

Biomedical Sciences
Graduate Program Handbook

2018-2019

BIOMEDICAL SCIENCES AREA Ph.D. PROGRAM (Updated February, 2019)

Welcome to the Department of Biomedical Sciences at the University of Missouri!

This graduate handbook has a lot of the information needed to familiarize you with our department, faculty, research, and current graduate students. Additional information may be found at our website (<https://biomed.missouri.edu/>) and the MU Graduate School website (<http://gradschool.missouri.edu/>).

**The information regarding MU requirements in this handbook is provided for convenience. Make sure you check the Graduate School website for accuracy.

Graduate Program

1. New Graduate Students

- A. A temporary advisor will be assigned by the Director of Graduate Studies for all new, uncommitted students.
- B. During the first semester, students not committed to an advisor are expected to do 3 rotations in departmental laboratories. These should involve work in laboratories involving different disciplines (molecular, cellular or integrative). Rotations generally will be two months in length. Dates of the rotations will be established by mutual consent between the student and the director of the laboratory. Rotations may involve one hour of course credit, at the student's discretion. The student's temporary advisor will coordinate the laboratory rotations. This will involve individual meetings with faculty members to establish which laboratories will be included in rotations. New students with a major advisor are encouraged to do rotations during the course of their studies.

2. Academic Process for Doctoral Students

A typical process and timeline for doctoral students is provided below. This will likely vary somewhat on an individual basis, based on the unique needs of the student and his/her committee. Further details for steps are provided below.

- A. Choose an advisor**
 - a. A doctoral student selects an adviser or co-advisers by mutual consent. Advisors must be doctoral faculty members in the department.
- B. Complete qualifying process**

- a. To be officially admitted to a PhD program, the student must pass a qualifying examination or process. A minimum grade of “B” in each of the core courses may serve as the Ph.D. qualifying examination.

C. Choose a doctoral program committee (D1 form; by end of 2nd semester)

- a. The doctoral program committee is composed of a minimum of four members of the MU graduate faculty and includes at least three members from the student's doctoral degree program, and one outside member from a different MU program. At least two of the doctoral committee members must have a primary academic appointment in Biomedical Sciences and at least two must be MU doctoral faculty.

D. Submit plan of study (D2 form; by end of 3rd semester)

- a. The doctoral advisory committee provides academic program approval of the student's plan of study — a list of the courses and the credit to be earned in each of them — that will, when completed:
 - Prepare the student for research or scholarly investigation in the chosen field of study;
 - Satisfy the course requirement of the academic program;
 - Satisfy the Graduate School's requirement for a minimum of 15 hours of course work at the 8000/9000 level (exclusive of one-one-one individual courses)

E. Take comprehensive exam (D3 form; end of 4th semester)

- a. The comprehensive examination consists of written and oral sections. It must be completed at least seven months before the final defense of the dissertation. The two sections of the examination must be completed within one month.
- b. The student must be enrolled to take this examination. It is to be administered only when MU is officially in session.
- c. Successful completion of the comprehensive exam advances the student to candidacy.

F. Write dissertation proposal (within 12 months of comprehensive exam)

- a. Must be presented in writing and orally to committee.
- b. Committee must approve.
- c. Approved copy is submitted to the Director of Graduate Studies.

G. Write dissertation

- a. Doctoral students will perform original research that develops a central theme with multiple aspects exhibiting both depth and continuity, typically evidenced by 2 or more first-author, peer-reviewed publications.
- b. The format of the dissertation is determined by the doctoral committee. Typically, it consists of completed manuscripts presented as chapters, together with an overall Introduction and Discussion that integrates and synthesizes the studies around a central theme.
- c. Results of the dissertation research are expected to be published in a refereed journal. At least one manuscript originating from the doctoral dissertation must be submitted to a

peer-reviewed journal prior to graduation, i.e. prior to signing of the D4 form by the Director of Graduate Studies.

H. Defend the dissertation (D4 form)

- a. The dissertation defense consists of a seminar-style presentation and an oral defense with the dissertation committee.
- b. For the dissertation to be successfully defended, the student's doctoral committee must vote to pass the student on the defense with no more than one dissenting or abstaining vote. Failure of the dissertation defense results in dismissal.

