

Quantitative & Systems Biology
Ph.D. AND MS DEGREE REQUIREMENTS

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1. Introduction

1.1 Aims and Scope: Research areas available to QSB graduate students cover a wide range of biological subdisciplines, some of which are often housed in clearly defined, separate departments at traditional campuses. The QSB program at UC Merced was founded without departments and institutional boundaries, allowing for the development of a uniquely inclusive graduate program in which molecular biologists, cell and developmental biologists, bioengineers, computational biologists, evolutionary biologists, ecologists, biophysicists, biochemists, and theoretical biologists can interact easily and regularly, fostering new ideas and exciting research collaborations. QSB students share the common interest of applying or developing quantitative methods to better understand biological systems. Moreover, QSB aims to link the biological subdisciplines by training our students in quantitative and systems approaches that can be applied to biological systems at different scales and through the promotion of multidisciplinary collaborations. In addition to specialized areas of research, QSB students develop Quantitative (data driven, statistical, computational, and modeling) and Systems (high-throughput experimental, whole organism, ecological, and cross-species) skills for approaching biological problems.

1.2 Admissions Requirements: Applicants must meet the minimum requirements for admission to graduate study at University of California, Merced, described in the Section II of the [Graduate Policies and Procedures](#).

Consideration for admission into the QSB graduate program requires a bachelor's degree (or equivalent four-year undergraduate degree), three letters of recommendation from instructors or supervisors who can comment on the applicant's scholarly ability and promise as a researcher, official transcripts, TOEFL or IELTS score (if applicable) and submission of the graduate online application with fee by the stated admission deadline.

A minimum GPA of 3.0 is required. The graduate program may seek to waive this minimum by written petition to the Graduate Division, under circumstances when the applicant has demonstrated strong academic or professional skills, has documented extenuating circumstances during their undergraduate studies, or other mitigating considerations apply in the student's academic and professional record. Any applicant who spent the majority of their primary and secondary education in a nation/territory where English is not the primary language must take and pass an approved English proficiency examination prior to admission. Passing scores are defined in the Graduate Policies and Procedures Handbook.

Applications will be accepted for enrollment in the fall semester. Enrollment in other semesters will be considered on a case-by-case basis. Applicants are encouraged to contact individual faculty members to discuss their research interests before applying for graduate study.

Admission decisions are made on a case-by-case basis. Meeting some or all of these criteria does not guarantee admission, but merely eligibility.

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- 1.2.1 Prerequisite:** No Specific topics of coursework are required for admission to the program.
- 1.2.2 Decisions:** Applications are reviewed by the QSB Admissions Committee, in accordance with the QSB Admission Policy. Admission decisions are made on a case-by-case basis. Meeting some or all of the admission criteria does not guarantee admission, but merely eligibility. Performance at prior academic institutions and accomplishments in undergraduate or Master's level research, letters of recommendation, and faculty evaluations, typically arising from in-person interviews on-campus, are important determinants of an applicant's potential for success in graduate education and will be evaluated by the Admissions Committee. Finally, the match of the candidate's skills and interests to QSB research programs will be considered. The Admissions Committee will send their admission recommendations to the Chair of the Graduate Program, who will then approve (or deny) the recommendation to the Vice Provost and Dean of Graduate Education on the basis of available space and the competitiveness of applicants compared to the eligible pool.
- 1.2.3 Admission Methods:** Students can be admitted through one of two mechanisms. Rotation track admissions, where first-year graduate students will rotate through two-three QSB faculty labs prior to selecting a thesis advisor. Direct Admit students will negotiate with potential faculty advisors prior to acceptance into the program. Program acceptance requires a signed agreement between the student and the faculty advisor.
- 1.2.4 Transfer Students:** Ph.D. students wishing to transfer into the QSB Program from a graduate program outside of UC Merced will need to submit a formal application for admission. Review of the application will be made through the standard admissions procedure in QSB. If the student is accepted into the program, the student's academic and curricular status within QSB will be evaluated by the Educational Policy Committee. This evaluation will entail course articulations (including syllabi) relative to those required for QSB students. Likewise, for advanced Ph.D. transfer students, the evaluation will also entail examination of the written Qualifying Exam proposal (if the student had previously been admitted to "candidate" status). The student will be notified upon admission of the need to submit a request for course and exam evaluations before concluding their first semester in the program. If all criteria are met, the student will be advanced to candidacy and should select a QSB Doctoral committee (see 3.6 below). Transfer students must still meet the four semesters in academic residence requirement in order to graduate.
- 1.2.5 Off-cycle Admission of Students:** Acceptance of students outside of the normal (Fall) admission cycle is possible but is strongly discouraged and will only be considered on a case-by-case basis. Reasons for off-cycle admission include but are not limited to: available funding for the applicant that will be lost if the applicant does not matriculate off-cycle; or evidence that the applicant has financial or residency constraints that make on-cycle admission impossible. Students wishing to enter through off cycle admission will need to submit a formal application for admission using the "Direct Admit"

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option, which assumes that a QSB faculty member will be taking on responsibility for advising the student. Review of the application will be made by the Admissions Committee in QSB. Acceptance of the student into QSB Program will only be made if there is a convincing written rationale from the faculty advocate for off-cycle admission.

