

Graduate Student Handbook

For the degree of
Master of Applied and
Environmental Biology

Department of Biological Sciences

**Missouri University
of Science and Technology**

Revised August, 2015

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Introduction

The Department of Biological Sciences offers an interdisciplinary approach to addressing problems in applied and environmental biology. The program emphasizes research that focuses on understanding environmental responses and adaptations in biological systems at the molecular, cellular, organismal, and ecological levels. In addition to independent research, faculty members collaborate with other science and engineering disciplines on the Missouri University of Science and Technology (Missouri S&T) campus through collaborations with the Ceramic Engineering, Chemical Engineering, Chemistry, Civil Engineering, Computer Science, Computer and Electrical Engineering, Geology and Geophysics, Mechanical Engineering and Metallurgical Engineering departments. The degree of Masters of Biology in Applied and Environmental Biology will uniquely provide the student with superior understanding and appropriate skills to recognize and develop procedures for addressing problems in applied and environmental fields of biology.

Objectives of the Program

The major objectives of the Master's Program in Applied and Environmental Biology are to enable students to 1) take coursework that will provide a strong background in biological sciences, 2) design and plan experiments that will address hypotheses they develop and yield useful data, 3) engage in intellectual discussions with each other, faculty members and visiting professionals, and 4) participate in professional scientific meetings.

Qualifications of Prospective Students

Students seeking admission to the graduate degree program in *Applied and Environmental Biology* will be required to meet the standard admissions requirements as defined in the Missouri S&T Graduate Catalog. Normally, it is expected that a student applicant will

have a bachelor's degree in biology or a related field. Specifically, it is recommended that a student should have:

- A minimum of 30 semester hours of biology course work, including:
 - Introductory Biology
 - Cellular Biology
 - Genetics
 - Ecology
 - Microbiology
- At least one course in Organismal Biology (Zoology, Botany, Human Anatomy, Human Physiology, etc.)
- At least two laboratory courses (May be included as part of the courses above)
- Two semesters of Organic Chemistry
- Two semesters of Physics (Algebra or Calculus-based)
- One semester of Calculus
- One semester of Statistics
- One semester of Geology or Earth Science
- One semester of Biochemistry
- A cumulative undergraduate GPA of 3.0 or higher (on a 4.00 scale)
Students with cumulative GPA as low as 2.75 may be accepted, depending on results of Graduate Records Examination, academic performance during the last 60 semester hours of undergraduate work, and recommendation by the Graduate Admissions Committee.

If a student's preparation for formal graduate study (including physical sciences or mathematics) is judged to be inadequate, a program of prerequisite course work may be outlined for the purpose of properly supplementing his/her preparation. Such courses will not be credited as course requirements for the degree.

Admission Policies

The prospective student shall have a Bachelor's degree in a biology-related discipline with an overall GPA of 3.0 or better on a 4.0 grade scale. An official transcript must be submitted. The application for admission to the graduate program must also be accompanied by a letter, to the Chair of the Graduate Admissions Committee, giving a brief summary of the applicant's background and the specific areas of research interest, if known at the time. Three letters of recommendation are also required.

The Verbal, Quantitative, and Analytical Writing portions of the Graduate Record Examination (GRE) must be taken. International and national students should take the examination before admission, and have a Quantitative score of at least 600 (148), a Verbal score of 370 (144), and an Analytical Writing score of at least 4. The Department requires a minimum TOEFL score of 550 (paper score) or 79 (iBT) or 213 (computer score) from foreign applicants to be accepted to a graduate program.

Prospective students may substitute GRE with MCAT. The MCAT score should be at least 23.

Residency Requirements:

Research work normally must be performed on the Missouri S&T campus; off-campus research will require prior written approval and must be supervised by the faculty. A maximum of 6 credit hours may be performed off campus.

Visa for International Students

International students need to be aware of the following regulations.