I. Submit final approved dissertation to the Graduate School.

- a. The dissertation advisor and committee's signature signifies approval and is required for graduation.
- b. An electronic copy of the final dissertation should be submitted to the Director of Graduate Studies.

3. Course of Study

- A. Students admitted to the doctoral program select an advisor, by mutual consent, from doctoral faculty members in the Biomedical Sciences Area Program by the end of the first year after starting the program.** Because of differing interests and variable backgrounds, the graduate program for each student is individually arranged, but will reflect a multidisciplinary approach to biomedical research. **All doctoral students must meet the requirements for graduate degrees as defined in the Graduate School Catalog.** The course work and research requirements for the Ph.D. degree will be determined by the student's Doctoral Program Committee and approved by the Director of Graduate Studies. Evaluation of student course work, seminar and research requirements will be made by the doctoral program committee. Departmental faculty will review student progress semi-annually. **A D-1 form, verifying the qualifying process and confirming the student's adviser and doctoral committee, must be submitted to the MU Graduate School by the end of the student's second semester of enrollment.**
- B. The University of Missouri requires a minimum of 72 semester hours beyond the baccalaureate degree for the Ph.D.** Doctoral Students must satisfy the Graduate School's requirement for **a minimum of 15 hours of 8000/9000-level graded coursework to be completed at MU.** The 15 hours should consist of coursework that has been approved by the appropriate curricular committee and excludes any individualized study courses including (but not limited to) problems, readings, and research hours. Graduate credit is earned for courses at the 7000-level or greater. **After selection of the student's adviser and doctoral committee, a D-2 form, presenting the course work to be included in the student's program of study, must be submitted to the MU Graduate School, no later than the end of the student's third term of enrollment.** A Plan of Study form for graduate certificates and designated graduate minors

must be submitted to the Graduate School at least one term prior to the conferral of the certificate or minor.

C. Each student in the Biomedical Sciences program is required to take all courses in the core curriculum. **The core courses are:**

- a. **Veterinary Physiology** 8420 and 8421 (or 10 hours of equivalent courses)
- b. **Veterinary Neuroscience** 8100 (2 hours)
- c. **Veterinary Cell Biology** 7333 (4 hours) (or 4 hours of equivalent courses)
OR
Cytology, Histology and Organology of Domestic Animals 7302 (I) & 7303 (II) (5 hours)
(or 4 hours of equivalent courses)
- d. **Multidisciplinary Approaches to Biomedical Sciences** (2 hours).
- e. **Departmental Seminar** 8410*

D. In addition to the core curriculum, students must take a minimum of one additional course at the 7000 level or greater in **each** of the following three areas: **1)** molecular biology; **2)** cellular biology; and **3)** integrative biology. The choice of these courses will be made by the student in consultation with his/her advisor and doctoral program committee.

E. ***Seminar**

- (1) All doctoral students are required to register for two semesters per academic year for the seminar course (8410) offered by the Department of Biomedical Sciences. A maximum of 4 hours of credit in the Biomedical Sciences seminar course may be applied toward the >8000 level course work requirements for the Ph.D. degree. Grades for the 8410 seminar course are determined by the seminar coordinator.
- (2) After their first year, students **are required** to present one formal Biomedical Sciences seminar per year. This requirement is independent of official registration for the seminar course.
- (3) Graduate student attendance is **required** at the Biomedical Sciences seminar.

4. A minimum grade of "B" in each of the core courses may serve as the Ph.D. qualifying examination.

5. **The comprehensive examination will follow Graduate School guidelines and be given near the end of the student's formal course work and must be completed at least seven months before the final defense of the dissertation.** This examination will be the independent work of the student and reflect the understanding of a multidisciplinary approach to biomedical sciences. This includes knowledge of material covered in the core courses. **It will include both a written and an oral examination, both sections of the examination must be completed within one month.** The comprehensive exam may be related, yet substantially distinct, from the dissertation proposal. The specific nature of the examination will be determined by the Doctoral Program Committee following consideration of the individual needs of the student. A Ph.D. student must successfully complete

the comprehensive examination within a period of five years beginning with the first semester of enrollment as a Ph.D. student. **A D-3 form, recording the official results of the doctoral comprehensive examination and carrying the signatures of all members of the committee, must be submitted to the MU Graduate School within two weeks after completion of the examination.** A student who fails may not take a second comprehensive examination for at least 12 weeks. Failure to pass two comprehensive examinations automatically prevents candidacy.