1.3 General Committees

- 1.3.1 Executive Committee:** The Executive Committee will consist of eight members who will serve rotating terms of three years. The eight members will act as Group Chair, Secretary, Treasurer, Educational Policy Committee Chair, Recruitment Committee Chair, Admissions Committee Chair, Seminar Committee Chair, and Awards Committee Chair. The Group Chair will serve as an *ex officio* member of all Committees. Members can be re-elected and serve two consecutive three-year terms but must sit out one election cycle before running for a third term.
- 1.3.2 Admissions Committee:** The Admissions Committee will consist of three to five faculty members and is charged with reviewing applications for admissions, making recommendations for admissions to the QSB Chair and Vice Provost and Dean of Graduate Education, exploring graduate student support mechanisms, and allocating intramural financial assistance.
- 1.3.3 Education Policy Committee:** The Educational Policy Committee (EPC) will consist of two to three faculty members and is responsible for establishing and guiding the educational Groups of the Group. The EPC will periodically conduct reviews of the Groups, including the five-year review. The EPC in consultation with the group faculty will determine changes in requirements of the QSB Graduate Group. The EPC acts as a liaison with QSB-relevant departments and graduate groups to coordinate teaching plans.
- 1.3.4 Recruitment Committee:** The Recruitment Committee will consist of two to three faculty members and is charged with the development of recruiting materials for the Group, promotion and representation of the Group to prospective students, and identification and coordination of recruitment partnerships between QSB and other institutions.
- 1.3.5 Seminar Committee:** The Seminar committee will consist of two to three faculty members and graduate students and is charged with organization of the weekly QSB seminar series. This entails soliciting speakers from QSB faculty and coordinating the seminars together with the SNS staff. The Seminar Committee shall also be responsible for organizing the scientific program of the Annual QSB retreat.
- 1.3.6 Awards Committee:** The Awards committee will consist of two to three faculty members and is charged with soliciting applications and/or nominations for various awards such as fellowships, travel awards, and retreat awards, and with evaluating the nominations and applications that it receives.

2. Master's Degree Requirements

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Students may be admitted to the graduate program in Quantitative and Systems Biology to work towards a Thesis or Non-thesis Master's Degree (M.S.). Students, at the time of successfully passing their qualifying exam and advancing to candidacy for a Ph.D, can apply for a Non-thesis Master's Degree along the way. Additionally, a Ph.D. student who has been in residence for at least two semesters, completed the Master's degree requirements, is in good academic standing, and has completed at least three of the core courses may petition the Advisor and QSB Program (Chair) to pursue a terminal M.S. degree. The recipient of a M.S. degree is understood to possess knowledge of a broad field of learning that extends well beyond that attained at the undergraduate level, but is not necessarily expected to have made a significant original contribution to knowledge in that field.

The Quantitative and Systems Biology Program has established the following requirements for the M.S. degree. Each M.S. student has a committee with at least three members, and students writing a master's thesis have a graduate research advisor. In addition, both M.S. program tracks require QSB 294 (Responsible Conduct of Research). As with the Ph.D. students, M.S. students are recommended to take research units (QSB 295), journal clubs (QSB293), and group meetings (QSB292) to help fulfill their unit requirements and education.

2.1 Degree Plan I – Thesis: This plan requires a minimum of 24 semester units in approved courses, at least 20 of which must be earned in 200-series graduate-level courses exclusive of credit given for thesis research and preparation. A general examination is also required.

2.1.1 Program Learning Outcomes (PLOs):

Quantitative and Systems Biology Skill – Knowledge and understanding of Quantitative and Systems approaches to biological problems, and demonstrated ability to conceive, plan, execute and/or interpret the applications of these approaches to research questions.

Ethics – Knowledge and understanding of ethical standards in proposing and executing professional scientific research.

Communication – Ability to engage in effective communication of original and existing scientific inquiry and results orally and in writing.

Scholarship – Ability to demonstrate graduate-level scholarship in specialized areas of biology, including command of relevant literature.

Research Ability – Ability to execute and defend original research that contributes to knowledge in the relevant field of biology.

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2.1.2 Course Requirements - Core and Electives (total 7-9 units)

All students must take at least 3 units that satisfy the Quantitative Biology requirement, at least 3 units that satisfy the Systems Biology requirement, and QSB 294 Responsible Conduct of Research. *(For a list of the courses that meet the Quantitative and Systems course requirements see section 3.2 Course Requirements.)*

2.1.2.1 Core Course Plan (total 7-9 units)

Course Number	Course Name	Units
QSB 2XX	Quantitative Course	3 or more
QSB 2XX	Systems Course	3 or more
QSB 294	Responsible Conduct of Research	1

2.1.2.2 Summary:

Complete at least two semesters of full-time academic residence at UC Merced. Complete at least two of the Program's core graduate courses worth at least 3 units, and other coursework as described below, with an S or a letter grade of at least B-; one satisfying the quantitative biology requirement, and the other satisfying the systems biology requirement. Other courses may be substituted by petition to EPC.

Complete at least 24 units of upper-division and graduate coursework with a cumulative grade-point average of at least 3.0, and a semester GPA not below 3.0 for two consecutive semesters. At least 20 units must be graduate-level coursework.

Prepare an acceptable thesis describing original research in the field and successfully defend thesis to thesis committee.

Full-time students supported through University employment or fellowship must enroll for 12 units per semester including research, academic and seminar units. Per UC regulations, ordinarily students shall not receive credits for more than 12 units of graduate-level (200) courses per semester.

2.1.3 Thesis Requirements:

Should the Thesis Committee determine that the thesis is unacceptable, a recommendation to disqualify the student may be made to the Vice Provost and Dean of Graduate Education.

Detailed information and instructions on the submission and filing of the thesis is available in the UCM Thesis and Dissertational Manual. A schedule of dates for filing the thesis in final form are published on the Graduate Division website in the [Dates and Deadlines section](#).

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2.2 Degree Plan II – Non-thesis: This plan requires a minimum of 32 units in approved courses, at least 24 of which must be from graduate-level courses in the 200 series, and no more than 4 units may be Graduate Research QSB 295 or equivalent. Passing a comprehensive examination administered by a three-member faculty committee is required of each candidate. At least two semesters of academic residence at UC Merced is required. No thesis is required.