- An international student must register for and complete a full-time credit load (12 hours for undergraduates, 9 hours for graduates) for any semester of enrollment, including the final semester, unless authorized in advance by the Office of International and Cultural Affairs. The student must contact the Office of International and Cultural Affairs to apply for a waiver BEFORE he registers or drops below the required load. In the past the student was not required to apply for a waiver for the final semester.
- The student must make appropriate progress in his degree program. In practical terms, this means that students must complete their I-20 degree program with the minimum academic requirements. In order to meet this requirement, full-time credit hours must contribute to the I-20 degree program each semester. Hearer status hours do not contribute to the full-time requirement under normal circumstances.
- If a student withdraws from Missouri S&T before degree program completion, the Office of International and Cultural Affairs must be notified by the student, immediately. If the Office is not notified appropriately, that student is immediately considered to be out-of-status.
- Students must now apply for Optional Practical Training (the one-year post degree-completion work authorization for international students) before degree completion.
- The student's I-20 must accurately reflect degree level, academic major and funding.
- An important change in the regulations mandates that F-2 visa holders (dependents of F-1 visa holders) cannot be enrolled full-time without applying for change of status to F-1.

Graduate Faculty Expertise

Ronald L. Frank, Ph.D.

Associate Professor

Director, Laboratory of Plant Molecular Genetics

Research Interests

- Identification of gene families using computer algorithms
- Evolution and expression of gene families in plants
- Structure and expression of phenylalanine ammonia lyase genes in soybean

Chen Hou, Ph.D.

Assistant Professor

Director, Laboratory of Animal Physiology

Research Interests

- Metabolic basis of aging
- Energetic basis of animal growth and reproduction
- Cellular energetics and stress

Yue-Wern Huang, Ph.D.

Professor
Director, Laboratory of Toxicology

Research Interests

- Develop a system with nanomaterials and cell penetrating peptides (CPPs) to deliver biologically active molecules *in vitro* and *in vivo* for basic science research and biomedical applications relevant to disease treatment
- Discover physical and chemical properties of nanomaterials that govern molecular mechanisms of nanotoxicity
- Endocrine modulation in the environment

Melanie R. Mormile, Ph.D.

Professor
Director, Laboratory of Environmental Microbiology

Research Interests

- Anaerobic microorganisms
- Biodegradation of organic chemicals
- Extremophiles in saline environments

Dev. K. Niyogi, Ph.D.

Associate Professor
Director, Laboratory of Freshwater Ecology

Research Interests

- Effects of humanity on stream ecosystems
- Role of biodiversity in controlling ecosystem processes
- Nutrient uptake in streams and other aquatic systems

Stephen P. Roberts, Ph.D.

Professor, Dean, College of Arts, Science, and Business
Director, Laboratory of Insect Physiological Ecology

Research Interests

- Biomechanics and energetics of insect flight
- Mechanisms of stress tolerance
- Role of behavior and environment in aging and senescence

Katie B. Shannon, Ph.D.

Associate Teaching Professor
Director, Laboratory of Cytokinesis

Research Interests

- The temporal and spatial control of cell division
- Budding yeast as a model to determine how cytokinesis is cell-cycle regulated.

Julie Semon, Ph.D.

Assistant Professor
Director, Laboratory of Regenerative Medicine Laboratory

Research Interests

- Identifying differences between sources of adult stem/progenitor cells

- Regulation of stem/progenitor cell niche
- Trafficking and fate determination of stem/progenitor cells

Matthew S. Thimgan, Ph.D.

Assistant Professor

Director, Laboratory of Genetic and Behavioral Somnobiology

Research Interests

- Using genetics in the model organism, *Drosophila melanogaster*, to understand the link between lipid metabolism and sleep regulatory pathways
- Understanding why sleep deprivation has adverse consequences and how we might minimize these effects
- Genetic mutant screens to identify novel genes involved in insomnia.

David J. Westenberg, Ph.D.

Associate Professor

Director, Laboratory of Rhizosphere Microbiology

Research Interests

- Rhizosphere microbiology
- Bioenergetics of symbiotic nitrogen fixation
- Cell-cell communication in plant-microbe interactions
- Microbiology education

Adjunct Faculty Expertise

Chang-Soo Kim, Ph.D.

Associate Professor

Intelligent Microsystem Laboratory

Research Interests

- Solid-state microdevice engineering
- Biomedical and biological sensors

Francisca Oboh-Ikuenobe, Ph.D.

