regarding this program and direct any questions to:**

Dr. Kwok-Fan Chow  
[kwokfan\\_chow@uml.edu](mailto:kwokfan_chow@uml.edu)  
978-934-4022

Phone: 978-934-3666

<https://stage.uml.edu/Sciences/chemistry/Programs-of-Study/Graduate/Doctoral-Program/Biochemistry.aspx>

# Doctoral Research (Ph.D.) in the Biological Sciences

## Ph.D. in Applied Biology

The program combines fundamental and rigorous training in the pursuit of new knowledge regarding the mechanisms of biological processes coupled with the skills needed to apply this knowledge in the workforce. In addition to traditional academic careers in research and education at colleges and universities and academic research hospitals and institutes, our graduates are also prepared for non-academic careers. To provide students an area of focus within the broad field of biology, the Applied Biology program includes four options:

1. **Biomedical Science**
2. **Developmental & Evolutionary Biology**
3. **Quantitative Biology & Biophysics**
4. **Cellular & Molecular Biology**

Students select their option anytime during their first two years in the program. Each option contains a list of approved advanced option graduate courses. Students are required to complete at least four advanced courses in their option and two courses outside of their option. A complete description is present below and in outline form in Appendix 1. A maximum of 9 credits may be completed at other institutions (including those from the UMass Inter-Campus Course Exchange Program); if choosing to take classes at other institutions, the student must receive prior permission from the Graduate Coordinator.

## Curriculum Description and Degree Requirements

### Year 1

*Core Competency Courses:* Each student's competency in foundational areas of biology (e.g., Biochemistry, Cell & Molecular Biology, Genetics, Developmental Biology, Evolutionary Biology) will be evaluated upon entry into the program based on their academic background, and courses will be assigned based on any identified deficiencies.

### Core Competency Courses

- BIOL.5190 Biochemistry I
- BIOL.5260 Evolutionary Biology
- BIOL.5380 Advanced Genetics
- BIOL.5420 Cell Biology
- BIOL.5670 Molecular Biology
- BIOL.5800 Developmental Biology

**Research Lab Rotations:** At least one semester of laboratory rotations with 2 different research faculty for course credit (BIOL.7210 Special Problems in Biology) is required. Students who have not matched with an advisor after the first semester-will do a second semester of laboratory rotations in two additional faculty laboratories. Rotations will be assigned to the student based on their stated interests, background and availability. At the end of each rotation students will prepare

a brief written report and deliver a 10-minute oral presentation in a simulated conference setting that will be open to all students and faculty. Students will be matched to a permanent thesis advisor by the end of the first year.

**Core Courses:** The series of core courses included in the Applied Biology Program ensure that all students develop key skills needed to be successful in completing their independent research.

### **Core Program Courses**

- BIOL.6040 Professional Communication in Science and Technology
- BIOL.6030 Graduate Colloquium Biology
- BIOL.7210 Special Problems in Biology (Rotations course)
- BIOL.6060 Applied Biology I
- BIOL.6070 Applied Biology II
- BIOL.6050 Graduate Proposal Writing Seminar

**Optional Industry Internship** – In the summer after the first year (and in some instances at later times), students may participate in an industry internship for course credit (BIOL.7070 "Internship Biology") at a biotech/biomedical company that complements their option specialization. Prior to initiating an internship, students must have completed at least one traditional academic year (fall/spring or spring/fall), have completed 18 credits and be in good academic and judicial standing. Students on F-1 or J-1 nonimmigrant status must also obtain prior approval from the International Students & Scholars Office.

### **Year 2**

In the second year of the program, under the guidance of their Ph.D. supervisor, students develop an individual dissertation research project (IDRP) plan. The Applied Biology Program Committee The advisor and student will work together to select a Dissertation Advisory Committee (in consultation with GPEC as needed) comprised of 3-4 faculty members, who will review and approve the Individualized Development Plan (IDP) (<https://myidp.sciencecareers.org/>). A **Thesis Enrollment Form** (see TOC) will be provided to the student as they form their committee. This committee will administer the qualifying examination, so it is important to select a committee early, two to four months before the anticipated exam date. Students will continue taking courses to fulfill their option specialization requirements, with the aim of completing coursework by the end of year 2.

**Comprehensive Qualifying Examination:** All students are required to take and pass a "Comprehensive Biology" qualifying examination. This exam is given in the late spring after the second year. Advanced students in good standing, generally with a master's degree, may petition to take this exam at the end of their first year. Students who fail the qualifying examination will be given one opportunity to retake the exam in the early fall of the next academic year. Students who fail the exam a second time will lose doctoral degree candidacy and, if appropriate, may be directed to complete an M.S. degree.

The qualifying examination will evaluate the students' critical thinking and the ability to apply scientific principles to address research problems, as detailed in the following learning objectives:

1. **Core knowledge.** Demonstrate familiarity with core knowledge for the student's discipline (as determined by the student's qualifying exam committee and built around/represented in the paper selection).
2. **Scientific literacy.** Demonstrate knowledge of literature relevant to the chosen articles, and the application of scientific methods to test hypotheses and understand biological processes.
3. **Critical thinking.**
  - a. Application of scientific literacy, including the ability to synthesize and integrate fundamental biological concepts presented in their coursework or literature.
  - b. Demonstrate proficiency in self-directed learning and ability to extrapolate based on their current knowledge (ie: How would one go about finding missing information? How one would formulate a hypothesis and test it?).
4. **Experimental Design and Data Analysis.** Demonstrate understanding of the significance, approach, and analysis for chosen papers.
  - a. Significance: demonstrate understanding of the context of the work and implications of the authors' hypothesis
  - b. Approach: describe experimental strategies and explain why specific methods were chosen (rather than possible alternatives); demonstrate understanding of appropriate controls (or lack of).
  - c. Analysis: demonstrate ability to interpret data presented and draw conclusions. Clearly explain any statistical analyses applied to demonstrate validity of conclusions. Discuss appropriateness of figures/tables and possible alternatives to communicate the findings.
5. **Oral Communication.** The student can organize and clearly explain their thoughts and provide rationale/support for their ideas.