2.2.1 Program Learning Outcomes (PLOs):

Quantitative and Systems Biology Skill – Knowledge and understanding of Quantitative and Systems approaches to biological problems, and demonstrated ability to conceive, plan, execute and/or interpret the applications of these approaches to research questions.

Ethics – Knowledge and understanding of ethical standards in proposing and executing professional scientific research.

Communication – Ability to engage in effective communication of original and existing scientific inquiry and results orally and in writing.

Scholarship – Ability to undertake and demonstrate original graduate level scholarship in specialized areas of biology, including integrative command of historical and current literature and broader scientific context, and identification of open research problems.

Research Ability – Ability to propose and defend a feasible research plan to apply scientific techniques to open research problems and execute, complete and defend original research that advances scientific knowledge.

2.2.2 Course Requirements - Core and Electives (total 32 units)

All students must take at least 3 units that satisfy the Quantitative Biology requirement, at least 3 units that satisfy the Systems Biology requirement, and QSB 294 Responsible Conduct of Research. *(For a list of the courses that meet the Quantitative and Systems course requirements see section 3.2 Course Requirements.)*

2.2.2.1 Core Course Plan (total 7-10 units)

Course Number	Course Name	Units
QSB 2xx	Quantitative Course	3 or more
QSB 2xx	Systems Course	3 or more
QSB 294	Responsible Conduct of Research	1

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2.2.2.2 Summary: Complete at least two semesters of full-time academic residence at UC Merced; Complete at least three of the Program's core graduate courses worth at least 3 units, and other coursework as described above, with an S or a letter grade of at least B-; one satisfying the quantitative biology requirement and the other satisfying the systems biology requirement. Other courses may be substituted by petition to EPC.

Complete at least 32 units of upper-division and graduate course work with a cumulative grade-point average of at least 3.0, and a semester GPA not below 3.0 for two consecutive semesters. At least 24 units must be graduate level, and no more than 4 units may be Graduate Research QSB 295 or equivalent.

Pass a comprehensive qualifying examination with both a written and oral component administered by a three-member faculty committee. This examination will test the student's understanding of the main concepts in the field at the graduate level.

Full-time students supported by University employment or fellowship must enroll for 12 units per semester including research, academic and seminar units. Per UC regulations, ordinarily students shall not receive credits for more than 12 units of graduate-level (200) courses per semester.

2.2.3 Comprehensive Examination:

2.2.3.1 Timing: Students may take the comprehensive examination at a time determined by the student and committee (typically during the fourth semester). However, it is important that the comprehensive examination be completed at or near the end of the coursework for the Master's degree. Students must be registered or in current filing fee status at the time when they take the examination. In addition, students must be advanced to candidacy prior to degree conferral.

2.2.3.2 Examination: The comprehensive exam will consist of a written paper on a topic agreed upon with the Master's committee, including the advisor. Other formats of the comprehensive exam must be agreed upon with the advisor and committee and approved by the EPC Chair. The exam is submitted by the date established by the advisor, allowing about 3 weeks of time for exam review and feedback, and for the student to make changes to the document by the exam deadline.

2.2.3.3 Outcome: Examinations can result in either a pass, fail, or partial pass by unanimous consensus of the Comprehensive Examination Committee. The results, as well as the procedures for repeating a failed examination, are described in Section VI. F of Graduate Policies and Procedures Handbook. The committee must report the result to the Graduate Council via the Vice Provost and Dean of Graduate Education within 30 days, using the Final Report for the Master's Degree Form found on the Graduate Division website.

2.3 Advising Structure and Mentoring: The Graduate Advisor is the faculty member who supervises the student's research and thesis for Track I and comprehensive examination for Track II. The Committee Chair is the faculty member who represents the graduate group in meetings, mediates the interests of the student and advisor, reports meeting outcomes to the graduate group, and is expected to lead committee to consensus. The Graduate Chair, who is appointed by the Vice Provost and Dean of Graduate Education, is a resource for information on academic requirements, policies and procedures, and registration information until the Thesis Committee is formed. The Graduate Student Coordinator assists students with identifying appointments and general university policies.

2.3.1 Advising Structure: A graduate student is expected to have a faculty advisor at all times during their graduate studies.

In the absence of a faculty advisor, the Graduate Group Chair becomes the student's temporary advisor. It is the responsibility of the student to secure a permanent advisor in a timely manner, typically a semester or less.

QSB has adopted [GC approved](#) Mentoring Guidelines.

2.4 Master's Degree Committees: Master's students form a single Committee to advise on their thesis (Track I) or for the comprehensive examination (Track II).

2.4.1 Thesis Committee (Track I): The student, in consultation with the major advisor, nominates three or more faculty, who are voting members of the University of California Academic Senate or the equivalent, to serve on the Thesis Committee. One committee member will be the Graduate Advisor. These nominations are submitted, as recommendations from the Graduate Group Chair, to the Vice Provost and Dean of Graduate Education for formal appointment in accordance with Graduate Council policy. The Chair of the committee shall always be a member of the Merced Division and of the Graduate Group supervising the master's program; no exceptions will be granted for this position. Detailed instructions are found in Graduate Policies and Procedures, Section VII. A.2.2, at the [Graduate Division Website](#). The Thesis Committee will oversee and evaluate the thesis preparation and defense for (Degree Plan I).

2.4.2 Non-Thesis Committee (Track II): The student, in consultation with the major advisor, nominates three or more faculty, who are voting members of the University of California Academic Senate or the equivalent, to serve on the Committee. One committee member will be the Graduate Advisor. These nominations are submitted, as recommendations from the Graduate Group Chair, to the Vice Provost and Dean of Graduate Education for formal appointment in accordance with Graduate Council policy. The Chair of the committee shall always be a member of the Merced Division and of the Graduate Group supervising the master's program; no exceptions will be granted for this position. Detailed instructions are found in Graduate Policies and Procedures, Section VII. A.2.2, at the [Graduate Division Website](#). The Non-Thesis Committee will oversee and evaluate the preparation and administration of the Comprehensive Exam (Degree Plan II).