Professor

Head of Geology & Geophysics

Research Interests

- Organic-walled microfossils (Palynology) as tools for biostratigraphy, paleoclimates and paleoenvironments
- Sedimentology and sequence stratigraphy

Daniel B. Oerther, PhD, PE, BCEE

John A. and Susan Mathes Chair of Environmental Engineering

Research Interests

- Molecular microbial ecology of environmental bioprocesses
- Environmental determinants of the obesity epidemic
- Sustainable development

Zhaozheng Yin, Ph.D.

Assistant Professor
Director, Computer Vision and Biomedical Imaging Laboratory

Research Interests

- Optics-oriented microscopy image analysis
- Large-scale cell tracking system for stem cell engineering and discovery

Curriculum & Degree Requirement

Graduate study in the Department of Biological Sciences encompasses an interdisciplinary approach to problems in applied and environmental biology. The program emphasizes research designed to understand responses and adaptations in biological systems at cellular and molecular levels. Areas of particular interest include microbiology, cell biology, applied plant genetics, toxicology and bioinformatics. Faculty research programs are distinguished by their close association with other science and engineering disciplines on the Missouri S&T campus. Graduate study in Biological Sciences is characterized by close interactions with productive faculty members. While courses of study are individualized, they include seminars, laboratory rotations and specialized courses in multiple disciplines. Emphasis is placed on research efficiency and communication skills. The requirements are described as follows.

With guidance from the advisor and the graduate committee, each candidate will complete a plan of study to satisfy interests of the candidate and the advisor plus requirements for the Master of Science degree.

Master’s Degree with Thesis

The master’s degree program with thesis shall consist of a minimum of 30 semester hours of graduate credit over and above the prerequisites. It is recommended that at least six credit hours be devoted to courses outside the major department. Up to 6 credit hours may be taken at the 3000-level in courses offered by other departments. A minimum grade of B is required for each biological science course used to fulfill the M.S. degree requirements. The following courses are required.

- 6202 Problems in Applied and Environmental Biology (2 hr)
- 5010 Graduate Seminar (1 hr)
- 6223 Research Proposal Writing (3 hr)
- 5099 Graduate Research (6 hr)
- One additional BioSci course at 5000 or 6000 level

Candidates are required to conduct original research that is defended in a final oral examination.

Student should select advisor and committee and **COMPLETE FORM I** (<http://grad.mst.edu/currentstudents/gradforms.html>) within six weeks after the beginning of the semester in which the student takes his/her 15th graduate credit hour. Each semester, the student must follow the program of study on Form I exactly or **SUBMIT FORM I-A** indicating changes to the program of study to the Office of Graduate Studies. Within four weeks of the beginning of their last semester, students must check with the Registrar’s Office to **MAKE APPLICATION FOR DIPLOMA.**

Candidates of Master’s Degree with thesis are required by the Department to present their draft research proposal in the departmental seminar series in their early second semester. The candidates are recommended to also organize a committee meeting so that committee members can give feedbacks on the draft research plan.

The findings and results of research undertaken by the candidate for a master’s degree must be presented in a thesis. A minimum of an original and three (3) copies normally will be prepared following thesis specifications unless a different format is approved in advance. A manual entitled “Regulations and Specifications for Thesis and Dissertations (T/D)” can be found on the web at

http://grad.mst.edu/documents/SPECIFICATIONS_FOR_THESSES_AND DISSERTATIONS.pdf. The student will distribute copies of the thesis to the examining committee and arrange a time and place for the oral defense of the thesis. The student must be enrolled at the time of the examination in accordance with Missouri S&T Policy Memorandum II-20. Such examinations are normally scheduled only when the school is officially in session. Each committee member should be allowed to examine the thesis for at least seven days before the oral defense. The defense may be comprehensive in character and the candidate should exhibit an acceptable knowledge of a professional area as defined by the program.

In order for the candidate to pass the examination, all the examining committee must vote affirmatively. If any member of the committee votes not to pass the candidate, the Office of Graduate Studies shall appoint a new examining committee on which the dissenting member may be replaced, and the new committee will administer a second examination. A student who fails a second time will no longer be eligible for a master’s degree from Missouri S&T.

Immediately following the thesis defense, the chair of the examining committee will report the action of the committee (**GRADUATE FORM II**) to the Office of Graduate Studies. Deadline for Form II will be announced prior to the beginning of each semester, and can be located on the web at: <http://grad.mst.edu/currentstudents/gradforms.html>.