6. **The student will prepare a proposal for the doctoral research project no later than twelve months after completion of the comprehensive examination.** This proposal must be approved by the Doctoral Program Committee. Committee evaluation of the proposal should include an oral presentation of the proposed work by the student. This proposal must be written and approved a minimum of six months before the defense of thesis. A copy of the approved proposal will be submitted to the Director of Graduate Studies.
7. **Following the term after the term in which the comprehensive examination is completed, status as a continuous enrollment doctoral student begins.** Ph.D. candidacy is maintained by enrolling in 9090 Research for two or more semester hours each fall and winter semester and for one semester hour each summer session up to and including the term in which the dissertation is defended. Speak to your advisor about how many Research credits he/she want you to take. The Graduate School will not automatically enroll a student for continuous enrollment.
8. **In accordance with graduate school guidelines, the oral defense of thesis research must be completed within five years after the comprehensive examination.** Failure to do so will require the student to retake the comprehensive examination, or be dropped from the graduate program.
 - A. The Director of Graduate Studies should be notified at least 30 days in advance of the proposed date for the thesis or dissertation seminar and defense. The notification should be in writing from the student's major advisor.
 - B. The student's thesis or dissertation research will be presented as a departmental seminar given immediately before the oral defense examination. The pre-defense seminar may be used to satisfy the annual seminar requirement.
 - C. The oral defense of the thesis or dissertation will be public and open to all interested parties. Questions will be restricted to the Doctoral Program Committee or as determined by the major advisor. **Following the thesis or dissertation defense, a D-4 form, reporting the official results of the defense, must be submitted to the MU Graduate School.**
9. **Transfer Credit:** The Doctoral Program Committee may recommend that a specific number of hours from a master's or doctoral degree program be transferred toward the total hours required for the Biomedical Sciences doctoral degree.

- A. Transfer credit is limited to a maximum of thirty credit hours for a doctoral degree (e.g., D.V.M. or Ph.D.), at the discretion of the student's Doctoral Program Committee.
- B. Transfer credit for students who do not have an earned master's or doctoral degree is limited to a maximum of 12 hours of graduate credit.
- C. Transfer credit for students who have additional credit hours beyond an earned master's or doctoral degree done at MU or elsewhere is limited to a maximum of six hours of graduate credit.

10. Graduate Student Doctoral Program Committee

- A. Research is the essence of graduate study in all biomedical sciences, and a dissertation reporting the results of original research is required. A faculty member with special competence in that area of research, i.e., the major advisor, supervises the research. Identification of the major advisor is a critical step in any graduate program, and this relationship is individually arranged at the initiative of the student. Such an arrangement can precede any formal application for admission to the Graduate School, or it can be deferred.
- B. The doctoral program committee is composed of a minimum of four members of the MU graduate faculty and includes at least three members from the student's doctoral degree program, and one outside member from a different MU program. At least two of the doctoral committee members must have a primary academic appointment in Biomedical Sciences and at least two must be MU doctoral faculty. Members from national and international institutions are encouraged. Additional committee members with specialized expertise who do not meet the criteria for the MU graduate faculty or doctoral faculty may serve on a doctoral committees as a fourth or fifth member, with special permission of the vice provost/dean of the Graduate School. The Director of Graduate Studies serves as ex officio of all graduate student advisory committees. The composition of the committee should reflect the multidisciplinary aspect of the Biomedical Sciences Area Program, and will include at least one member from each area of molecular, cellular and integrative research. The committee should meet approximately every six months.

11. Direction of Graduate Students

- A. The major advisor may serve as chairperson of the Doctoral Program Committee and must be a member of the Department of Biomedical Sciences doctoral faculty. First-time advisors are encouraged not to serve as chairperson. The Committee shall elect a member other than the major advisor to serve as Chair during the oral sections of the comprehensive exam and dissertation defense.

12. Additional Considerations

- A. The major advisor will report to the faculty of Biomedical Sciences annually on the progress of his/her graduate student(s). This report will encompass the individual student's academic performance, research progress, conduct and effort, and development as a scientist.
- B. It is highly desirable that each student present a research slide or poster presentation at a national scientific meeting at least once before graduation.

