



Molecular & Cellular Biology

THE UNIVERSITY OF ARIZONA.

MCB Graduate Program Handbook

Effective Fall 2016

THE UNIVERSITY OF
ARIZONA[®]
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A. Table of Contents

B. MCB Degree Requirements	2
1. Minor degree requirements	2
C. Steps to Degree - Timeline	2
1. YEAR 2.....	2
2. YEAR 3 AND BEYOND	3
3. FINAL YEAR.....	4
D. Teaching Assistantships (also see BMCB program handbook).....	4
1. Teaching assignments	4
E. Selecting a Supervisory Committee and Committee Meetings	5
1. Selecting a committee.....	5
2. Arranging meetings.....	5
3. Meeting agendas	6
F. Preliminary Examinations.....	7
1. Description of the Preliminary Written Examination and Oral Comprehensive Examination	7
2. Information and guidelines for the oral comprehensive exam	10
3. Recommended time frame for the preliminary exam	11
4. BMCB program and University policies regarding the oral comprehensive exam.....	11
G. Dissertation and Final Defense	11
1. General description of the dissertation and final oral defense	12
2. List of specific steps necessary for graduation.....	12
3. Guidelines for preparation of the dissertation	13
4. Description of two different formats allowed by the program – Options 1 and 2.....	14
H. Advanced Student Evaluation.....	17
I. Warning Status	17
J. Student Appeal of Warning Status.....	18
K. Annual Research Retreat.....	18
L. Personal and/or Medical Leave	19
M. The Next Step – Finding Postdoctoral Opportunities	19
N. Required Forms.....	21

B. MCB Degree Requirements

The degree requirements for the MCB Ph.D. degree are:

Science, Society & Ethics - MCB 695E

Cell Systems - MCB 572A

Genetic and Molecular Networks - MCB 546

Scientific Communication (year 2) – MCB 575

One Elective Course (A course from the Computational track is recommended)

Students on the Computational track must complete two additional courses from the following:

Intro to Systems Biology – MCB 580

Stat. Bioinformatics & Genomic Analysis – MCB 516A

Quantitative Modeling of Biological Systems – PSIO 572

The Graduate College requires 36 units, of which 18 units must have letter grades.

1. Minor degree requirements

Per University policy, students must declare a minor. Nine units are needed to satisfy the minor degree requirement. Although a minor subject is usually taken outside the major department, a minor within the major department is permitted. In this case, a total of 45 units in that area is required. If you declare a minor outside of MCB or BIOC, please contact the minor department for their minor course requirements.

For the Biochemistry minor, three courses are required: BIOC 565, 568, one elective. For the MCB minor, three courses are required: two MCB-listed electives and one course from the following list: MCB546, MCB572A or MCB580.

C. Steps to Degree - Timeline

1. YEAR 2

FALL

1. Meet with director of the BMCB graduate program and your thesis advisor before the start of classes to confirm your coursework.

Continue coursework and/or minor electives.

36 units are required for the major (18 must be from courses with grade of A or B).

9 units are required for minor.

2. Choose a supervisory committee by November 1, in consultation with your thesis advisor.

3. Meet with committee to discuss preliminary exam topics by the end of the fall semester.

At this committee meeting:

- Present your plan of study to the committee for approval
- Briefly present an overview of your research project
- Discuss a timeline for the preliminary examinations.

The preliminary written examination must be completed by the end of March.

- 4. Submit the First Committee Meeting form to the BMCB graduate program coordinator**
- 5. Complete the Responsible Conduct of Research Statement** – via GradPath in your UAccess student account.
- 6. Complete the Plan of Study form** - via GradPath in your UAccess student account.
- 7. Register for, attend and participate in a weekly seminar and journal club.** Present a journal club in the fall or spring.
- 8. Attend research retreat and present a poster on your thesis project.**

SPRING

Please note: All portions of the Preliminary Exam must be completed by May 1 of the second year.

- 1. Complete coursework and/or minor electives.**
All students are required to complete MCB 695E (Science, Society & Ethics) or equivalent by the end of the second year.
- 2. Complete the preliminary written examination by the end of March.**
Submit the Qualifying Written Exam Report form to the BMCB graduate program coordinator.
- 3. Schedule your Oral Comprehensive Examination before May 1**
 - The proposal must be submitted to the supervisory committee two weeks before the examination. See Section F for formatting guidelines.
- 3. Complete the Comp Examination Committee Appointment AND Announcement of Doctoral Comprehensive Exam forms** - via GradPath in your UAccess student account.
Announcement form due two weeks before the scheduled examination.
- 4. Take the oral preliminary exam.**
Submit the Qualifying Oral Exam Report form to the BMCB graduate program coordinator.
- 5. Register for, attend, and participate in weekly seminar and journal club.** Present a journal club in the fall or spring.

2. YEAR 3 AND BEYOND

- 1. Annual Presentations.**
Students are required to present a journal club or a 30-minute talk on their dissertation research each year (schedule follows) until they complete their Ph.D. degree. It is advisable students schedule one of their committee meetings right after the talk, if presenting their research.