At the close of a successful thesis defense, the members of the examining committee will sign the thesis in the space provided on the title sheet to signify that they have read and approved the thesis. The approved copy of the thesis, including any corrections indicated by the examining committee, must be taken to the Office of Graduate Studies where it will be carefully checked to ensure that proper format has been followed. When all requirements have been met and payment made of enrollment or examination fees, the Office of Graduate Studies notifies the Registrar and forwards the approved thesis to the Missouri S&T Library.

The student will present a copy of the approved thesis to the department chair, a second copy to the advisor, and will retain a copy. If all requirements are met, the student receives degree, granted by the Board of Curators upon the recommendation of the graduate faculty.

For complete Admissions and Program Procedures, please see current Graduate Catalog, or visit the following Web site: <http://registrar.mst.edu/cataloginfo/cataloginfo>.

SUMMARY OF FORMS
Form I within six weeks after beginning of second semester or 12 hours completed.
Form I-A if changes to Form I, program of study, in semester changes are made.
Application for Diploma within four weeks of beginning of last semester.
Form II when thesis defense is complete.

Thesis Preparation: Students are responsible for the costs associated with printing and publishing their theses. However, the department will pay for the printing and binding of one copy that will be included in the departmental library.

Notification of thesis defense. When the date for the thesis defense has been finalized, the student will send an email notice containing the thesis defense date, time and location to the Faculty and Graduate Students mailing lists. The BioSci office staff can help you send out this notice.

Thesis defense. The summary thesis presentation that precedes the examination will be open to the public. In some instances, this thesis presentation can be presented as a departmental seminar. Attendance at the thesis examination is normally restricted to the thesis committee.

Master's Degree without Thesis

The master's degree program without thesis shall consist of a minimum of at least 30 hours. At least nine semester hours of the required work will be from the group of lecture courses bearing numbers in the 6000-level or above. It is recommended that at least six semester hours will be devoted to courses outside the major department. Up to 6 credit hours may be taken at the 3000-level in courses offered by other departments. Candidates of Master's Degree without thesis are required to complete two core courses:

- 6202 Problems in Applied and Environmental Biology (2 hr)
- 5010 Graduate Seminar (1 hr)

Student should select advisor and **COMPLETE FORM I** within six weeks after the beginning of the semester in which the student takes his/her 15th graduate credit hour. Each semester, the student must follow the program of study on Form I exactly or must **SUBMIT A FORM I-A** indicating changes to the program of study to the Office of Graduate Studies. Within four weeks of the beginning of their last semester, students must check with the Registrar to **MAKE APPLICATION FOR GRADUATION.**

Non-thesis MS degree candidate takes a comprehensive written examination. The candidate must successfully complete a comprehensive examination conducted by an examining committee (**GRADUATE FORM I-B**). The committee will consist of three members, including at least one member from outside the candidate's department. The chair and at least one-half of the members should be graduate faculty members. This examination will be given only once each semester or summer session and not earlier than six weeks before Friday of the end of the semester or three weeks before the end of the summer session. The candidate will have passed the comprehensive examination if all, or all but one, of the committee members vote to pass. A student who fails the examination must take it again at the next regular scheduled examination time. A student who fails a second time will no longer be eligible for a master's degree from Missouri S&T. The Chair of the examining committee reports the action of the committee to the Office of Graduate Studies on **GRADUATE FORM III.**

If all requirements are met, student receives degree, granted by the Board of Curators upon the recommendation of the graduate faculty.

For complete Admission and Program Procedures, please see the current Graduate Catalog or visit the following Web site: <http://registrar.mst.edu/cataloginfo/cataloginfo>.

SUMMARY OF FORMS

Form I within six weeks after beginning of the semester in which the student takes his/her 15th graduate credit hour.