13. **Academic Probation and Dismissal:** The student will be subject to probation or dismissal from the program, following the recommendation of the student's doctoral program committee and/or the semi-annual faculty review. The student will be informed of his/her probation or dismissal by a letter from the Director of Graduate Studies.

a. A student may be subject to probation or dismissal if:

- (1) The student makes a grade of C or less in any course in the Biomedical Sciences core curriculum (See V.B.1.a.). The student **MUST** receive a minimum grade of B (3.0). If grade is below a B, student will be dismissed from the program. However, if the student is doing well in the laboratory, they can make an appeal. If lab performance is poor, student will be automatically dismissed from the program.
- (2) The student makes a C or less in two graduate level courses.
- (3) The student fails to maintain an overall GPA of 3.0.
- (4) The student fails to make satisfactory progress in the thesis research project as determined by the student's doctoral program committee.
- (5) The student fails to demonstrate growth and development as a scientist.

B. In accordance with graduate school guidelines, a student may be placed on probation for a period that may vary from 30 days to a full semester.

C. A student may appeal probationary status to the GPAC. No members of the GPAC who are also on the student's doctoral program committee may participate in the appeal decision. If a majority of the members of GPAC are also on the student's committee, an ad hoc committee will be appointed by the Chair of Biomedical Sciences to consider the appeal of probation. If the Chair is on the student's committee, the Associate Dean for Research and Postdoctoral Studies of the College of Veterinary Medicine will be asked to appoint an ad hoc appeals committee.

14. Graduate student study area

- A. Space in departmental graduate student study areas will be assigned by the GPAC.
- B. Assignment will be on a first come-first served basis using the following priorities for assignment:
 - a. New departmental Ph.D. students
 - b. Senior (after comprehensives) departmental graduate students.
 - c. Veterinary students enrolled in department graduate program.
 - d. Graduate students from other departments.

15. Financial Support:

- A. **Stipends:** Pre-doctoral Training Awards will be awarded on a competitive basis. The amount of the stipend will be equivalent to the National Research Service Award as published on the NIH website for the year in which it is awarded. The faculty Research Incentive Fund (RIF) will appropriate sufficient funds each year to be used for up to four stipends/yr that will be awarded according to the Guidelines of Biomedical Sciences Pre-doctoral Training Awards. The goal is to fund student stipends on a rotating basis, e.g., two Year 1 stipends and two Year 2 stipends each year. However, expenditures for student stipends will not exceed one-third of the total faculty RIF. If stipend expenditures exceed one-third of RIF in a given year, the number of stipends will be decreased the following year. Criteria considered in awarding the Pre-doctoral Training Awards include course grades (undergraduate, graduate or professional), class rank, GRE scores, previous research experience, letters of recommendation, the applicant's letter of intent, and the interview when applicable. Decisions regarding allocation of stipends will be made by the GPAC by May 1 of each year. Initial stipend awards will be made for a period of two years, with the second year of funding contingent upon: **1)** attaining a GPA of 3.0 in the core curriculum, **2)** satisfactory rate of progress in the program as judged by the major advisor and the student's graduate program committee, **3)** evidence of efforts to secure other sources of funding, and **4)** budgetary considerations of the major advisor and the department. Departmental stipends are intended to be used for the year in which they are awarded and not to be divided to provide funding to a student for a time period longer than one year. It is anticipated that the student's major advisor will be responsible for funding the remainder of the student's graduate program.
- B. The Life Sciences Fellowship Program is a prestigious and competitive fellowship that awards its recipients with a stipend of \$25,000 (2013 amount) a year for up to four years, as well as a tuition waiver and health insurance. Applicants cannot apply directly to this fellowship program. The Department of Biomedical Sciences will review the applications that have met the deadline, and a committee will then decide which applicants to recommend for funding (our office must recommend students to the Life Sciences Department before February 15th). Contact Debbie Allen (Allendebra@missouri.edu) or by phone at 882-2816) More information can be found at: <http://bondlsc.missouri.edu/fellowships> .