The qualifying exam is based on three papers which will be chosen by the PI with input from the thesis committee. The papers will pertain to the student's dissertation work and their area of specialization. The preparation of a short research summary or an aims page from the research proposal can be useful to send to the committee to aid in selecting appropriate papers. The PI will send the papers to the student 2 weeks in advance of the exam and the student will have a full 2 weeks to prepare for the exam (and will be excused from lab work during this time).

**PI's role during the qualifying exam:** The PI is responsible for sending the papers to the student. The PI may attend the qualifying exam if the student agrees. However, as the aim is for students to demonstrate independence, the PI may only attend as an observer: the PI cannot help the student, comment or otherwise contribute to the discussion, or have a vote in the ultimate outcome of the exam. In preparation for the exam, the student can discuss *general* strategy with their PI. But the student should avoid discussing the specifics of the selected papers with their PI or other faculty.

The qualifying exam is an oral assessment and the committee's questions will center around the papers; however, the discussion can include a wider range of topics based on the responses given by the student. There are three options for the exam: Pass, Conditional Pass, and Fail. The committee will set the terms and timeline for the student to convert a Conditional Pass to a Pass. The QE Chair will deliver the results to the student by collecting statements/suggestions from committee members and completing a **Report of Examination Form** (see TOC). The Report must be submitted to the student, the PI, and the Graduate Coordinator after completion of the examination.



### Qualifying Exam Committee makeup:

1. At least three members of their dissertation committee (note: the PI is not a member of the QE committee)
  - a. If an external member cannot attend, the student and PI must find a Biological Sciences faculty member to substitute.
  - b. The committee will select one member who will serve as chair of the qualifying exam and write up the **Report of Examination Form**
2. The GPEC representative who will ensure consistency and fairness in the qualifying exam administration and serve as an advocate for the student.

Scheduling: The student must schedule their qualifying exam with their committee and the GPEC representative. If in person, the student, with assistance from the department admin, will reserve a room. If virtual, the student will create and circulate the meeting link to the committee.

### **Year 3**

In year three, students concentrate on their research and prepare their Written and Oral Dissertation Proposal. The student's proposal must be presented and approved by their Dissertation Advisory Committee before the start of the student's 4th academic year. The written proposal will be based on the student's project, using a standard grant application format as approved by the student's Dissertation Advisory Committee. The written proposal will be submitted to the Dissertation Advisory Committee at least 2-weeks prior to the scheduled oral presentation. The student will present and defend their proposal orally to their Dissertation Advisory Committee who will approve the proposal or recommend revisions. A **Report of Examination Form** (see TOC) will be provided to the student upon completion of the presentation. In instances where the Dissertation Advisory Committee deems that the student's proposal is not of sufficient quality, the student may be allowed to re-submit a revised written proposal and re-present/defend it. It is expected that students would submit their proposals to the NSF, NIH or another funding agency for funding consideration. If students are unable to successfully defend their proposal after a second attempt, they will be advised to pursue completion of a Master's degree.

### **Years 4-5**

In years 4 and 5 students will work closely with their dissertation supervisor and Advisory Committee to complete their research and dissertation. After successfully defending their proposal, each student will meet with his/her Dissertation Advisory Committee every 6-12 months to provide updates on progress as well as immediate and long-term plans. The student will prepare an "Action Item Report" after each meeting that will include specific milestones and a detailed time-line for completion. These reports will be approved by the student's committee, submitted to the Applied Biology Program Committee and included within the student's academic record. As students begin to make significant progress in their research, they will also be required to give an interim report in the form of a seminar in the Department of Biological Sciences Colloquium series. Once students have completed a significant body of publishable research, they will prepare a written dissertation and present a public oral defense to their Dissertation Advisory Committee.

### **Summary of Graduation Requirements**



1. Completion of 60 credits min: 30 credits of coursework and 30 credits of dissertation research.
2. Participate in a Teaching Assistantship and/or Industry Internship.
3. Pass the Qualifying Exam in the appropriate Specialization Option area.
4. Provide regular updates (at least annually) to a Dissertation Advisory Committee and submit written action item reports after each meeting.
5. Write a Dissertation Proposal for approval by the Dissertation Advisory Committee and provide a public oral defense.
6. Deliver a public oral interim report generally in the 4th year.
7. Deliver a written and oral defense of the Dissertation.
8. Submit the Dissertation
9. Have a minimum cumulative GPA of 3.00
10. Meet all other University requirements

### **Doctoral Dissertation Research**

In addition to the other requirements of the Graduate School, a candidate for a doctoral degree must complete an acceptable dissertation. The dissertation must satisfy the following criteria: 1) it should demonstrate the candidate's intellectual competence and maturity in the field of concentration; 2) it should make an original and valid contribution to knowledge; and 3) it should be an individual achievement and the product of independent research. Although doctoral dissertations may result from a project involving collaboration of several scholars, the individual contribution of each doctoral candidate must be substantial, clearly identifiable, and presented separately. The Committee will judge the completed dissertation in terms of the candidate's ability to review and make critical use of the literature; to formulate a problem, develop appropriate methodology, and work systematically toward a solution; and to summarize the material or data and draw conclusions from them. The writing should be of publishable quality.