Form I-A if there are changes to Form I (program of study) in the semester changes are made

Application for Graduation (diploma) within four weeks of beginning of final semester

Form I-B (when comprehensive is required) making up committee for comprehensive examination

Form III (when comprehensives are required) to report results when comprehensive exam is completed

Additional courses are required to satisfy requirements for the Master of Science degree, as outlined below. Prior to the end of the first semester, candidates will select a thesis advisor and graduate committee and (with approval of the graduate committee) complete a plan of study. Additional courses include, but not limited to, the following lists:

3001	Special Topics (Nanobiotechnology) (2 hr)
3483	Biomedical Problems (3 hr)
3783	Biological Design and Innovation I (3 hr)
4323	Molecular Genetics (3 hr)
4329	Molecular Genetics Lab (2 hr)
4353	Cancer Cell Biology (3 hr)
4363	Freshwater Ecology (3 hr)
4383	Toxicology (3 hr)
4463	Global Ecology (3 hr)
4393	Immunology (3 hr)
4493	Virology (3 hr)
5001	Advanced Nanobiotechnology (2 hr)
5210	Biomaterials I (3 hr)
5240	Tissue Engineering I (3 hr)
5313	Pathogenic Microbiology (3 hr)
5333	Genomics (3 hr)
5353	Developmental Biology (3 hr)
5433	Neurobiology (3 hr)
5533	Pharmacology (3 hr)
6273	Techniques in Applied and Environmental Biology (3 hr)
6210	Biomaterials II (3 hr)
6240	Tissue Engineering II (3 hr)
6313	Environmental Microbiology (3 hr)
6423	Astrobiology (3 hr)
6513	Advanced Microbial Metabolism (3 hr)
6523	Biomolecules (3 hr)
6363	Advanced Freshwater Ecology (3 hr)
6463	Bioremediation (3hr)
6383	Advanced Toxicology (3 hr)
5099	Research (variable)

Out-of-Department Courses (examples):

Statistics 5425	Introduction to Biostatistics (4 hr)
Chem 4620	Intermediary Metabolism (3 hr)
Chem 4630	Industrial Biochemistry (3 hr)
Chem Eng 5340	Principles of Environmental Monitoring (3 hr)
Elec Eng 5450	Digital Image Processing (3 hr)
Elec Eng 5460	Machine Vision (3 hr)
Env Eng 5630	Environmental Law and Regulations (3 hr)
Chem Eng 5350	Environmental Chemodynamics (3 hr)
Chem 6620	Intermediary Metabolism and Biosynthesis (3 hr)
Env Eng 6601	Biol Principles in Environmental Eng Systems (2 hr lec, 1 hr lab)
Env Eng 6612	Biol Operations in Environmental Eng Systems (3 hr)
Geol 4451	Aqueous Geochemistry (3 hr)
Geol 5671	Clay Mineralogy (2 hr lec, 1 hr lab)
Ge Eng/Geol 4421	Radioactive Waste Management and Remediation (2 hr lec, 1 hr lab)
Met 5520	Scanning Electron Microscopy (2 hr lec, 1 hr lab)
Nuc Eng 4363	Health Physics (3 hr)
Nuc Eng 4365	Radiation Protection Eng (3 hr)
Stat 3113	Applied Statistics (3 hr)

Equipment and Facility

The department's office, teaching and research laboratories, equipment rooms (including imaging, histology, lab preparation, and bioanalytical facilities), faculty offices, student study hall and conference room are housed in Schrenk Hall. Equipment required to support graduate research in the biological sciences is available within the department or in the laboratories of collaborators in other disciplines. The Missouri S&T Institutional Animal Research Facility (managed by the department) provides access to vertebrate animals for research. The 1,780 square foot facility includes colony rooms, a room for sterile surgery, a cage-washing room, and other support rooms. Faculty and students requiring additional analytical instruments have access to such equipment through the research centers at Missouri S&T such as the Environmental Research Center for Emerging Contaminants, the Center for Environmental Science and Technology (CEST), and the Advanced Material Research Laboratories. The Department of Biological Sciences is also equipped with state-of-the-art instruments for cell and molecular biology, including an Applied BioSystems model 3130 Genetic Analyzer for DNA sequencing, AFLP analysis and other fragment analysis applications, epifluorescent microscopes with CCD cameras and digital imaging software, high speed centrifuges with fixed angle and swinging bucket rotors, laminar flow hoods, microcentrifuges, gel dryer, evaporative centrifuge, PCR machines, electroporator, protein and DNA gel-electrophoresis units, UV cross-linker, semi-dry and submarine nucleic acid/protein transfer units, numerous general use incubators, growth chambers, shaking incubators, UV-trans-illuminator, assorted teaching and research microscopes, nanopure water purification system, UV-Vis spectrophotometers (including a Nanodrop instrument), scintillation counters, microtiter plate reader, semi-automatic cell-harvester, media prep room with autoclaves, -70°C freezers, and automated media dispenser. Equipment for environmental microbiology includes a Coy anaerobic glovebag.

