

Graduate Group in Biochemistry, Molecular, Cellular & Developmental Biology
Ph.D. and M.S. DEGREE REQUIREMENTS
Graduate Council Approval: April 15, 2009

MASTER'S PROGRAM

1) Admissions Requirements

Applicants for admission to BMCDB must meet the University of California minimum GPA requirement for admission (3.0 overall). Other requirements for admission include:

- Hold a Bachelor's degree: An undergraduate major in biology or chemistry is typical for BMCDB graduate students, but is not required. Prerequisites include calculus; statistics; physics; general chemistry; organic chemistry; biology; biochemistry; genetics.
- Graduate Record Examination (General Test)
- English proficiency examination for international applicants who have not studied at an English speaking University: TOEFL or other University approved examination. International applicants must meet the Office of Graduate Studies minimum TOEFL score requirement (or equivalent for other University-approved examination).
- Three letters of recommendation.

2) M.S. Degree, Master's Plan I and II:

Plan I. This plan requires a minimum of 30 units of adviser-approved, graduate and upper division courses (the 100 and 200 series only) in which the student receives a letter grade (B- or better) or S, and, in addition, a thesis. At least 12 of the 30 units must be graduate work in the major field.

Plan II. This plan requires a minimum of 36 units of adviser-approved, graduate and upper division courses, of which at least 18 units must be graduate courses in the major field, and in which the student receives a letter grade (B- or better) or S. Not more than 9 units of research (299 or equivalent) may be used to satisfy the 18-unit requirement. A comprehensive final examination in the major subject is required of each candidate. No thesis is required.

3) Course Requirements - Core and Electives (see summary table)

**the following 5 courses replace the former 4 core courses (MCB 221 A,B,C,D) which were 4 units each*

a) Core Courses (15 units):

- MCB 210 Molecular Genetics & Genomics (3 units)
- MCB 211 Macromolecular Structure & Interactions (3 units)
- MCB 212 Cell Biology (3 units)
- MCB 213 Developmental Biology (3 units)
- MCB 214 Molecular Biology (3 units)

Additional required courses (4 units):

MCB 215 (2 units) Directed Readings. The goal of this course is to develop critical reading skills for graduate students and to expose them to major paradigm

advances in specialized fields of molecular and cellular biology. To advance active learning and participation, this course is designed to bring small groups of students together with faculty who are expert in a given area. Faculty (2/section) will choose papers that highlight major advances (technical and/or intellectual) and that form a narrative of discovery. Faculty will provide a historical background to the problem addressed by the paper, review special techniques used in the paper and challenge students to develop their own ideas for how to address the major questions in the field. The intensive meeting schedule and small group size are a critical to the goals of the course.

MCB xxx (pending) (2 units; S/U grading) Research Ethics. *Modeled after GGG296.* Review of basic skills required of contemporary scientists. Topics include scientific conduct, manuscript preparation, grant writing, seminar presentations and time management. Emphasis on responsibilities of scientists to factually and thoughtfully communicate results.

b) Elective Courses (11 units Plan I; 8 units Plan II):

Each student must take at least two additional letter graded advanced undergraduate or graduate courses to be selected in consultation with the academic adviser and major professor (see attachment (b) for courses). Attention to the schedule on which such courses are offered is essential - many are offered only in alternate years

c) Total Minimum Unit Requirement:

A total of 30 units for Plan I and 36 units for Plan II (core, elective and research) are required. Students will enroll for 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the course requirements may not be taken S/U unless the course is normally graded S/U.

Students must maintain a GPA of 3.0. If the GPA falls below 3.0, the student is placed on academic probation. If a student is on academic probation for more than three quarters, the student is subject to disqualification upon recommendation of the BMCDB Executive Committee to the Dean of Graduate Studies.

4) **Special requirements** – none

5) **Committees:**

a) **Admission Committee**

Once the completed application, all supporting material, and the application fee have been received, the application will be submitted to the Admissions Committee. The Admissions Committee consists of six graduate group faculty and one graduate group student. Based on a review of the entire application, a recommendation is made to accept or decline an applicant's request for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by Graduate Studies. Applications are accepted through December 15 of the previous year for the next Fall entering class.

b) Course Guidance/Advising/Major Professor Selection

Upon entering the group, students will work with the Master degree adviser to ensure the students enroll in the correct courses and remedy any deficiencies. The Master degree adviser will also help place the student in a lab if research is to be undertaken (Plan I). A minimum of 12 units is required per quarter to maintain full time student status.

c) Thesis Committee or Comprehensive Examination Committee

The student, in consultation with his/her major professor and graduate adviser, nominate 3 faculty to serve on the Thesis (Examination) Committee. These nominations are submitted to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy (DDB 80, Graduate Council B.1.). The major professor serves as Chair of the thesis committee.