### **Selection of Dissertation Committee members and Chair:**

The Dissertation Committee is selected by the student and the research advisor in accordance with the policy of the department. The Dissertation Committee shall consist of at least three members, one of whom is the research advisor and at least two of whom shall be from the student's major department. An additional outside expert from industry or another university may be a member of the committee, but that individual must possess academic credentials which would qualify them to serve as a member of the University of Massachusetts Lowell faculty. The responsibilities of the Dissertation Committee shall be to:

1. Approve the research topic and research proposal.
2. Supervise the progress of the dissertation.
3. Read, evaluate, and approve or disapprove of the written dissertation.
4. Hear, evaluate and approve or disapprove of the oral defense of the dissertation.
5. Report the completion of all dissertation requirements to the department and Graduate School.

**Selection of Committee Chair:** The student will select a committee member (with UML affiliation, not the student's advisor) to head their committee. The Committee Chair's role is to provide guidance for the committee and to be a resource for the student should any issues arise. The Committee Chair must agree to and accept this role.

A **Dissertation Committee Meeting Report** (see TOC) will be completed by the student and committee upon completion of each meeting.

### **Dissertation Credits**

Graduate students who have completed all the requirements except the writing and defense of the dissertation and who do not need to use university resources must register for Continued Matriculation (CONT.7010 for Ph.D.) and pay a fee each semester until they graduate. (**Note: International students on F-1 or J-1 visas must be registered for a minimum of nine credits each semester**).

### **Dissertation Preparation**

Every graduate student who completes a dissertation is required to bear the cost of microfilming and of binding two copies of the manuscript for the University's files. Copywriting is optional and available for an additional fee.

### **Dissertation Defense**

The defense is open to the public. At least two weeks prior to the dissertation defense, announcements of the defense that list the graduate student's name, dissertation title, and place and time of the defense, must be submitted to the following:

1. UMass Lowell Today - online news distribution that includes dissertation defense dates.
2. Chairperson of the department
3. College Dean
4. Graduate School Dean for posting and distribution.

**Please see TOC for guidelines on the defense.**

**Procedure for students accepted into a doctoral program who elect to instead obtain the Master's degree and leave the university.**

1. The student must file an Academic Petition requesting to be changed from the doctorate to the master's degree program.
2. The student's research advisor must submit to the Records Office, grade change forms withdrawing the student from doctoral dissertation and adding master's thesis for the appropriate number of credits.
3. The student must complete all required courses for the master's degree, compile a minimum 3.0 grade point average, successfully defend their thesis, and complete the clearance process at the Graduate School.
4. All graduate courses (and undergraduate coursework used for graduate credit), whether taken for the original doctoral program or for the master's degree, will be included in the grade point average and listed under the master's degree program.

## Written Proposal Guidelines for M.S. Thesis and Ph.D. Dissertation

The Department of Biological Sciences accepts proposals written in formats that follow either NSF or NIH guidelines. Below are summaries of these guidelines. Please check online for specific details regarding these guidelines and ask your research advisor which guidelines are most appropriate for your research. M.S. Thesis proposals are often at least 6 pages, and must be no longer than 12 pages (including figures and excluding references). Ph.D. Proposals are expected to be 12 pages (including figures and excluding references).

NSF Guidelines: <https://jef.works/blog/2017/10/15/NSF-GRFP-application-tips-and-example/>

NIH Guidelines: <https://www.niaid.nih.gov/grants-contracts/three-new-f31-sample-applications>

### Suggested Formatting:

1. Standard 8.5" x 11" page size
3. 12-point, Times New Roman font
4. 10-point font may be used for references, footnotes, figure captions and text within figures
5. 1" margins on all sides
6. Single-spaced (approximately 5 lines per inch) or greater line spacing. Do not use line spacing options such as "exactly 12 point," that are less than single spaced.

**1. Cover page** with proposal title, student name, and advisor name

**2. Project Summary:** A single page overview of the research.

- NIH Specific Aims page, which summarizes the context and significance of the work, a short description of aims, and a summary of impact. Details and examples can be found:
  - <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6133727/>
  - <https://www.biosciencewriters.com/NIH-Grant-Applications-The-Anatomy-of-a-Specific-Aims-Page.aspx>
- NSF Project Summary page often consists of three parts: one paragraph that describes the research; one paragraph on the intellectual merit of the proposed research; and one paragraph on the broader impacts of the proposed research. **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes." Details and examples can be found:
  - <https://grantwriting.stanford.edu/project-summary/>
  - <https://grantrainingcenter.com/blog/important-part-nsf-proposal-summary-page/>

**3. Project Description (6-12 pages):**

### Research Proposal

A. Background and literature review

- What is the background needed to appreciate your proposed research?
- What is the present state of knowledge in your field?
- What is the gap in knowledge?
- How will your proposed research address this gap?

B. Research Strategy

- Most proposals will be separated into several specific aims, each of which addresses a separate hypothesis
- What approach(es), materials, and methods will be used for each aim?
- How will the data be analyzed?
- How will the results be interpreted in light of the hypothesis?
- What are potential pitfalls or alternative approaches that could be used?

C. Significance of the research

- What impact will this proposal have for the field?

**References Cited**

Reference information is required in the text of the proposal as citations and in the references cited section. All reference citations must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication.

**Optional components (determined by Advisor)**

An advisor may require their student to produce other documents (ex: a detailed methods section, comprehensive background/introduction, or additional tables/figures). These are allowed, however will not be considered by the proposal defense committee.