Out of Department Expertise and Resources

In addition to the Department of Biological Sciences, there are many researchers and facility that perform or support biological research. They include Center for Bone and Tissue Repair and Regeneration (<http://cbtrr.mst.edu>), Center for Environmental Science and Technology (<http://cest.mst.edu>), Environmental Research Center for Emerging Contaminants (<http://erc.mst.edu>), and Material Research Center (<http://mrc.mst.edu>). Graduate students may utilize these facilities to support their research activities.

Selection of Thesis Advisor

All thesis students must select a major research advisor their first semester. The major research advisor must be a tenured/tenure-track member of the Department of Biological Sciences or hold an adjunct position with the department. The Graduate Coordinator can assist the student in selection of a major advisor who complements the student's academic and/or research emphasis. This assignment need not be permanent. If the student's emphasis changes, a new major advisor can be selected. The Graduate Coordinator and the Department Chairperson must, however, be notified by the student of any change in major advisor.

Responsibilities of Thesis Advisor

The graduate advisor is responsible for all phases of the student's program of study. It is of the utmost importance that a good channel of communication be open between the advisor and the student. All problems and questions should be brought to the attention of the advisor first before seeking assistance elsewhere.

An advisor should:

1. Meet regularly with graduate students to assess progress.
2. Discuss overall program of study and course requirements with graduate students.
3. Discuss expectations regarding thesis research projects, timetable, publications, etc.
4. Help graduate students choose a thesis committee.
5. Acquaint students with their laboratory and its policies.
6. Assist with experimental protocol, data analysis, scientific writing, and seminar preparation.
7. Help fund graduate student research.
8. Provide feedback on proposals, manuscripts, posters, etc., in a timely manner.
9. Encourage students to attend professional meetings.
10. Ensure that necessary research equipment is available and in working order.

Expectations of Responsibilities of Graduate Student

1. Meet regularly with your major advisor and thesis committee.
2. Read the literature in your field of research.
3. Complete required courses maintaining a GPA > 3.0.
4. Complete your thesis and submit manuscripts for publication if a thesis student.
5. Present your results at local, state and/or national meetings.
6. Become an independent, critical thinker. Use library resources, experimental results, and advice from fellow graduate students.
7. Work Expectations.
 - a. GRAs and GTAs require at least 20 hours per week.
 - b. Course work = 3 hours for every credit hour (ex: 3x9=27).
 - c. Thesis work
8. Maintain clean, safe laboratory and work environment.
9. Be responsible for appropriate training (chemical safety, disposal of waste biological materials and hazardous waste, etc.)
10. Assist others in the laboratory, especially new graduate and undergraduate students.
11. Apply for funding from different sources to support your research and travel.
12. Attend departmental seminars and other relevant presentations and functions.
13. Remember that enthusiasm, optimism and dedication toward your research are important!

Selection of Committee for Thesis Student

Students must select a Thesis Committee in consultation with their advisor, by the sixth week of their second semester of course work. The Committee will consist of the student's major advisor plus two additional members of the graduate faculty of S&T. The Thesis Committee will review and approve the student's course requirements and research program. The Committee will review the student's thesis and participate during the student's final thesis defense.

Selection of Committee for Non-Thesis Student

Students must select a Non-Thesis Committee in consultation with their advisor by the sixth week of their second semester of course work. The Committee will consist of the student's major advisor plus two additional members of the graduate faculty of S&T. The Thesis Committee will review and approve the student's course requirements and research program. The Committee will review the student's thesis and participate during the student's final thesis defense.

Transfer from Thesis to Non-thesis Program

A thesis student can ask to be transferred to the non-thesis program. If the student already has submitted a Form 1, then a Form 1-A should be used to change options. The Form 1 and 1-A are actually the same form, but the correct box should be checked at the top of the form. Forms are on-line at <http://grad.mst.edu/currentstudents/gradforms.html>.