6) Advising Structure and Mentoring

The **Major Professor** is the faculty member who supervises the student's research and thesis (Plan I); this person serves as the Chair of the Thesis Committee. The **Master of Science Adviser**, who is appointed by the Chair of the group, is a resource for information on academic requirements, policies and procedures, and registration information until the Course Guidance Committee is formed. A Student Mentorship committee will deal with any mentoring problems that arise. The **Mentoring Guidelines** can be found in the graduate student handbook on the web (the current BMB handbook can be found at: <http://biosci2.ucdavis.edu/ggc/bmb/programs/courses.html>).

7) Advancement to Candidacy

Every student must file an official application for Candidacy for the Degree of Master of Science after completing one-half of their course requirements and at least one quarter before completing all degree requirements. The Candidacy for the Degree of Master form can be found online at: <http://www.gradstudies.ucdavis.edu/forms/>. A completed form includes a list of courses the student will take to complete degree requirements. If changes must be made to the student's course plan after s/he has advanced to candidacy, the Graduate Adviser must recommend these changes to Graduate Studies. Students must have their Graduate Adviser and thesis committee Chair sign the candidacy form before it can be submitted to Graduate Studies. If the candidacy is approved, the Office of Graduate Studies will send a copy to: the Thesis Committee Chair, the appropriate graduate staff person, and the student. If the Office of Graduate Studies determines that a student is not eligible for advancement, the department and the student will be told the reasons for the application's deferral. Some reasons for deferring an application include: grade point average below 3.0, outstanding "I" grades in required courses, or insufficient units.

8) Comprehensive Examination and Thesis Requirements

a) Thesis Requirements (Plan I)

The Master's thesis is to be carried out under the supervision of a faculty member of the BMCDB Group and must represent a contribution to knowledge in biochemistry, molecular genetics, cell biology or developmental biology. The thesis is submitted to a committee of three faculty members recommended by the Adviser and appointed in accordance with the Academic Senate regulations. The topic of the thesis should be acceptable to all members of the committee when they agree to serve and a joint meeting of committee members and the student should be held at that time. For the thesis to be acceptable for the degree, all committee members must sign the title page. Instructions on preparation of the thesis and a schedule of dates for filing the thesis in final form are available from Graduate Studies; the dates are also printed in the UC Davis General Catalog

b) Comprehensive Examination (Plan II)

The student must pass a comprehensive final examination in biochemistry, molecular genetics, cell and developmental biology. The comprehensive exam is taken after all coursework is finished, in the winter/spring of the 2nd year. The format is an oral examination administered by a committee of three faculty members nominated by the Adviser. A unanimous vote of the committee is required to pass a student. If a student does not pass the examination, the committee may recommend that she or he be re-examined one time. If the Graduate Adviser concurs, the student may be re-examined. A student who does not pass on the second attempt is subject to disqualification from further work as a graduate student. The results of all Master's examinations must be reported to Graduate Studies.

9) Normative Time to Degree

The Normative Time to Degree for the M.S. program is six quarters (two years).

10) Typical Time Line and Sequence of Events

Year 1:

<i>Fall</i>	<i>Winter</i>	<i>Spring</i>
MCB211	MCB212	MCB214
MCB210	MCB213	MCB215
MCB291	MCB291	MCB291
	Advancement to candidacy in Winter or Spring	

Year 2:

<i>Fall</i>	<i>Winter</i>	<i>Spring</i>
Elective(s)		
Ethics		
MCB291	<i>M.S. Comprehensive Exam or preparation of thesis</i>	
MCB299 for Thesis Plan I		

11) Sources of funding

There is no guarantee of funding for the Plan I and Plan II Master programs. Master students can TA to support themselves. Faculty are NOT required to support a MS student.

12) PELP and Filing Fee status.

Information about PELP (Planned Educational Leave) and Filing Fee status can be found in the Graduate Student Handbook:

<http://www.gradstudies.ucdavis.edu/students/handbook/1.html>

Ph.D. PROGRAM

1) Admissions Requirements

Applicants for admission to BMCDB must meet the University of California minimum GPA requirement for admission (3.0 overall). Other requirements for admission include:

- Hold a Bachelor's or Master's degree: An undergraduate major or masters degree in biology or chemistry is typical for BMCDB graduate students, but is not required.
- Graduate Record Examination (General Test) is required; Subject test in Biochemistry, Biology or Chemistry is highly recommended.
- English proficiency examination for international applicants who have not studied at an English speaking University: TOEFL or other University approved examination. International applicants must meet the Office of Graduate Studies minimum TOEFL score requirement (or equivalent for other University-approved examination).
- Three letters of recommendation

Deficiencies:

If there are deficiencies in background, appropriate remedial undergraduate courses will be recommended; they must be completed prior to the Qualifying exam either by (1) taking courses as approved by the Graduate Adviser, or (2) by being a Teaching Assistant in the appropriate courses, and by attending the course lectures.