## M.S. Thesis or Ph.D. Dissertation Proposal Defense Guidelines

### Timing of the Proposal Defense:

	M.S. Thesis	Ph.D. Dissertation
Select committee	In first or second semester	Before end of 4th semester
Thesis/dissertation enrollment form	When forming a committee or in the first semester enrolling for thesis credits.	Submit before end of 4th semester
Written proposal	Submitted to committee members no less than two weeks before the oral presentation	
Completion of oral proposal defense	Cannot be in the same semester as thesis defense & graduation	Before end of 6th semester, cannot be in the same semester as thesis defense & graduation
Format	Oral defense (public option recommended)	Public oral defense
Advertising	If public: At least 2 weeks in advance	At least 2 weeks in advance
Report of examination form	Immediately after oral presentation, signed by PI, committee members, and student. Submit to graduate coordinator.	

**Scheduling and Advertising:** It is the responsibility of the student, with assistance from the Biology Administrator and/or mentor, to reserve an appropriate venue (e.g., OS235) for the defense. The room should be reserved for 2 hours. The date, time, and defense title should be shared with the Biology Administrator at least two weeks in advance so that the defense can be advertised within the department and University News (note if this step is not taken, the proposal defense can be canceled by the Graduate Advisor). The student should visit the conference room the day prior to the defense to be sure there are no technical issues with connecting their laptop to the projector. A backup copy of the talk should be brought on a USB drive.

**Oral Defense Structure:** The proposal defense is open to the public (required for PhD, recommended for MS) and will be divided into five sections. Interruptions from the audience are discouraged (however, brief critical clarifications/question from the committee, that won't derail presentation, are allowed)

1	Proposal Presentation (~45min)	Open to Public
2	Questions from Public	Open to Public
3	Questions from Committee	Open to Public
4	Closed door questions	Private - Student, PI, Committee
5	Committee Convenes	PI and Committee
6	Decision delivered to student	PI

**Outcomes:**

Pass: The student has completed and passed all portions of the exam.

Fail: The student has not completed and passed all portions of the exam. An opportunity for re-examination may be granted. The committee will outline requirements and recommendations for the student to address prior to re-examination.

Conditional pass: The student has minor issues to be fixed, and once addressed will Pass the exam. The committee will outline requirements and recommendations for the student to Pass the exam.

**PI's role during the defense:** The PI will introduce the student. As the aim of the defense is to examine the student's preparedness and scientific knowledge, the PI should otherwise refrain from speaking or giving assistance/visual cues to the student during the defense. The PI will deliver the decision to the student.

**Committee Chair's role:** At the beginning of the defense, the Committee Chair will remind the committee and audience of the rules for the defense. After the presentation has concluded, the Chair opens public questioning (step 2). After the audience has had time to ask questions, the Chair invites the public to stay or leave prior to committee questions (step 3) and asks the public to leave for the closed door session (step 4). While all committee members are encouraged to avoid sensitive questions during the public sessions, the Chair can defer questions to the closed door session.

The student is not expected or required to provide refreshments for this meeting.

## Ph.D. Dissertation Committee Meetings

Committee meetings are an essential component of the dissertation process and are an excellent opportunity to get feedback and advice from outside researchers. These meetings are more informal than presentations/defenses. While the student should prepare slides to present their work/plans and guide the discussion, the meeting is more of a conversation than a presentation.

### **Formatting of the Dissertation Committee meeting presentation:**

- Prepare an ~45 min presentation updating the committee on progress since the last meeting.
- The student should expect to be interrupted by committee members, and may not get to cover the entire presentation within the allotted time.
- In addition to data, the student should also report on publications/presentations/posters accomplished or in progress.
- Include plans for upcoming work.

### **Timing:**

1. The committee meeting should be booked well in advance to assure all members can be present. Commonly, a poll is circulated to find times convenient for all members.
2. Prior to each committee meeting, the student will meet one-on-one with the committee Chair to discuss progress and any issues.
3. After the proposal defense, the committee should meet at least annually, more frequently if deemed necessary by the PI, Committee, or student.
4. After the meeting, the student must submit a signed Dissertation Committee Meeting Report (which includes written action items) to the Biological Sciences Graduate Coordinator, outlining what work will be accomplished before the next meeting.

**Scheduling:** It is the responsibility of the student, with assistance from the Biology Administrator and/or mentor, to reserve an appropriate venue (e.g., OS219) for the meeting. The room should be reserved for 2 hours. The student should visit the conference room the day prior to the meeting to be sure there are no technical issues with connecting their laptop to the projector. A backup copy of the talk should be brought on a USB drive.

For virtual meetings, it is the student's responsibility to create and circulate a link for the meeting. Prior to the meeting the student should familiarize themselves with the software, ensure their camera and microphone are functioning, and know how to share their screen.

**Meeting structure:** Committee meetings are more of a discussion than a traditional presentation. The student will present their work and future plans to the committee, who may interrupt at any time with questions/comments.

**PI's role in the meeting:** The PI introduces the student. As the meeting is meant to assess student's performance and progress, the proceedings should be led by the student, with the PI serving in a support capacity to help clarify if needed.



**Committee Chair's role in the meeting:** The Chair will meet with the student one-on-one in advance of the Committee meeting and will provide opportunities for the student to bring up any issues in their lab or with their PI that need addressing. The Chair will assure that the committee drives the discussion based on the student's presentation and any questions or issues that arise.

The student is not expected or required to provide refreshments for this meeting.