Financial Assistantships

Assistantships generally take two forms: graduate teaching assistantship (GTA) and graduate research assistantship (GRA). The department offers a limited number of GTA. GRA may be available to work with a faculty member who is funded through a research grant.

Graduate Teaching Assistantships (GTA)

Some of the GTA's responsibility include, but not limited to:

- being available to the instructor during the semester;
- attending TA meetings when needed;
- Having a thorough understanding of the class materials;
- posting you name and office hours, and keep your office hours;
- keeping accurate records of student grades; and
- treating students in a professional and courteous manner.

Graduate Research Assistantships (GRA)

Graduate research assistantships are given out by faculty members who have research funding. The responsibility of a GRA is to assist the principal investigator (PI) accomplish the goals in the funded project. Graduate students who are supported by research projects shall discuss work with the PI.

Sources of additional funding for research and travel

There are other types of funding to support research activities. Students can find such information under the Financial Assistance in the Graduate Catalogue.

Tips for a Successful Graduate Experience

Graduate school is much different from the undergraduate education with which you are familiar. You will take fewer courses and will study subjects which require more active oral and written communication. You will conduct an independent research project and will be assigned duties as a Teaching or Research Assistant (a form of

apprenticeship). Since you and your advisor will be working together closely, requiring a great deal of time and effort from both sides, it is important that you are clear on expectations.

General expectations

Successful graduate schooling requires both academic ability and hard work. Your advisor will only take on advisees who he/she believes can successfully complete the degree. By success, it means finishing the requirements within an agreed-upon schedule (usually two years) and completing a thesis project which is publishable in a peer-reviewed journal. Your advisor's primary role is to provide guidance on the research project and related activities, and to critically evaluate the thesis. Administrative details, such as course registration and meeting various deadlines for graduation, are the responsibility of the student.

You can expect a close interaction with your advisor. Good camaraderie in the lab is very important. Your fellow students deserve regular communication about what you're doing. Your advisor may expect you to help other lab members, such as sharing techniques, teaching new students, helping in fieldwork, and reading drafts of papers.

You can expect your advisor to stay involved in hands-on research, keep abreast of the literature, provide regular advice on your research, and to mark and return drafts of proposals and papers. Your advisor will also attempt, but cannot guarantee, to provide financial support for research assistantships and to attend scientific meetings. Such support comes from research grants, which are generally quite competitive.

Sufficient progress in both coursework and research are required in order for you to stay in the program and to keep your assistantship. Since graduate school is at least a full-time occupation, you should not work in any outside job. During the academic year (fall and spring semesters), you can expect to devote an average of 20 hours per week on courses (perhaps less during the second year), 20 hours to the duties of your assistantship, and 10 hours to research. During the summer and winter, you can expect to devote full time to research. If you are unable or unwilling to commit the time and energy to your graduate education, you should seriously reconsider whether you belong in the graduate program in Biology. Graduate studies are NOT a job. It is a commitment and devotion to science which requires curiosity, enthusiasm, and energy. If you can make the commitment, you will find your graduate program a period of significant intellectual and personal growth, and, once complete, you will be able to call yourself a Biologist.

Coursework

Graduate students in Biology typically take a couple courses per semester. Students have a tendency to want to take more courses than they need; this impulse is best resisted. Students are also expected to attend departmental seminars.

Biology graduate students must maintain at least a B average, and should attain "A" grades in the courses most closely related to their areas of interest. "A" grades in all your courses are nice, but they are not worth killing yourself over, particularly if other

areas of your graduate program (or home life) suffer. If you go on to a Ph.D. program, demonstrated aptitude for research and other experience outside of coursework are considered more important than distinguishing between a 3.5 and 4.0 G.P.A. The same holds true for those seeking employment directly after the Masters.

Progress on research

For most students, completing the research is the most challenging part of the graduate degree. If you divide it into manageable chunks and don't procrastinate, the project is much easier. Certainly completing some part of the project early provides a real boost for self confidence. Your advisor expects continuous progress on the research; you should tell your advisor when you are having difficulty so as not to force him/her into "bugging" you.