2) Dissertation Plan B

Three member (minimum) dissertation committee, an optional final oral examination (made on an individual student basis by the dissertation committee), and an exit seminar.

3) Course Requirements

**the following 5 courses replace the former 4 core courses (MCB 221 A,B,C,D) which were 4 units each*

a) Core Courses (15 units):

- MCB 210 Molecular Genetics & Genomics (3 units)
- MCB 211 Macromolecular Structure & Interactions (3 units)
- MCB 212 Cell Biology (3 units)
- MCB 213 Developmental Biology (3 units)
- MCB 214 Molecular Biology (3 units)

Additional required courses (20 units):

MCB 215 (pending) (2 units) Directed Readings. The goal of this course is to develop critical reading skills for graduate students and to expose them to major paradigm advances in specialized fields of molecular and cellular biology. To advance active learning and participation, this course is designed to bring small groups of students together with faculty who are expert in a given area. Faculty (2/section) will choose papers that highlight major advances (technical and/or intellectual) and that form a narrative of discovery. Faculty will provide a historical background to the problem addressed by the paper, review special techniques used in the paper and challenge students to develop their own ideas for how to address the major questions in the field. The

intensive meeting schedule and small group size are a critical to the goals of the course.

MCB xxx (pending) (2 units) Research Ethics. Modeled after GGG296.

Review of basic skills required of contemporary scientists. Topics include scientific conduct, manuscript preparation, grant writing, seminar presentations and time management. Emphasis on responsibilities of scientists to factually and thoughtfully communicate results.

MCB 220L – (5 units) Advanced Molecular Biology Laboratory Rotations. Taken in both the fall and winter for a total of 10 units. Two, five-week rotations per quarter. At the end of each rotation, students give short presentations on their rotation projects to other first-year students, the instructor in charge and any other faculty and students who wish to attend. In addition, each student prepares a short written report.

MCB 291 – (1 unit) Current Progress in Molecular and Cellular Biology Seminar. Taken fall, winter and spring quarters of years 1 and 2 for a total of 6 units. Seminars presented by guest lecturers on subjects of their own research activities.

b) Elective Courses (6 units):

Each student must take at least two additional advanced courses (minimum of 6 units) to be selected in consultation with the academic adviser and major professor (see attachment (b) for courses). Attention to the schedule on which such courses are offered is essential - many are offered only in alternate years

c) Total Minimum Unit Requirement = 72 units:

A total of 72 units (core, elective, and research) are required. Students will enroll for 12 units per quarter including research, academic and seminar units. Courses that fulfill any of the course requirements may not be taken S/U unless the course is normally graded S/U. Required core and elective courses constitute 41 units, the additional 31 units is enrollment in research credit (299).

Students must maintain a GPA of 3.0. If the GPA falls below 3.0, the student is placed on academic probation. If a student is on academic probation for more than three quarters, the student is subject to disqualification upon recommendation of the BMCDB Executive Committee to the Dean of Graduate Studies.

4) Teaching Assistantship (TA) requirement:

Participation in teaching is an essential part of training in the graduate program. In addition, teaching experience can be helpful later in obtaining employment. Students are required to TA one adviser-approved undergraduate biochemistry, molecular genetics, cell biology or developmental biology lecture or laboratory course. It is expected that students fulfill this requirement during the third quarter of their first year or during the first two quarters of the second year. It must be fulfilled prior to the qualifying examination. While working as TA's students must register for MCB 390 (1 unit) or equivalent.

Teaching assignments may vary according to past teaching experience and source of support. Open positions are advertised quarterly across the campus. Application forms may be obtained from Departmental offices. In general, applications are current only for the quarters indicated on the form. New applications must be filed for subsequent consideration.