Annual Presentation Schedule:

3rd year students: research talk in fall semester journal club AND poster at research retreat

4th year students: journal club in fall or spring AND research talk at retreat

5th year and above students: journal club in fall or spring AND poster at research retreat

2. Arrange annual committee meetings.

Schedule a committee meeting every academic year. An *Annual Meeting Report* form must be submitted to the BMCB graduate program coordinator after each meeting. Provide an *Annual Meeting Committee Update* form to each member of your committee at least one week in advance of your scheduled meetings.

3. Register for, attend, and participate in a weekly seminar and journal club. Present? See schedule above.

4. Attend research retreat each fall and present: 4th year students present research talk; all other students present a poster.

3. FINAL YEAR

1. Within the year, hold a committee meeting to map out thesis content and remaining experiments.

2. **Secure approval of the dissertation prospectus.** Obtain approval of the dissertation prospectus no later than three months before the final defense. Submit a *Dissertation Prospectus Approval* form to BMCB graduate program coordinator for inclusion in your file.

3. **Complete Doctoral Dissertation Committee Appointment** form via GradPath in your UAccess student account.

4. **Submit a polished draft of the dissertation three to five weeks prior to final defense.** It is the responsibility of the student and their committee to be sure that the dissertation document conforms to Graduate College and BMCB Program requirements. See *Manual for Dissertations* at http://grad.arizona.edu/system/files/etd_Diss_Manual.pdf

5. **Complete the Announcement of Final Oral Defense** form via GradPath in your UAccess student account. Due at least seven working days before final defense; the student is responsible for scheduling the seminar room.

If at all possible, students should schedule the dissertation defense presentation during normal journal club/seminar times (except during the summer).

D. Teaching Assistantships (also see BMCB program handbook)

1. Teaching assignments

Teaching assignments are made in May or June for the following year. Every effort will be made to accommodate your interests when course assignments are made.

E. Selecting a Supervisory Committee and Committee Meetings

1. Selecting a committee

Selection of a supervisory committee is a matter worthy of both careful thought and investigation. The committee's role goes beyond that of simply evaluating you and includes challenging you to excellence, providing fresh insights for your project, and integrating you as a colleague in the intellectual life of the program. The committee can also serve as a valuable source of external evaluation of differences of opinion between you and your advisor. For these reasons, it is essential that you not only choose a committee that commands your respect but also one with which you can interact fruitfully. It is recommended that you interview prospective committee members to determine their views on what constitutes Ph.D.-level research, expectations on the content of the oral examination and dissertation, etc. You should also aim to choose committee members that complement each other in their range of experience and expertise.

Your committee should consist of five members: your thesis advisor plus four faculty members. One member of your committee, usually your thesis advisor, serves as the chair of your committee. At least one of your committee members, outside of your advisor, must be a BMCB trainer. If you select a minor outside of MCB or BIOC, one of your committee members must represent your minor department. After completing the preliminary examination and advancing to candidacy, your committee can be reduced to four members (your Advisor plus three).

2. Arranging meetings

Committee meetings are scheduled by the student every year (beyond the first year). SCHEDULE A TWO-HOUR BLOCK OF TIME. However, make every effort to end the meeting in an hour. It is better to focus on the most significant results rather than to show everything that you have done since the last meeting.

Arranging a time for committee meetings can be one of the most difficult tasks for a graduate student. Faculty often have well over 20 hours of their week committed to classroom teaching, meetings, and seminars. In addition, faculty may make frequent out-of-town trips for seminar engagements and attendance at scientific meetings or national service committees. While it can be challenging to schedule a meeting of all five members of your committee, it is well worth the effort to have five people focusing all of their attention on you and your research question. The most successful approach is to plan ahead (2 months before the meeting) before their schedules become too restricted.

Two approaches seem to work well for finding a mutually satisfactory time: (1) Use a Doodle poll (doodle.com). Provide possible days and times for a meeting over the course of a four-week period that you already know are compatible with your schedule and that of your advisor. (2) Email possible days and times for a meeting that you already know are compatible with your schedule and that of your advisor to your committee members. They can check off when they are (or are not) available, and you can match up everybody's schedules. Use email to confirm the final date, time, and place. Send out an email reminder the week of the meeting.

If over the course of two months you cannot find a time during which all members of your committee can meet, it is acceptable to have a meeting with as few as three members present, rather

than to have no meeting at all. However, you should then make an appointment to meet with each of those members that could not attend the meeting to discuss the status of your research and other issues, such as attending scientific meetings, submission of manuscripts, and future career decisions.

3. Meeting agendas

The following guidelines should be used by the student in arranging the agenda for the annual meetings with their supervisory committee. **The student should provide a written summary (Annual Meeting Committee Update form) of progress to the committee at least one week in advance of the meeting and bring an Annual Progress Report form, which will be filled out by the appointed chairperson and signed by the attending committee members.** The original form should be submitted to the BMCB program coordinator (Denise Slay) for inclusion in the student's file. Both forms are available on the BMCB website. Note: students should use the First Committee Meeting form (available on BMCB website) for their first meeting.