Individual students differ a great deal in how much help they need at the start. Some would like a topic handed to them; others would like to develop their own idea from the start¹. For the Masters, with only two years to finish, some combination of the two approaches is probably best. Remember—it's **your research**, so the successes and failures are ultimately your own, and you will learn a great deal from them.

Students who are full time in the graduate program and supported by assistantships should plan to complete their work in two years. Previous research or work experience is very helpful for starting out, but hard work is the best key to staying on track. Your advisor may suggest the appropriate balance between reading, planning, lab and fieldwork, and writing (depending on how far along you are), but the total number of hours is up to you. During the academic year, the typical graduate student puts in about equal time on classes and teaching, and spends very little time on the research. This is not recommended. Instead, it is recommended that you put in an average of 10 hours per week on your research, less during tough times (e.g. finals), more during vacations.

The following timeline may help your research progress planning.

Year 1 - Fall. Start reading your literature review and settle on a precise thesis topic. Complete a draft of your thesis proposal by the end of the fall semester. Continue to do some lab work.

Year 1 - Spring. Revise your proposal to your advisor's satisfaction and continue reading (at least one paper a week). Once the proposal is complete, present a copy to each of your committee members and solicit their comments during a group meeting. (This is a good time to also go over your schedule for courses). The department also requires you to present your draft research proposal in the departmental seminar series in early second semester.

¹ For additional perspective, read the commentaries by Stephen Stearns and Ray Huey in the June 1987 issue of Bull. Ecol. Soc. of America.

Year 2 - Summer. Spend at least half time on your own research. This is the time when you should collect the bulk of your data. In your spare time, continue reading! Each project has its own nature; therefore, you and your advisor should discuss the execution timeframe and milestones.

Year 2 - Fall. Complete your data collection. As soon as you have even a small chunk done, analyze the data collected so far and write it up. This is very helpful. First, you have less to think about later. Second, this helps to organize your thinking and further data collection. Third, completing one part of your research is an enormous confidence builder. If you have made good progress, your advisor will probably invite you to present a talk at a regional/national meeting.

Year 2 - Spring. Complete the data analysis and thesis writing. Plan on going through several markings and revisions before it's done. Once revisions were complete, you will present your data at the departmental seminar series. This will allow you to warm up for your thesis defense and obtain input from your colleagues and other faculty members. Then you will present copies to your committee for them to read prior to your defense. Present your thesis talk and defense.

Finishing the degree. While you seek employment or further education, your advisor will help you "beat the bushes" for opportunities and will write letters of reference as needed. This is easy for your advisor to do, since she/he should know you quite well through your research and course work.

While you look for a job or prepare to go on for the doctorate, organize your thesis into one or more papers for publication. This will take further revisions, but it's worth it to have the fruits of your efforts out where it can better contribute to our understanding of Biology. (Scientific publications are far easier for others to obtain than are theses.) Since your advisor will probably have spent a large amount of time supervising your research, he/she would expect to be a co-author on your paper(s). If you write the paper, you'll be senior author, and if your advisor write it, he/she will be senior author. You need to send out at least one manuscript to a peer-reviewed journal before you graduate. By doing so, you enrich your resume and reduce extensive future back-and-forth communications between you and your advisor for your publications after you graduate.

After you complete your work on campus, you should promptly turn in all keys. (The university "encumbers" your grades until this is done.) Any equipment, supplies, books, or Xerox copies purchased at university expense will remain in the lab. Your lab notebook will remain your own. All lab notebooks with data from research assistantships should remain in the lab. Your advisor may ask you for a copy of your thesis data and graphics files and borrow your slides to make duplicates for future talks. Likewise, your advisor's slide collection may be available to you, as needed in your talks.

Conflicts with Graduate Supervisor

Constant and positive communications between graduate student and advisor usually yield the most productive outcome. However, conflicts do occur. Once situation arises, your advisor should attempt to resolve it instantly. Both graduate student and advisor involved should try, with good will, to understand the root of the conflicts and then, together, find a solution. If there is still unresolved discrepancy, the department Chair may serve as a mediator.

Academic Integrity

Academic integrity is crucial as loss of academic integrity could incur severe consequences and hamper a person's career. At all times, students should maintain the highest level of academic integrity. Student resources for academic integrity are detailed at: <http://ugs.mst.edu/StudentResources-ai.html>.