5) **Committees**

a) **Admissions Committee**

Once the completed application, all supporting material, and the application fee have been received, the application will be submitted to the Admissions Committee. The Admissions Committee consists of six graduate group faculty and one graduate group student. Based on a review of the entire application, a recommendation is made to accept or decline an applicant's request for admission. That recommendation is forwarded to the Dean of Graduate Studies for final approval of admission. Notification of admissions decisions will be sent by Graduate Studies. Applications are accepted through December 15 of the previous year for the next Fall entering class.

b) **Course Guidance/Advising/Major Professor Selection**

Upon entering the group, students are assigned an Academic Adviser based on their area of interest (Biochemistry, Molecular Biology, Cellular Biology, Developmental Biology). A minimum of 12 units is required per quarter to maintain full time student status. Selection of the dissertation adviser (major professor) is normally accomplished by the end of the winter quarter, first year. The chair of BMCDB sends a letter to each first year student requesting that the student find a major professor with whom the student wishes to work and who is willing to take the student into the laboratory and to provide the necessary financial support. Students submit their requests to the BMCDB Student Affairs Committee, which approves and makes final assignments. Satisfactory progress in the BMCDB program is dependent upon assignment of a dissertation adviser by the end of spring quarter in the first year.

c) **Qualifying Examination Committee**

Qualifying examination committees will consist of five faculty members who are recommended to Graduate Studies by the BMCDB Student Affairs Committee in the Winter quarter of the student's second year. The faculty members may all be in the program, but will come from at least three different departments. Three members will be selected by the BMCDB Student Affairs Committee with solicited input from major advisers and students, who will be asked to recommend names of the members - ideally two of these faculty will also to serve on the student's dissertation committee. The remaining two faculty will be selected to ensure coverage of the core areas of BMCDB (i.e. Biochemistry, Molecular Biology, Cellular Biology, and Developmental Biology).

Qualifying examination committees are submitted to Graduate Studies and appointed in accordance with the Academic Senate regulations. The chair of the qualifying examination committee is expected to ensure that the student receives a fair examination. Qualifying Examination Committees may not include the major professor

who will serve as chair of the student's dissertation committee. The area of the student's dissertation research will be considered so that at least one individual with expertise in this area is a member of the qualifying examination committee.

The student, in consultation with his/her major professor and graduate adviser, nominate three faculty to serve on the Examination Committee. These nominations are submitted to the Student Affairs Committee and two additional faculty are chosen from the faculty at large. These names are forwarded to the Office of Graduate Studies for formal appointment in accordance with Graduate Council policy (DDB 80. Graduate Council B.1.).

6) **Mentoring**

The **Major Professor** is the faculty member who supervises the student's research and dissertation; this person serves as the Chair of the Dissertation Committee. The **Graduate Adviser**, who is appointed by the Chair of the program, is a resource for information on academic requirements, policies and procedures, and registration information until the Course Guidance Committee is formed. A Student Mentorship committee will deal with any mentoring problems that arise. The **Mentoring Guidelines** can be found in the graduate student handbook on the web (the current BMB handbook can be found at: <http://sandtiger.dbs.ucdavis.edu/ggc/bmb/programs/courses.html>)

7) **Advancement to Candidacy**

After the qualifying exam is passed, a student must file an application for advancement to candidacy for the degree of Doctor of Philosophy. The chair of a student's qualifying examination committee is sent the application form for advancement to candidacy. When the student has passed the examination, the chair signs and dates the form. The student then identifies a dissertation committee, provides a dissertation title, obtains signatures of the major professor and graduate adviser, pays a fee, and files the form with Graduate Studies. Graduate Studies requires that students must be advanced to candidacy by the ninth quarter of academic enrollment to be eligible for continued appointment as a graduate student researcher or teaching assistant.

8) **Dissertation requirements:**

a) The program requires an exit seminar of each student. Satisfaction of this requirement must be verified by the Dissertation Committee Chair.

b) The dissertation committee may require a final oral examination; the decision is made on an individual student basis.

c) Before advancing to candidacy for a doctoral degree, a student must have satisfied all requirements set by the graduate program, must have maintained a minimum GPA of 3.0 in all course work undertaken (except those courses graded S or U), and must have passed a Qualifying Examination before a committee appointed to administer that examination.

- All students will complete the course requirements before taking their Qualifying Examination.
- The Qualifying Examination will consist of written and oral examinations.
- The written research proposal should be provided to members of the qualifying examination committee at least 1 week before the qualifying exam. The qualifying exam should be taken by the Spring quarter of the second year and no later than the end of the Fall quarter of the third year after admission to the Ph.D. program.
- According to university policy, graduate students cannot hold an academic title (e.g., Teaching Assistant, Research Assistant) for more than 9 quarters before passing their Qualifying examination.
- Passing this exam makes the student eligible for advancement to candidacy.

d) Written component of Qualifying Examination:

The goal of the dissertation research proposal is to provide a substantial and original contribution to the fields of biochemistry, molecular genetics, cell and/or developmental biology. The scope should be similar to that of a postdoctoral grant proposal. Written versions of the dissertation research proposal are to be prepared by the student and distributed to the committee at least one week prior to the examination. The format is that of an NIH postdoctoral fellowship proposal. Organize sections 1-5 of the research proposal to answer these questions: (1) Specific aims. What do you intend to do? (2) Background and significance. Why is the work important? (3) Preliminary studies. What have you already done? (4) Research design and methods. How are you going to do the work? (5) References. DO NOT EXCEED 5 PAGES FOR SECTIONS 1-4. The following distribution for length is recommended:

(1) **Specific aims.** State briefly the broad, long-term objectives of the work. Then state the specific purposes of the proposed research. One-half page is recommended.