## M.S. Thesis and Ph.D. Dissertation Defense Guidelines

### Timing of the Defense:

	M.S. Thesis	Ph.D. Dissertation
Written thesis/dissertation	Submitted to committee members no less than two weeks before the oral presentation	
Completion of thesis/dissertation oral defense	Cannot be in the same semester as proposal defense	
Format	Public oral defense	
Advertising	At least 2 weeks in advance	
Report of examination form	Immediately after defense, signed by PI, committee members, and student. Submit to graduate coordinator.	

**Scheduling and Advertising:** It is the responsibility of the student, with assistance from the Biology Administrator and/or mentor, to reserve an appropriate venue (e.g., OS235) for the defense. The room should be reserved for 3 hours. The date, time, and defense title should be shared with the Biology Administrator at least two weeks in advance so that the defense can be advertised within the department and University News (note if this step is not taken, the proposal defense can be canceled by the Graduate Advisor). The student should visit the conference room the day prior to the defense to be sure there are no technical issues with connecting their laptop to the projector. A backup copy of the talk should be brought on a USB drive.

**Oral Defense Structure:** The proposal defense is open to the public and will be divided into five sections. Interruptions from the audience are discouraged (however, brief critical clarifications/question from the committee, that won't derail presentation, are allowed)

1	Presentation (~45min)	Open to Public
2	Questions from Public	Open to Public
3	Questions from Committee	Open to Public
4	Closed door questions	Private - Student, PI, Committee
5	Committee Convenes	PI and Committee
6	Decision delivered to student	PI

**Outcomes:**

Pass: The student has completed and passed all portions of the exam. No further edits are required on the thesis/dissertation.

Fail: The student has not completed and passed all portions of the exam. An opportunity for re-examination may be granted. The committee will outline requirements and recommendations for the student to address prior to re-examination.

Conditional pass: The student has minor issues to be fixed, and once addressed will Pass the exam. The committee will outline requirements and recommendations for the student to Pass the exam.

**PI's role during the defense:** The PI will introduce the student. As the aim of the defense is to examine the student's preparedness and scientific knowledge, the PI should otherwise refrain from speaking or giving assistance/visual cues to the student during the defense. The PI will deliver the decision to the student.

**Committee Chair's role:** At the beginning of the defense, the Committee Chair will remind the committee and audience of the rules for the defense. After the presentation has concluded, the Chair opens public questioning (step 2). After the audience has had time to ask questions, the Chair invites the public to stay or leave prior to committee questions (step 3) and asks the public to leave for the closed door session (step 4). While all committee members are encouraged to avoid sensitive questions during the public sessions, the Chair can defer questions to the closed door session.

The student is not expected or required to provide refreshments for this meeting.

## **Graduate student questions about admissions, research, courses, etc.**

**1. What is required for a student to change from a thesis to non-thesis option during their Master's degree program?** Any student (US or international) who wants to change their Master's program of study from thesis to non-thesis option must file an academic petition. If the student has taken thesis courses in previous semesters and earned a grade of "PR" (In Progress) those grades will be changed to "W" (Withdrawn) except for international students (see #3 below).

**2. What appears on the transcript of an international student who changes from a thesis to a non-thesis option?** Can a grade of "NC" (No Credit) be granted for international students in these circumstances? In the past, if a student earned a grade of "PR" for thesis work, the "PR" was changed to "U" (Unsatisfactory) on the student's transcript. In this circumstance, the "PR" is now changed to a "NC" (No Credit) on the student's transcript. The United States Bureau of Citizenship and Immigration Services (USCIS) requires that international graduate students be registered for a minimum of 9 credits per semester. When a student withdraws from classes s/he does not earn any credits, so the students cannot receive a "W." For an international student, this would mean that s/he is out of status and jeopardizes the student visa.

**3. Why can't an international student be given an "S" (Satisfactory) for these courses?** A grade of "S" signifies that the student has satisfactorily completed the work. To grant a grade of "S" would raise legal issues as official records would indicate the completion of work that was never completed.

**4. If a Master's or Doctoral student receives a "PR" for thesis or dissertation research, when and how is the grade changed to an "S?"** When the signed Thesis/ Dissertation is turned into the library for binding.

**5. If I want to change research advisors, how do I go about this?** To change advisors, the student must submit an academic petition with all required signatures of the coordinator and new dissertation advisor. The petition should clearly state that the previous thesis or dissertation project work is satisfactory and will carry over.

**6. If a student changes their thesis or dissertation advisor and s/he received a "U" in previous thesis/dissertation research courses(s), does that carry over?** Yes, the previous research will carry over. The Graduate Coordinator determines whether previous work will or will not be counted towards the degree and notes this on the petition. The grade of "U" remains unless GPAC approves the grade change.

**7. What if the previous work does not carry over; does the "U" still appear on the transcript?** Yes.

**8. How does the Registrar's office know who the advisor is?** Theses and dissertation advisors are recorded in ISIS. An academic petition is required to change advisors to ensure that records are accurate.

**9. What happens if there is no advisor listed for a student who is registered for thesis or dissertation research?** Please Notify the Biological Sciences Department Administrator.

**10. What does a student need to do to apply for graduation?** Applying for graduation is a multi-step process. At the beginning of the semester a student intends to graduate, they must first submit a “Declaration of Intent to Graduate Form” which is available at:

<https://www.uml.edu/thesolutioncenter/Forms/Academic-Forms.aspx> to the Biological Sciences Graduate Coordinator.

The Graduate Coordinator checks the student’s records. If all is in order, the student will be applied for graduation. The Intent to Graduate Form must be received by a specific date for Spring Graduation or Fall Graduation. If additional action is required (i.e., there is a problem with the number of credits towards the degree or the student’s GPA), the student receives a letter specifying what actions are required to graduate. The specified actions and the Declaration of Intent to Graduate Form must be received by the above specified dates to graduate on time.