- C. It is also highly recommended that students seek other sources of funding. More information can be found at the following websites:
- a. Graduate Student Support Program (Health Insurance and Fee Waivers) <http://gradschool.missouri.edu/financial/feewaiver/index.htm> Contact: Karen Gruen GruenK@missouri.edu 573-884-2326
 - b. Bulletin Board of Funding Opportunities-A database of external Fellowships <http://gradschool.missouri.edu/fellows/>
- D. **Extension of Funding.** Advisors of students with stipend awards seeking to obtain additional funding at the end of the two-year initial period should consult with the departmental Chair. The decision for subsequent funding will not be made by the GPAC. Students without an advisor may be considered for an extension of funding based on consideration of the student's grades, research productivity, and semi-annual faculty evaluations. Students are strongly encouraged to apply for extramural funds.
- E. Students entering the Biomedical Sciences program who are committed to a particular laboratory will not be considered for a departmental stipend unless the mentor can demonstrate that no other source is available to support the student's stipend.

16. Biomedical Sciences Travel Awards:

- A. Departmental travel scholarships can be submitted to Dr. Bowles for review by committee, at BowlesD@missouri.edu. A GCI Travel Request form can be requested from the departmental office. Presentation of the student's original research is required.

17. Resources for Graduate Students

Biomedical Sciences Area Graduate Student Organization:

Contact: Matt Cook, @missouri.edu

Preparing Future Faculty (PFF) : <http://gradschool.missouri.edu/pff>

PFF Fellows visit a mentor at a partner institution 1-2 times per semester, and participate in monthly class meetings and professional development/career workshops

Minor in College Teaching: <http://gradschool.missouri.edu/resources/preparing-faculty/minor-college-teaching/index.php>

12 credit hours beyond major program; 6 hours of core courses, 3-6 hours of Teaching Practicum, 3 hours of Teaching Electives, Teaching Portfolio

Educational Technologies at Missouri: <http://etatmo.missouri.edu/>

Online early feedback, Course management tools (Blackboard & WebCT), Web page design assistance for courses, Instructional design, Access to resources on instructional technology

Campus Writing Program: <http://cwp.missouri.edu/>

Workshops for TA's in Writing Intensive courses, Resources on Writing, Writing Intensive course evaluations

Graduate Student Organizations

<http://gradschool.missouri.edu/resources/grad-postdoc-networks.php>

Graduate School

Graduate Student Support Program (Health Insurance and Fee Waivers)

<http://gradschool.missouri.edu/financials/tuition-support-program/index.php>

Career and Student Development Resources <http://gradschool.missouri.edu/resources/>

Resources on job searches, writing, relationships in graduate school, financial aid, etc.

Professional Presentation Travel Scholarships

<http://gradschool.missouri.edu/forms-downloads/repository/presentation-travel-scholarship-form.pdf>

Doctoral students who have successfully completed doctoral comprehensives and been admitted to doctoral candidacy are eligible for a maximum of \$250 Professional Presentation Travel Scholarship. See details for deadline dates and specific requirements under Application for Professional Presentation Travel Scholarship.

John Bies International Professional Presentation Travel Scholarships and International Dissertation Research Travel Scholarships.

<http://gradschool.missouri.edu/financials/graduate-awards-travel-scholarships/travel-scholarships/john-bies-international/index.php>

Doctoral students who have successfully completed doctoral comprehensives and been admitted to doctoral candidacy are eligible for a maximum of \$1500 to defray transportation expenses associated with travel to international professional meetings or defray international transportation expenses associated with dissertation research. See details under John Bies International Professional Presentation Travel Scholarship and International Dissertation Research Travel Scholarship.

Dissertation Research Travel Scholarships

<http://gradschool.missouri.edu/financials/graduate-awards-travel-scholarships/travel-scholarships/dissertation-research/index.php>

Doctoral students who have successfully completed doctoral comprehensives and have been admitted to candidacy are eligible to compete for a maximum of \$400 for Dissertation Research Travel Scholarships to defray transportation expenses associated with dissertation research. See details, deadline dates, and specific requirements under Application for Dissertation Research Travel Scholarships at this website.

MU Counseling Center

<http://counseling.missouri.edu/>

The Counseling Center assists students who are having difficulties with their experiences at MU. Services include individual, couples, and group counseling, crisis intervention, biofeedback and stress management, testing, outreach presentations, and consultation to university departments, faculty, and staff. The Counseling Center has also begun offering a Dissertation Support Group.