(2) **Background and significance.** Briefly sketch the background to the proposal. Critically evaluate existing knowledge, and identify the gaps that the project is intended to fill. State concisely the importance of the proposed research by relating the specific aims to the broad, long-term objectives. One page is recommended.

(3) **Preliminary studies** - dissertation research only. Describe the work you have already accomplished that is relevant to the proposal. A maximum of one page is recommended.

(4) **Research design and methods.** Outline the experimental design and the procedures to be used to accomplish the specific aims. Include the means by which data will be collected, analyzed and interpreted. Describe any new methodology and its advantage over existing methodologies. Discuss the potential difficulties and limitations of the proposed procedures along with alternative approaches to achieve the aims. Provide a tentative sequence for the investigation. Although no specific number of pages is recommended for this section, the total for sections 1-4 should not exceed 5 pages.

(5) **References.** Each citation must include the names of all authors, title of the article, name of the book or journal, volume number, page numbers and year of publication.

Concepts within the research proposal can be discussed with others (such as the student's major professor and peers), but the writing of the proposal should be solely the student's work (i.e., no editorial assistance is allowed) as the proposal will serve as evidence of the student's proficiency in scientific writing.

The qualifying exam committee will be responsible for assessing that the student's writing proficiency is satisfactory before advancement to candidacy. Furthermore, the research proposal will provide information that may be discussed during the oral exam.

e) Oral component of the Qualifying Examination:

The oral portion of the qualifying exam is intended to demonstrate the student's critical thinking ability, synthesis, and broad knowledge of the field of study. It will start with ~ 20 min oral chalkboard presentation of the proposal; questions will be asked related to the research topic and then proceed to more general topics.

The committee will evaluate the student's general qualifications for a respected position as an educator or leader as well as the student's preparation in a special area of study based upon relevant portions of the student's previous academic record, performance on specific parts of the examination, and the student's potential for scholarly research as indicated during the examination.

f) Qualifying Examination Evaluations

There are three possible outcomes of the examinations - pass, not pass, and fail. Pass advances the student to candidacy for the Ph.D. Fail means that the student is disqualified. Not pass means that the student is required to retake all or part of the examination OR to satisfy another requirement. If requested, the second examination is to be scheduled at the earliest possible date and will be administered by the same committee. Satisfactory completion of this examination (or completion of the new requirement) will result in Advancement to Candidacy. Failure will result in a recommendation for disqualification. Note: To officially advance to candidacy, a fee must be paid to the Cashiers Office and the fully endorsed Advanced to Candidacy Petition can then be submitted to Graduate Studies.

9) Normative Time to Degree

A minimum of three years is required for the Ph.D. but ordinarily a student should plan on four to five years to satisfy all requirements of the degree. Normative time, measured from the time a student begins graduate study at any level at UCD, is 5 years for the current groups.

10) Typical Time Line and Sequence of Events

Year 1:

<u>Fall</u>	<u>Winter</u>	<u>Spring</u>
MCB211 (3u)	MCB212 (3u)	MCB214 (3u)
MCB210 (3u)	MCB213 (3u)	MCB215 (2u)
MCB220L (5u)	MCB220L (5u)	Elective
MCB291 (1u)	MCB291 (1u)	MCB299
		MCB291 (1u)

Year 2:

<u>Fall</u>	<u>Winter</u>	<u>Spring</u>
Elective	TA	MCB299
Research Ethics	MCB299	MCB291 (1u)
MCB299	MCB291 (1u)	QE
MCB291 (1u)		Advancement to Candidacy

Year 3-5: MCB299 (recommended)
Completion of Dissertation

11) Sources of funding

Students are supported through block grant funds and/or fellowships for the first two quarters. Once a student has joined a lab, the Major Professor is responsible for supporting the student. This can be through GSR, TA or a combination of the above.

12) PELP and Filing Fee status.

Information about PELP (Planned Educational Leave) and Filing Fee status can be found in the Graduate Student Handbook:

<http://www.gradstudies.ucdavis.edu/students/handbook/1.html>