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- 2.5 **Normative Time to Degree:** For students who are engaged in full-time study and making adequate progress, it is expected that they would advance to candidacy and complete the degree in 4 semesters.
- 2.6 **Typical Timeline and Sequence of Events:** The goals and needs of individual students vary considerably, and no single plan will accommodate all students. Therefore, the following program of study should be considered as a general guide only. In particular, the following example illustrates a 2-year program of study, which may not be appropriate for all students.

[For example:]

Year One	Fall	Spring
	QSB2xx Quantitative Course	QSB2xx Systems Course
	QSB 292	QSB 292
	QSB 293	QSB 293
	QSB 294	QSB 295
	QSB 295	
Year Two	Fall (Advancement to Candidacy)	Spring (Comprehensive Exam/Thesis completed)
	QSB 292	QSB 292
	QSB 293	QSB 293
	QSB 295	QSB 295

- 2.7 **Sources of Funding:** Graduate students who received a funding offer with their admissions offer will have their financial support according to the terms of the funding offer. Funding will come through a combination of Teaching Assistantships, graduate Research Assistantships, and/or Fellowships. Master's students are typically not expected to be funded by such means; but they may receive a funding offer with their admissions offer. More information on financial support can be found in the [Graduate Policies and Procedures Handbook](#).

3. Doctoral Degree Requirements

3.1 Program Learning Outcomes (PLOs):

Quantitative and Systems Biology Skill - Knowledge and understanding of Quantitative and Systems approaches to biological problems, and demonstrated ability to conceive, plan, execute and/or interpret the applications of these approaches to research questions.

Ethics - Knowledge and understanding of ethical standards in proposing and executing professional scientific research.

Teaching/Communication - Ability to effectively assist in the teaching of science in a classroom environment, and engage in effective communication of original and existing scientific inquiry and results orally and in writing.

Scholarship - Ability to undertake and demonstrate original graduate level scholarship in specialized areas of biology, including integrative command of historical and current

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literature and broader scientific context, and identification of open research problems.

Research Ability - Ability to propose and defend a feasible research plan to apply scientific techniques to open research problems and execute, complete and defend original research that advances scientific knowledge.

3.2 Course Requirements - Core and Electives

All students must take at least 3 units that satisfy the Quantitative Biology requirement, at least 3 units that satisfy the Systems Biology requirement, and at least three units from one additional graduate level QSB course.

Other courses may be substituted by petition to the EPC. Additional courses beyond these three may be taken as determined by the individual student's background and research topic in consultation with the student's Doctoral Committee.

Courses taken toward a graduate degree at another institution cannot be transferred for credit toward a Ph.D. at UC Merced. However, a course requirement may be waived if a similar course was taken at another institution. The General Petition form should be used for all requests for waivers of course work. Courses listed here are current as of the date on this document. The current list of courses is maintained on the QSB website.

3.2.1. Core Course Plan (total 12-15 units)

Course Number	Course Name	Units
QSB 2xx	Quantitative Course	3 or more
QSB 2xx	Systems Course	3 or more
QSB 291	Graduate Seminar	2
QSB 294	Responsible Conduct of Research	1
QSB 2xx	QSB Elective Course	3 or more

3.2.2. Quantitative Courses: The following courses satisfy the quantitative biology requirement, with an S or a letter grade of at least B-. If the student has a grade point average of at least 3.0 in all courses applicable to the degree, one UCM course in which a grade of B- is earned may be accepted by the petition process.

Course Number	Course Name	Units
QSB 207	Physical Biochemistry	3
QSB 214	Tissue Engineering Design	4
QSB 222	Modeling Social Behavior	4
QSB 227	Virology	3

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QSB 244	Phylogenetics: Speciation and Macroevolution	4
QSB 246	Community Ecology	3
QSB 247	Phylogenetic Comparative Methods	3
QSB 251	Advanced Molecular Immunology	3
QSB 256	Ecological Dynamics	3
QSB 271	Adult Brain Function and Dysfunction	3
QSB 275	Epigenetics and Gene Expression	3
QSB 278	Gene Expression Analysis	3
QSB 280	Advanced Mathematical Biology	3
QSB 281	Molecular Dynamics and Biomolecular Simulation	4
QSB 282	Bioinformatics	5
QSB 285	Biostatistics	4
CHEM 260	Introduction to Scientific Computing	3

3.2.3. Systems Courses: The following courses satisfy the systems biology requirement, with an S or a letter grade of at least B-. If the student has a grade point average of at least 3.0 in all courses applicable to the degree, one UCM course in which a grade of B- is earned may be accepted by the petition process.

Course Number	Course Name	Units
QSB 200	Molecular Cell Biology	3
QSB 211	Advanced Neurobiology: Development and Signaling	3
QSB 215	Principles of Biological Technologies	3
QSB 248	Advanced Topics in Ecology and Evolution	3
QSB 250	Embryos, Genes, and Development	3
QSB 253	Evolution and Development	3
QSB 290	Current Topics in Quantitative and Systems Biology	3
QSB 297	Systems Biology: From Molecules to Metabolic Networks	3

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3.2.4 Summary:

Students must 1) complete at least four semesters of full-time academic residence at UC Merced; 2) Complete at least two of the Program's graduate courses worth at least 3 units each, one from among the QSB courses satisfying the Quantitative Biology requirement and the other chosen from among the QSB courses satisfying the Systems Biology requirement; 3) Complete one additional QSB course worth at least 3 units; 4) Complete 1 unit of QSB 294 (Responsible Conduct of Research) and at least 2 units of QSB 291 (QSB Seminar Series); and 5) Complete additional units as needed of upper-division coursework, graduate coursework, or research and discussion units with a cumulative grade-point average of at least 3.0, and a semester GPA not below 3.0 for two consecutive semesters. All coursework must be completed with an S or a letter grade of at least B- to count toward these requirements.