**Appendix I. Applied Biology Ph.D. Curriculum Outline**

<b>Major Required (Core) Courses (Total courses required = 7)</b>		
<b>Course Number</b>	<b>Course Title</b>	<b>Credit Hours</b>
BIOL.6040	Professional Communication in Science & Technology	3
BIOL.6060	Applied Biology I	1
BIOL.6070	Applied Biology II	1
BIOL.6030	Graduate Colloquium Biology	1
BIOL.6030	Graduate Colloquium Biology	1
BIOL.6050	Graduate Proposal Writing Seminar	1
BIOL.7210	Special Problems in Biology	3
	SubTotal # Core Credits Required	11
<b>Other/Elective Course Choices (Total courses required = 7) (attach list as needed)</b>		
BIOL.XXXX	Competency Course*	3
BIOL/other	Competency Course or Advanced Elective**	3-4
BIOL/other	Special Problems in Biology or Advanced Elective	3
BIOL/other	Advanced Elective	3-4
BIOL/other	Advanced Elective	3-4
BIOL/other	Advanced Elective	3-4
BIOL/other	Advanced Elective	3-4
	SubTotal # Elective Credits Required	21-26
<b>Curriculum Summary</b>		
Total number of courses required for the degree		14
Total credit hours required for degree		60
<b>Prerequisite or Other Additional Requirements:</b>		
Students will also complete 23-28 credits of Ph.D. Dissertation Applied Biology		

**Suggested course load for first two years of Ph.D.:**

<b>Semester I</b>	<b>Cr</b>	<b>Semester II</b>	<b>Cr</b>
<b>BIOL.6040 Professional Communication in Science &amp; Technology</b>	<b>3</b>	<b>BIOL.6030 Graduate Colloquium</b>	<b>1</b>
<b>BIOL.6060 Applied Biology I</b>	<b>1</b>	<b>BIOL.6070 Applied Biology II</b>	<b>1</b>
<b>BIOL.7210 Special Problems in Biology</b>	<b>2</b>	<b>BIOL.7210 Special Problems in Biology (or) Core Competency/Advanced Elective</b>	<b>3</b>
<b>Core Competency Course</b>	<b>0-3</b>	<b>Core Competency/Advanced Elective/Special Problems in Biology</b>	<b>3-4</b>
<b>Dissertation credits</b>	<b>0-3</b>	<b>Dissertation credits</b>	<b>0-3</b>
<i><b>Total Semester Course Credits</b></i>	<i><b>9</b></i>		<i><b>9</b></i>
<b>Semester III</b>	<b>Cr</b>	<b>Semester IV</b>	<b>Cr</b>
<b>BIOL.6030 Graduate Colloquium</b>	<b>1</b>	<b>BIOL.6050 Graduate Proposal Writing Seminar</b>	<b>1</b>
<b>Core Competency/Advanced Elective</b>	<b>3-4</b>	<b>Advanced Elective</b>	<b>3-4</b>
<b>Advanced Elective</b>	<b>3-4</b>	<b>Advanced Elective</b>	<b>3-4</b>
<b>Dissertation credits</b>	<b>0-2</b>	<b>Dissertation credits</b>	<b>0-2</b>
<i><b>Total Semester Course Credits</b></i>	<i><b>9</b></i>		<i><b>9</b></i>

**Appendix II.** A pdf of this form will be provided to you by the graduate advisor for the purpose of enrolling in thesis or dissertation research



## Department of Biological Sciences

### Thesis/Dissertation Enrollment Form

Dissertation research is a requirement for the Applied Biology PhD program. During thesis (BIOL.7430) or dissertation (BIOL.7530) work, the student concentrates on an in-depth, independent, scholarly investigation of a contemporary biological problem. It is the student's responsibility to ensure that this contract is filled in and approved before the project is commenced.

Student Name \_\_\_\_\_ ID# \_\_\_\_\_

The student must consult with the research advisor and the [graduate student manual](#) to assure proper committee make up.

#### Committee Members

Biological Sciences Faculty Advisor \_\_\_\_\_

Committee Chair \_\_\_\_\_

Second Committee member \_\_\_\_\_

Additional Committee member  
(if needed) \_\_\_\_\_

Additional Committee member  
(if needed) \_\_\_\_\_

The student presents to the Committee a proposal of intended research and obtains the Committee's approval of the research topic. After completing the written thesis, the student gives an oral presentation of her/his results to the Thesis Committee.

Projected Proposal Presentation Date \_\_\_\_\_

Faculty Advisor \_\_\_\_\_  
Print Signature

Graduate Student \_\_\_\_\_  
Print Signature

By signing above the student confirms that permission has been obtained from his/her thesis advisor to complete the MS Biological Sciences thesis requirements. The student also agrees to comply with posted guidelines for thesis research and UML policies concerning academic integrity.

<https://www.uml.edu/Catalog/Graduate/Policies/Grading-Policies.aspx>  
<https://www.uml.edu/Catalog/Graduate/Policies/Academic-Integrity.aspx>

Graduate Coordinator \_\_\_\_\_  
Print Signature

\*The Graduate Coordinator (or Department Chair if necessary) signature affirms approval of the Department Graduate Academic Committee.