Statistics Help <http://sssc.coas.missouri.edu>

The Social Science Statistics Center provides MU graduate students with assistance with projects, theses, and dissertations. Check this website for a description of their services.

Computer Information. IATS Everything Technology Help Desk 573-882-5000 or
<http://iatservices.missouri.edu/help/>

Software training courses: Offered at no charge to students.
<http://iatservices.missouri.edu/training/catalog.html>

Library Tours-New graduate students to the MU campus may find it useful to take one of the library tours offered.

<http://mulibraries.missouri.edu/guides/classstours/default.htm>

Writing Help

The Learning Center Writing Lab offers free, fifty-minute writing consultations for MU graduate students. Graduate students may come for help with short papers, seminar reports, letters, or vitas. To make appointments, call the Learning Center Writing Lab at 573-882-2493.

International Center <http://international.missouri.edu/>

Funding opportunities, International fellowships and scholarships, Curators Grants-In-Aid Program for International Students, News and Resources.

MS in Basic Biomedical Sciences

1. University Requirements

The general requirements and procedures published by the University of Missouri-Columbia Graduate School apply to all students admitted to the Master's Program in Biomedical Sciences.

2. Degree Requirements

To attain the master's degree, **30 hours of graduate credit must be completed; 15 hours or more shall be 8000 level** (exclusive of research, problems and independent study courses); and six to nine hours of 9090 Research. **A grade of 3.0 or better is required in all core courses** and serves as the qualifying examination for the degree. In addition to the departmental core courses, students may take courses specifically planned to meet the needs and strengths of the individual. The master's candidate is evaluated semiannually for satisfactory rate of progress as defined by timely completion of course courses and progress on research activities as stipulated by the master's program committee. The master's candidate must carry out original research culminating in a written thesis, present the thesis work at a departmental seminar and defend the thesis in an oral examination by the master's program committee. The time limit for the master's degree is five years after initiating the program.

3. Areas of Study

Major biomedical disciplines include:

- A. anatomy of domestic species (gross or microscopic)
- B. physiology/pharmacology (molecular, cellular and integrative)
- C. biochemistry/molecular biology
- D. endocrinology
- E. toxicology

Specific areas of interest are exercise sciences, cardiovascular and neurosciences, muscle biology, membrane transport biology, reproductive biology, and developmental toxicology.

4. Each student in the Biomedical Sciences program is required to take all courses in the core curriculum. **The core courses are:**

- a. **Veterinary Physiology** 8420 and 8421 (or 10 hours of equivalent courses)
- b. **Veterinary Neuroscience** 8100 (2 hours)
- c. **Veterinary Cell Biology** 7333 (4 hours) (or 4 hours of equivalent courses) OR Cytology, Histology and Organology of Domestic Animals 7302 (I) & 7303 (II) (5 hours) (or 4 hours of equivalent courses)
- d. (3) **Multidisciplinary Approaches to Biomedical Sciences** (2 hours).
- e. (4) **Departmental Seminar** 8410

Master's Degree Forms:

M1: Program of Study for the Master's Degree Form

This form provides the student, the department and the Graduate School, with a plan for all course work, transfer credit and research hours that will comprise a student's program of study. It serves as a blueprint and general plan for the student to follow. Changes on the plan of study can be made easily by submitting a **Course Substitution Form**, available from the Graduate Program Coordinator or the MU Graduate School. **The M1 Form should be submitted NO LATER than the beginning of the student's second year of study.**

M2: Request for Thesis Committee Form

This form is required only of students who will be writing a thesis. The Master's **thesis committee consists of at least three faculty**. Two must be from the major department and one must be from an MU department or area program other than that awarding the degree. Origination of this form is the responsibility of the major adviser and should be filled out in time for the committee to be involved in consideration of the acceptability of the research project and the written thesis. **The M2 Form should be submitted to the Graduate School NO LATER than the beginning of the student's second year of study.**

M3: Report of the Master's Examining Committee

This form reports the final results of **1) Master's thesis defense 2) Master's project presentation or 3) Master's comprehensive exam**. It must be signed by all approved committee members. **Note:** Thesis students should also submit the "Approval Page" of their thesis. This page must be signed by the first, second and third readers and is submitted with the final, original unbound copy of the thesis, in a suitable box. Theses are submitted to the Graduate School after being successfully defended.