Full-time students supported through University employment or fellowship must enroll for 12 units per semester including research, academic and seminar units. Per UC regulations, ordinarily students shall not receive credits for more than 12 units of graduate level courses per semester.

Graduate students who transfer into our program having taken courses in other graduate programs may make a single petition for waiver of course work (not credits) to EPC on entrance to QSB for fungible equivalence of courses taken. They should be prepared to demonstrate having obtained a suitable grade (equivalent to an S or a letter grade of at least B) in a class of equivalent semester-hours or greater, and syllabus content comparable to that of a requirement being matched.

All requirements for formal course work beyond the minimum are flexible and are determined by the individual student's background and research topic in consultation with the student's Doctoral Committee.

- 3.2.5 Elected Concentrations:** QSB has official concentrations in Ecology and Evolutionary Biology and Molecular and Cellular Biology. These are elected concentrations and can be declared using the Graduate Division form Petition for Change of Major/Degree. Concentrations that are elected are listed on students' transcripts.

3.2.5.1 Ecology and Evolutionary Biology: Course requirements for this concentration are one graduate-level course in Quantitative Biology (3-5 units), one graduate-level course in Systems Biology (3-5 units), one graduate-level course in Ecology (3-5 units), one graduate-level course in Evolutionary Biology (3-5 units). No course may fulfill more than one course requirement. The dissertation must fall within the areas of ecology and/or evolutionary biology broadly defined, as determined by the student's dissertation committee.

Ecology Courses:

Course Number	Course Name	Units
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QSB 218	Global Change Biology	3
QSB 245	Biogeography	3
QSB 246	Community Ecology	3
QSB 248	Advanced Topics in Ecology	3
QSB 256	Ecological Dynamics	4

Evolutionary Biology Courses:

Course Number	Course Name	Units
QSB 230	Ecological Genetics	3
QSB 244	Phylogenetics	3
QSB 245	Biogeography	3
QSB 247	Phylogenetic Comparative Methods	3
QSB 257	Evolutionary Dynamics	4

3.2.5.2 Molecular and Cellular Biology: Course requirements for this concentration are one graduate-level Quantitative Biology course (3-5 units), one graduate-level Systems Biology course (3-5 units), one graduate-level Molecular and Cellular Biology course (3-5 units), and one graduate level QSB course of 3-5 units, excluding QSB 291 and QSB 295. QSB 200 must be taken. No course may fulfill more than one course requirement. The dissertation must fall within the areas of Molecular and Cellular Biology broadly defined, as determined by the student's dissertation committee at the time of the doctoral dissertation defense.

Molecular and Cellular Biology Courses:

Course Number	Course Name	Units
QSB 200	Molecular Cell Biology	3
QSB 202	Graduate Level Biochemistry	3
QSB 207	Physical Biochemistry	3
QSB 211	Advanced Neurobiology	3
QSB 212	Advanced Signal Transduction and Growth Control	3
QSB 215	Principles of Biological Techniques	3
QSB 220	Cellular Microbiology	3

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QSB 223	Human Parasitology	3
QSB 227	Virology	4
QSB 250	Embryos, Genes and Development	3
QSB 251	Advanced Molecular Immunology	3
QSB 252	Cancer Genetics and Tumor Biology	4
QSB 253	Evolution and Development	3
QSB 261	Advanced Physiology	3
QSB 271	Adult Brain Function and Dysfunction	3
QSB 290	Topics in Systems Biology	3

3.3 Special Requirements

- 3.3.1 Laboratory Rotations:** Students who are admitted under the lab rotation track will participate in two to three rotations with QSB faculty members. After selecting the normal course requirement for first year students, students will register for QSB 288 (rotation research). Typically, two rotations occur during the first semester. A third rotation often occurs at the beginning of the second semester. By the end of the spring semester, but usually sooner, students are required to join a lab. This decision must be mutual- that is, both the student and the advisor must agree that the student will join the advisor's lab. If by this time a first-year rotation student has still not found a thesis advisor, the student will be put on Notice of Potentially Unsatisfactory Degree Progress and be granted one additional semester to find a lab or change degree objective (possibly to a coursework-based Master's degree) or be disqualified from QSB. Details of the QSB rotation system are described on the QSB web page.
- 3.3.2 Teaching Requirement:** QSB requires all graduate students pursuing the Ph.D. to acquire teaching experience at the post-secondary level under faculty supervision, for at least one semester. This requirement is usually satisfied by appointment as a Teaching Assistant or Teaching Fellow in undergraduate courses. For more information, consult the Academic Appointment and Graduate Student Employment section in the Graduate Policies and Procedures Handbook.
- 3.3.3 Qualifying Exam:** All students must pass a qualifying exam that includes both a written and oral component.
- 3.3.4 Technical Seminar:** All students must present an open technical seminar at least twice while in residence. The topic of the seminar may be the student's own research or it may be any other topic that falls within the areas of study spanned by the program, broadly defined. The seminar may be presented as part of a regular seminar series, at a scientific conference, or, if necessary, as a special seminar. The open presentation given as part of the Ph.D. defense may be counted as one of the required seminars.
- 3.3.5 Publication:** The final confirmation of the quality of a Ph.D. dissertation is the ability to publish the research results in a peer-reviewed journal. The research field may influence the timing and work required to publish research results. Whether a student has made sufficient progress for the Ph.D. ultimately will be determined by the student's Doctoral Committee. However, it is expected that the research project should

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be sufficiently complete to support publication of at least one full manuscript. The process of writing the manuscript will be undertaken with the assistance and guidance of the student's Research Adviser.