**Appendix III.** A pdf of this form will be provided to you by the graduate advisor for the purpose of providing updates to your Dissertation Committee



## Department of Biological Sciences

### Dissertation Committee Meeting Report

The student should provide this form to the committee for the meeting. It is to be completed and signed by all upon conclusion of the meeting. The student shall submit a copy of the completed form to the Biological Sciences Graduate Coordinator and committee members. It is the student's responsibility to ensure that a report is submitted to the committee and feedback provided by the committee ***at least once per year.***

Student Name	<input type="text"/>	ID#	<input type="text"/>
Date of report	<input type="text"/>		
Last report submitted	<input type="text"/>		
Next meeting date	<input type="text"/>		

<b>Committee Member Certification</b>	<input type="text"/>	<input type="text"/>
Biological Sciences Faculty Advisor	Print	Signature
Departmental Committee member	<input type="text"/>	<input type="text"/>
	Print	Signature
Second Committee member	<input type="text"/>	<input type="text"/>
	Print	Signature
Additional Committee member (If needed)	<input type="text"/>	<input type="text"/>
	Print	Signature
Additional Committee member (If needed)	<input type="text"/>	<input type="text"/>
	Print	Signature

By signing above the committee confirms that the student has presented a progress report for committee review.

**Summary of progress since last report (attach separate pages if necessary).**

**Committee recommendations (attach separate pages if necessary).**

Graduate Student	<input type="text"/>	<input type="text"/>
	Print	Signature
Graduate Coordinator	<input type="text"/>	<input type="text"/>
	Print	Signature

**Appendix IV.** A pdf of this form will be provided to you upon completion of your thesis or dissertation proposal and defense presentations.



**Department of Biological Sciences**

**Report of Examination**

This form should be used for MS Thesis Proposal Presentation/Defense, Ph.D. Proposal/Dissertation Defense/Oral Exam. The student must present this form to the committee on the date of the presentation/exam. PASS should only be recorded in the case where ALL portions of the exam are completed. In the case of FAIL, please indicate recommendations concerning the earliest opportunity for re-examination, if this possibility is to be granted.

Student Name \_\_\_\_\_ ID# \_\_\_\_\_

Examination/Presentation Date \_\_\_\_\_

**Indicate PASS or FAIL in the appropriate box.**

MS Proposal Presentation	<input type="checkbox"/> PASS	<input type="checkbox"/> FAIL	<input type="checkbox"/> Conditional PASS
MS Thesis Defense	<input type="checkbox"/> PASS	<input type="checkbox"/> FAIL	<input type="checkbox"/> Conditional PASS
Ph.D. Proposal Defense	<input type="checkbox"/> PASS	<input type="checkbox"/> FAIL	<input type="checkbox"/> Conditional PASS
Ph.D. Dissertation Defense	<input type="checkbox"/> PASS	<input type="checkbox"/> FAIL	<input type="checkbox"/> Conditional PASS
Qualifying Exam	<input type="checkbox"/> PASS	<input type="checkbox"/> FAIL	<input type="checkbox"/> Conditional PASS

Recommendations:

**Committee Members Present**

Biological Sciences Faculty Advisor \_\_\_\_\_  
 Print \_\_\_\_\_ Signature \_\_\_\_\_

Departmental Committee member \_\_\_\_\_  
 Print \_\_\_\_\_ Signature \_\_\_\_\_

Second Committee member \_\_\_\_\_  
 Print \_\_\_\_\_ Signature \_\_\_\_\_

Additional Committee member (If needed) \_\_\_\_\_  
 Print \_\_\_\_\_ Signature \_\_\_\_\_

Additional Committee member (If needed) \_\_\_\_\_  
 Print \_\_\_\_\_ Signature \_\_\_\_\_

By signing above the committee certifies the exam results.

Student Name \_\_\_\_\_  
 Print \_\_\_\_\_ Signature \_\_\_\_\_

Graduate Coordinator \_\_\_\_\_  
 Print \_\_\_\_\_ Signature \_\_\_\_\_

**Appendix V.** Skills you (may have) learned as a graduate student in the Biological Sciences

Most resumes and CVs have a subsection where you list the skills and techniques you learned during your coursework. Employers look to this list when evaluating you as an applicant, but often times, students forget the skills they learned over the course of their graduate (and undergraduate) career and only describe the topic they worked on, e.g., thesis or dissertation. Below, we provide a short list of skills, techniques, and technologies you may have learned to jog your memory. This list is not meant to be exhaustive.

pipetting	sterile technique	solution prep	protein precipitation
column chromatography	batch ion-exchange chromatography	Protein assays (Biorad, BCA)	Cell culture (mammalian)
SDS PAGE	Electrophoresis	Western blot	PCR
bacterial expression	plasmid purification	Southern blots	Affinity purification
cell viability assays	hemocytometry	immune tissue ID	gel diffusion assays
antibody isolation	serology	ultracentrifugation	Primer Design
micro ELISA	lab animal handling	enzyme purification	protein expression
histological staining	hematology	R data analysis	Python data analysis
Perl programming	kinematic analysis	embryo culture	immunohistochemistry
in-situ hybridization	RNAi	Electroporation	DNA sequencing
microtomy	paraffin/resin embedding	brightfield microscopy (upright, inverted)	widefield fluorescence microscopy
gram staining	dissection (macro, micro)	parasite floatation assays	taxonomy
electron microscopy	confocal laser scanning microscopy	atomic force microscopy	spreadsheet maintenance

## Important milestones – MS thesis in Biological Sciences (all options)

See Grad Handbook for specific course requirements for each program option

Here's a list of [grad-level courses](#) & semesters they're typically offered.

Courses taken at other institutions, including through ICX, are only allowed with prior permission of the Graduate Coordinator.