3.3.6 Dissertation Defense: All students must present and successfully defend a doctoral dissertation containing an original contribution to knowledge in the field. A student, with permission of their thesis advisor, may petition the Executive Committee to opt out of the public defense.

3.4 Dissertation Plan: In accordance with University of California policy, a minimum of four semesters in academic residence is required prior to awarding the Ph.D. Typically, a longer period of study, four to six years, is required for completion of all degree requirements. The expectation for QSB graduate students is that the PhD will be completed within five to six years. Departures from this expectation are decided in consultation with the graduate research advisor, Doctoral Committee, and the Program Chair. A student advances to candidacy by passing the qualifying exam. A student completes the Ph.D. degree upon fulfillment of all program degree requirements and thus demonstrating the ability to undertake original graduate level scholarship in his/her specialized areas of biology. Section 3.9 provides more detailed information on the dissertation phase.

3.5 Advising Structure and Mentoring: The Graduate Advisor is the faculty member who supervises the student's research and dissertation. The Doctoral Committee Chair is the faculty member who represents the graduate group in meetings, mediates the interests of the student and advisor, reports meeting outcomes to the graduate group, and is expected to lead committee to consensus. The Graduate Chair, who is appointed by the Vice Provost and Dean of Graduate Education, is a resource for information on academic requirements, policies and procedures, and registration information until the Doctoral Committee is formed. The Graduate Student Coordinator assists students with identifying appointments and general university policies.

3.5.1 Selection of Research Advisor: A graduate student is expected to have a faculty advisor at all times during their graduate studies. The heart of the Quantitative and Systems Biology Ph.D. program is the completion of a piece of original scientific research leading to the preparation and defense of a Ph.D. thesis, which occurs in the graduate advisor's research lab. Direct admission students select their graduate advisor prior to accepting admission. Rotation track students perform laboratory rotations and select an advisor from the rotations.

Regardless of admissions track, each student will discuss research interests and possible Ph.D. projects with faculty in the program as early as possible, and select a graduate research advisor during the first year of study. Selection of a graduate Research Advisor must be mutually agreed upon by faculty and student, is subject to approval by the Graduate Program, and must occur before the student's faculty committee can be constituted. The student and the research advisor together will develop a research topic, and research will normally occupy a majority of the student's time after the first year of residence. Research collaborations with faculty or senior scientists outside UC Merced are allowed and encouraged. However, the graduate research advisor must be a member of the Quantitative and Systems Biology

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Program. Rotation track students will be assigned to a first year advisor when they first enroll.

In the absence of a faculty advisor, the Graduate Group Chair becomes the student's temporary advisor. It is the responsibility of the student to secure a permanent advisor in a timely manner, typically a semester or less.

QSB has adopted [GC approved](#) Mentoring Guidelines.

3.6. Doctoral Degree Committees:

3.6.1 Candidacy Committee: The Candidacy Committee in QSB consists of at least three members, with at least two who are UC senate faculty members. Additional committee members are permitted if warranted by the student's research project, though in total, the majority of committee members on the Qualifying Exam Committee must be affiliated with QSB. The Graduate Research Advisor is not part of the Candidacy Committee. The members of each student's examination committee will select one member to chair the Candidacy Committee. The composition of the committee is typically the same as the Doctoral Committee, with the exception of the Graduate Research Advisor. If necessary, to maintain a minimum committee size of three, the Graduate Research Advisor can be replaced for the Qualifying Exam only by another member of the Program, selected by the Chair of the Doctoral Committee in consultation with the student, Research Advisor, and members of the Doctoral Committee. The Candidacy Committee is typically formed by the end of Year 1. Nominations of non-faculty members (i.e., Professional Researchers or faculty members from other universities) will be considered on an exception-only basis and must be approved by the Graduate Dean. For further details on the appointment process, see the Graduate Policies and Procedures Handbook on Doctoral Candidacy Committee.

3.6.2 Doctoral Committee: The Doctoral Committee shall supervise the preparation and completion of the dissertation and the final defense. All students in QSB must have a graduate Research Advisor and Doctoral Committee. The student's graduate Research Advisor, normally in consultation with the student, the Graduate Program and other faculty, recommends appointment of faculty members to advise on and supervise the student's dissertation research, serve on the Candidacy Committee, and review and pass upon the merits of the doctoral dissertation. Member nominations are submitted to the Graduate Division for formal appointment in accordance with Graduate Council policy.

Structure: The Doctoral Committee in QSB consists of at least three members, who are UC senate faculty members. Additional committee members are permitted if warranted by the student's research project, though in total, the majority of committee members on the Doctoral Committee must be affiliated with QSB. One Doctoral Committee member is the student's graduate research advisor. The two or more other faculty are usually UC Merced faculty members in QSB; one of these other faculty members is appointed as Committee Chair, and the Chair must be a member of QSB. Under some circumstances, additional committee members can be drawn from UC Merced faculty members from outside the Program, regular or adjunct

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faculty members from any UC campus, or an individual from outside the University of California who has special expertise and qualifications. In this case, the committee member should submit a curriculum vita to the Chair of the Quantitative and Systems Biology graduate program for review.

Timeline and Meetings: The Doctoral Committee must be formed by the end of Year 1. The Doctoral Committee meets as a group once per year to be updated on the progress and advise on research directions as necessary. Yearly meetings must be done as a group, with a majority of the committee members present. All members of the committee must be in attendance in person for Ph.D. qualifying examinations and dissertation defense. Rare exceptions to the physical attendance requirement will be granted for committee members that must travel a long distance or for public health reasons. Following each meeting, the Committee Chair sends a report back to the student, the student's Research Advisor, the QSB Program Chair and the appropriate graduate program staff.

Committee membership changes: If a committee member's absence from campus for an extended period of time makes scheduling of examinations unreasonably difficult, the student may request that the committee be reconstituted. Reconstitution of the committee may also be justified by other reasons - for example a substantial change in the student's thesis topic or may be required by the departure of a committee member from the university. When membership changes must be made, the graduate advisor in consultation with the student should recommend a new committee member, giving the reason for the change. The change must be approved by the Chair of the Quantitative and Systems Biology graduate program with consultation from the Executive Committee if requested. A Request for Reconstitution of Committee Membership form must be completed and approved by the Vice Provost and Dean of Graduate Education.

3.7. Qualifying Examination Requirements: All students in QSB are required to pass a qualifying examination before advancement to candidacy for the Ph.D. degree. Students are expected to take the qualifying examination during the Spring semester or the summer of their second year of graduate study, unless they successfully petition the QSB Chair to take it at a specific later date. Students entering the Ph.D. program with a M.S. degree may request to take their qualifying exam during their first year, provided their Doctoral Committee approves. The dates for the examination are arranged between the student, their graduate research advisor, and the Candidacy Committee.

3.7.1. Components of the Exam: The qualifying exam consists of a written proposal and an oral examination. The written proposal serves as the research plan for the student and thus should be approved by the Research Advisor prior to sending to the Candidacy Committee.

3.7.2. Written proposal: One month before the scheduled oral exam, the student will provide to the Candidacy Committee a written document that describes their research topic, summarizes progress to date, and outlines what they propose to do, why it is relevant, and what will be learned. The format of the research proposal will be determined by the student in consultation with their Research Adviser and Candidacy Committee; however, the proposal must follow the format of a research proposal to a major funding agency in the student's area of research. The Candidacy Committee Chair will review this document prior to the exam and determine if the student has outlined a project that

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is appropriate for a Ph.D. If not, the Chair will create a consensus opinion with the committee that the Chair will transmit to the student and Research Advisor, and the student will be given approximately a month to rewrite the research plan. The student may then take the oral portion of the Qualifying Examination.

3.7.3. Oral Exam: The oral exam may be taken only after the student's written research proposal has been preliminarily approved by the Candidacy Committee Chair. The oral exam is conducted by the Candidacy Committee. It will focus on the student's research proposal, but it may cover any related field of science. Typically, the oral exam will last up to three hours. The Research Advisor may not be present during the student examination and the committee deliberation.

3.7.4. Outcome of the Exam:

The Candidacy Committee deliberates on the performance of the student with the student absent, and provides the outcome of the exam to the student at the end of the oral exam. The Candidacy Committee submits the results of the qualifying examination to the Graduate Division. Possible outcomes are:

- Pass (conditions may not be appended to a pass decision)
- Re-take, with an option to retake the examination within a specified time period, or to satisfy specific other requirements
- Fail

The committee members should include in their evaluations of the student such factors as relevant portions of the previous academic record, performance on the examination, and an overall evaluation of the student's performance and potential for scholarly research as indicated during the examination. The committee should strive to reach a unanimous decision. If a unanimous decision is reached, the committee shall inform the student of its decision in one of the forms listed above. If the decision is "Re-Take" or "Fail", the Qualifying Exam Committee Chair must include in a report a specific statement, which may include a minority report, explaining its decision and must inform the student of its decision. In the case of a "Re-Take" decision, the committee must include in its report a further statement of its terms and inform the student and their graduate research advisor of those terms. In those cases, when it is not possible for the members to resolve their differences, the student should be informed of the nature of those differences and each member should submit a detailed assessment of the student's performance to the Chair of the Graduate Program. The Chair, in consultation with other members of the Graduate Program, will use these individual reports to adjudicate the result.

Upon recommendation of the Candidacy Committee, a student who has not passed the examination may repeat the qualifying examination after a preparation time of no more than six months. The examination must be held by the same committee except that members may be replaced, with the approval of the graduate advisor, for a legitimate cause such as extended absence from the campus. Failure to pass the examination on the second attempt means that the student is subject to disqualification from further study for

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the doctoral degree. After a second examination, a vote of Re-take is unacceptable; only Pass or Fail is recognized by the Vice Provost and Dean of Graduate Education.

3.8. Advancement to Candidacy: All graduate students are considered resident graduates, not candidates for a degree, unless admitted to candidacy by the Graduate Division after formal application. Before advancing to candidacy for a doctoral degree, a student must have maintained a minimum GPA of 3.0 in all course work undertaken and must have passed the Qualifying Examination. Students are strongly encouraged to have completed all coursework requirements prior to advancement to candidacy: the need to take more than one Quantitative, Systems, or Elective course will require approval of the Chair of the Graduate Program. Normally, students advance by the 5th or 6th semester. The student must file the appropriate paperwork (Advance to Candidacy for the Degree of Doctor Philosophy Form and Conflict of Interest Form) with the Graduate Division and pay the candidacy fee in order to be officially promoted to Ph.D. Candidacy. Students must be advanced to candidacy prior to degree conferral.

3.8.1. Master's en route: Doctoral degree students are allowed to use their passing Qualifying Exam as the comprehensive exam for Master's Degree Plan I. To do so, all required coursework must also be completed. You will select the Master's along the way in the Advancement to Candidacy form from Graduate Division. If a student has successfully advanced to candidacy, they are allowed to use QSB 295 units to meet the 32-unit requirement. All other requirements are to be met under Plan II of the QSB Master's Degree.

3.9. Dissertation Requirements: The Ph.D. dissertation must be creative and independent work that can stand the test of peer review. The expectation is that the material will serve as the basis for publication(s) in a peer-reviewed journal. The work must be the student's, and it must be original and defensible. The student is encouraged to discuss with members of the Doctoral Committee both the substance and the preparation of the dissertation well in advance of the planned defense date. Detailed instructions on the form of the dissertation and abstract may be obtained from the Graduate Division.