	Fall	Spring	Summer
First year	<ul style="list-style-type: none"> <li>• Courses (full time is 9 credits)</li> <li>• Conduct research (enroll in thesis credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Courses (full time is 9 credits)</li> <li>• Conduct research (enroll in thesis credit)</li> <li>• Write MS thesis proposal with PI</li> <li>• Select MS thesis committee with PI               <ul style="list-style-type: none"> <li>• Submit Thesis Enrollment Form</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Option to conduct research               <ul style="list-style-type: none"> <li>• discuss with PI</li> </ul> </li> <li>• Option to <b>defend MS thesis proposal</b> <ul style="list-style-type: none"> <li>• Proposal defense can be committee member only or can be open to public</li> <li>• Submit Report of Examination</li> </ul> </li> </ul>
Second year	<ul style="list-style-type: none"> <li>• Courses (full time is 9 credits)</li> <li>• Conduct research (enroll in thesis credit)</li> <li>• Option to defend MS thesis proposal, if not defended over summer               <ul style="list-style-type: none"> <li>• The proposal defense must occur <i>at least one semester</i> before the final thesis defense</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• At beginning of semester, submit <a href="#">Request for Clearance</a> form to determine graduation eligibility</li> <li>• Courses (full time is 9 credits)</li> <li>• Conduct research (enroll in thesis credit)</li> <li>• Write MS thesis under supervision of PI</li> <li>• <b>Defend MS thesis</b> <ul style="list-style-type: none"> <li>• It is recommended that thesis defense is open to public</li> <li>• At least two weeks before MS thesis defense, formally schedule &amp; advertise via UML</li> <li>• Submit Report of Examination</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Option to defend MS thesis, if not defended in fourth semester</li> </ul>

Important contacts: Graduate Coordinator – Jeff Moore, Olsen 256, [Jeffrey\\_Moore@uml.edu](mailto:Jeffrey_Moore@uml.edu)

Biology Administrator – Irma Silva, Olsen 234, [Irma\\_Silva@uml.edu](mailto:Irma_Silva@uml.edu)

## Important milestones – PhD in Applied Biology

See Grad Handbook for requirements for specific program options

Here's a list of [grad-level courses](#) & semesters they're typically offered.

	Fall	Spring	Summer
<b>First year</b>	<ul style="list-style-type: none"> <li>• Courses (full time is 9 credits)               <ul style="list-style-type: none"> <li>• Suggested:                   <ul style="list-style-type: none"> <li>○ BIOL.6060 Applied Bio I</li> <li>○ BIOL.6030 Grad Colloquium</li> <li>○ Electives</li> </ul> </li> </ul> </li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Courses (full time is 9 credits)               <ul style="list-style-type: none"> <li>• Suggested:                   <ul style="list-style-type: none"> <li>○ BIOL.6070 Applied Bio II</li> <li>○ BIOL.6030 Grad Colloquium</li> <li>○ Electives</li> </ul> </li> </ul> </li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct research               <ul style="list-style-type: none"> <li>• discuss with PI</li> </ul> </li> </ul>
<b>Second year</b>	<ul style="list-style-type: none"> <li>• Courses (full time is 9 credits)               <ul style="list-style-type: none"> <li>• Suggested:                   <ul style="list-style-type: none"> <li>○ BIOL.6050 Grad Proposal Writing</li> </ul> </li> </ul> </li> <li>• Select PhD Dissertation Advisory Committee with PI               <ul style="list-style-type: none"> <li>• Submit Thesis Enrollment Form</li> </ul> </li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Courses (full time is 9 credits)               <ul style="list-style-type: none"> <li>• Suggested:                   <ul style="list-style-type: none"> <li>○ BIOL.6040 Professional Communication</li> </ul> </li> </ul> </li> <li>• <b>Qualifying exams</b> <ul style="list-style-type: none"> <li>• March – deadline to choose dissertation committee</li> <li>• May-June – qualifying exams</li> </ul> </li> <li>• Write PhD dissertation proposal with PI</li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Option to <b>defend PhD dissertation proposal</b> <ul style="list-style-type: none"> <li>• Proposal defense must be open to public</li> <li>• At least two weeks before proposal defense, formally schedule &amp; advertise via UML</li> <li>• Submit Report of Examination</li> </ul> </li> <li>• Conduct research               <ul style="list-style-type: none"> <li>• Discuss with PI</li> </ul> </li> </ul>
<b>Third year &amp; beyond</b>	<ul style="list-style-type: none"> <li>• Option to defend PhD dissertation proposal, if not defended in second year</li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Schedule <b>committee meetings</b> once a year               <ul style="list-style-type: none"> <li>• Submit PhD Dissertation Committee Meeting Report</li> </ul> </li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct research               <ul style="list-style-type: none"> <li>• discuss with PI</li> </ul> </li> </ul>
<b>Final year</b>	<ul style="list-style-type: none"> <li>• In penultimate semester, write PhD dissertation with PI (<a href="#">UML guidelines</a>)</li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• In final semester, <b>defend PhD dissertation</b> <ul style="list-style-type: none"> <li>• At beginning of semester, submit <a href="#">Request for Clearance</a> form to determine eligibility</li> <li>• At least two weeks before dissertation defense, formally schedule &amp; advertise via UML (                   <ul style="list-style-type: none"> <li>• Submit Report of Examination</li> </ul> </li> </ul> </li> <li>• Conduct research (enroll in dissertation credit)</li> </ul>	<ul style="list-style-type: none"> <li>• Live your life as a newly minted PhD!</li> </ul>

Important contacts:

Graduate Coordinator – Jeff Moore, Olsen 256, [Jeffrey\\_Moore@uml.edu](mailto:Jeffrey_Moore@uml.edu)

Biology Administrator – Irma Silva, Olsen 234, [Irma\\_Silva@uml.edu](mailto:Irma_Silva@uml.edu)