The submission of the dissertation is the last step in the program leading to the award of an advanced degree. All dissertations submitted in fulfillment of requirements for advanced degrees at UC Merced must conform to certain University regulations and specifications with regard to format and method of preparation. The UC Merced Thesis and Dissertation Manual are available at the Graduate Division website. The Doctoral Committee certifies that the completed dissertation is satisfactory through the signatures of all Committee members on the signature page of the completed dissertation.

Filing instructions are found in the UC Merced Thesis and Dissertation Manual. The thesis is expected to be submitted by the deadline in the semester in which the degree is to be conferred. The end of the semester is the deadline for submitting dissertations during each semester. Those students who complete requirements and submit dissertations after the end of the semester and prior to the start of the subsequent semester will earn a degree for the following semester, but will not be required to pay fees for that semester. In accordance with

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UC and UC Merced policy, all approved thesis/dissertation manuscripts automatically become available for public access and circulation as part of the UC Libraries collections.

Upon completion of the dissertation defense and approval of the dissertation, the Doctoral Committee recommends, by submission of the Report on Final Examination for the Ph.D. Degree Form, the conferral of the Ph.D. subject to final submission of the approved dissertation for deposit in the University Archives. The Committee recommendation must be unanimous.

Detailed information and instructions on the submission and filing of the dissertation is available in the UC Merced Thesis and Dissertation Manual. A schedule of dates for filing the thesis in final form are published on the Graduate Division website in the Dates and Deadlines section.

- 3.9.1. Dissertation Defense:** The Ph.D. final examination consists of an open seminar on the dissertation work followed by a closed examination by the Doctoral Committee. During the examination, the student is expected to explain the significance of the dissertation research, justify the methods employed, and defend the conclusions reached.
 - 3.9.2. Conduct of the Defense:** Administration of the final examination is subject to the Regulations of the Merced Division and policies of the Graduate Council governing critical examinations. The student must provide a copy of the written dissertation to each member of the Doctoral Committee and allow each committee member at least three weeks to read and comment on it. If one or more committee members believe that there are significant errors or shortcomings in the dissertation or that the scope or nature of the work are not adequate, the student must address these shortcomings before scheduling a defense. Once the committee members are in agreement that the dissertation is ready to be defended, the defense date may be scheduled by the student in consultation with the committee.
 - 3.9.3. Outcome of the Defense:** At the conclusion of the final examination, the committee shall vote on whether both the written dissertation and the student's performance on the final exam are of satisfactory quality to earn a University of California Ph.D. degree. All members of the Doctoral Committee must certify that the completed dissertation is satisfactory. A unanimous decision is required for a pass. Members of the committee may vote to make passing the exam contingent on corrections and/or revisions to the dissertation. In this case, the committee will select one member, normally either the graduate Research Advisor or the Doctoral Committee Chair, who will be responsible for approving the final version of the dissertation that is submitted to the Graduate Division. All members of the degree committee must sign the final dissertation.
- 3.10. Normative Time to Degree:** Normative Time to Advancement to Candidacy in QSB is [4-5] semesters for students who pursue the Ph.D. directly after the bachelor's degree. Normative Time in Candidacy, which are the remaining semesters recommended for completion of the dissertation, is [9-10] semesters.

3.11. Typical Timeline and Sequence of Events

<i>Year 1</i>	<i>Fall</i>	<i>Spring</i>
	<i>QSB 2xx (Quantitative or Systems Course)</i>	<i>QSB 2xx (Quantitative or Systems Course)</i>
	<i>QSB 294 Responsible Conduct of Research</i>	<i>QSB 291 Graduate Seminar</i>
	<i>QSB 291 Graduate Seminar</i>	<i>QSB 292 & 293 Group Meeting & Journal Club</i>
	<i>QSB 295 Research or 288 (rotation)</i>	<i>QSB 295 Research or 288 (rotation)</i>
<i>Year 2</i>	<i>Fall</i>	<i>Spring</i>
	<i>QSB 2xx – Elective Course</i>	<i>QSB 292 Group Meeting</i>
	<i>QSB 292 & 293 Group Meeting & Journal Club</i>	<i>QSB 293 Journal Club</i>
	<i>QSB 295 Research</i>	<i>QSB 295 Research</i>
	<i>Qualifying Exam Preparation</i>	<i>Qualifying Exams</i>
<i>Year 3</i>	<i>Fall (advancement to PhD candidacy)</i>	<i>Spring</i>
	<i>QSB 292 Group Meeting</i>	<i>QSB 292 Group Meeting</i>
	<i>QSB 293 Journal Club</i>	<i>QSB 293 Journal Club</i>
	<i>QSB 295 Research</i>	<i>QSB 295 Research</i>
<i>Year 4-5</i>	<i>Dissertation</i>	

3.12. Sources of Funding: Graduate students who received a funding offer with their admissions offer will have their financial support according to the terms of the funding offer. Funding will come through a combination of Teaching Assistantships, graduate Research Assistantships, and/or Fellowships. Master's students are typically not expected to be funded by such means; but they may receive a funding offer with their admissions offer. More information on financial support can be found in the [Graduate Policies and Procedures Handbook](#).

3.13. Change of Degree Level (Ph.D. to Masters, and/or Master’s to Ph.D.): Students who are changing from a Ph.D. to a terminal Master’s degree will need to complete the Graduate Division form Change of Petition for Change of Major/Degree. Students who wish to change from a Master’s to a Ph.D. will need to get approval from their Faculty Advisor and the Graduate Chair. If approved, the student will need to complete the Graduate Division form Petition for Change of Major/Degree.

4. General Information

4.1. Education Leave Program, In Absentia and Filing Fee status.

Information about ELP (Educational Leave Program), In Absentia (reduced fees when

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researching out of state), and Filing Fee status can be found in the Graduate Group Policies and Procedures Handbook, available on the Graduate Division Website.