The student sets the agenda and runs the meeting. After the scientific and programmatic/career discussions of the meeting are completed, all committee meetings should include a time in which the student can meet briefly with the committee in the absence of the advisor. This time offers the opportunity for the student to discuss any issues between the student and the advisor with the committee. The committee meeting should also include a brief time at the end during which the committee can meet in the absence of the student.

The following suggestions should make your committee meetings productive:

- (1) Meetings should include time during which the advisor leaves the room and the student is able to discuss concerns in the absence of the advisor.
- (2) Meetings should include time during which the student leaves and the advisor can speak to the committee in the absence of the student.
- (3) Committee meetings should block out a two-hour slot on the committee's schedule. This meeting is intended to discuss the entire results of one year of research, generate ideas and suggestions, and also to leave time for reasonable discussion of other issues, as might arise in (1) and (2) above.

First Meeting (by the end of the fall semester of the second year)

- Provide a general discussion of the proposed research for the dissertation.
- Discuss coursework taken and planned.
- Map timeline for preliminary/comprehensive examination

Subsequent Meetings

- Provide an outline of your research progress to the committee members at least one week before the meeting.
- Briefly present (30 minutes) your present and future research.
- Describe future research objectives and discuss any problems.
- Career Planning

Final Meeting before the dissertation defense (within the year of the defense)

- Map out the content of the thesis and discuss any remaining experiments.
- Come to a consensus on what research needs to be completed to satisfy the committee.
- A detailed summary of the meeting must be sent to the BMCB graduate program coordinator for inclusion in the student's file (complete a *Dissertation Prospectus Approval* form).

Note: A dissertation prospectus (see page 24) must be given to the committee members at least three months before the defense.

F. Preliminary Examinations

1. Description of the Preliminary Written Examination and Oral Comprehensive Examination

Before advancing to formal candidacy for the Ph.D. degree, you must pass an examination, which is prepared concurrently with course requirements. The examination consists of a written and oral portion. To satisfy the requirement of a qualifying examination (a Graduate College prerequisite to the preliminary examinations), the BMCB program stipulates that you must have passed the required core courses in the program with a grade of B (3.0) or better in each course, and maintain an overall average of B in all coursework. The written preliminary examination is described in detail below, and must be completed at least three weeks prior to taking the oral comprehensive examination. **All students are required to take MCB 575 in the Fall semester of Year 2.** This course is designed to coach you in writing and speaking about your research project. The written and oral examinations will be completed before May 1 of the second year. Planning for the examinations must be done well in advance. If a committee member is unavailable or is on sabbatical leave, a substitute member must be found.

a) MCB Written Preliminary Examination Procedure

1. The proposal will detail the student's intended dissertation project
 - a. The student may work with the advisor to develop experiments and logic in outline form, but the advisor's input on the writing should be limited to issues of grantsmanship rather than line-by-line editing.
 - b. The student is encouraged to seek feedback and additional expertise from others (for example, fellow students, collaborators, examination committee) on the proposal during its development.
2. Students must submit a first draft of the proposal to their dissertation committee. This should be a polished, complete document rather than an outline of ideas, (see detailed directions below for format etc.)
 - a. Faculty will provide written feedback to the student within one week
 - b. Faculty may comment on all aspects of the proposal: significance and feasibility of the project and clarity of the writing. Comments should provide conceptual guidance and not line-by-line editing of the draft.
3. Students are encouraged to discuss the feedback with committee members and their advisors.

4. The proposal must be revised for the final submission within three weeks.
5. Each faculty member on the committee (including the dissertation advisor) will provide a separate written assessment of the proposal and a vote (Pass, Conditional Pass, Fail) within two weeks:
 - a. If the student earns unanimous grades of Pass, s/he may move directly to the oral comprehensive examination
 - b. If the student earns any grades of conditional pass or fail, s/he must revise the proposal. Revisions are due in two weeks.
6. Each faculty member on the committee (including the dissertation advisor) will provide a written assessment of the **revised** proposal, with particular attention to the student's responsiveness to feedback from the previous submission, and a final vote (pass or fail) within one week.
 - a. The student is strongly encouraged to work closely with the committee members to ensure that the revised proposal addresses concerns raised in the initial review.
 - b. To proceed to the oral comprehensive examination, the student must not earn more than one failing grade on the revised written preliminary examination.
 - c. If more than one failing grade is earned, the student is transferred to a terminal master's.
7. Timeline (last possible dates to complete, but students are encouraged to begin earlier rather than later): **In the Spring of Year 2**
 - a. Feb 1: first draft submitted to the dissertation committee
 - b. Feb 8: written feedback to the student from each committee member
 - c. Mar 1: final submission to the committee
 - d. Mar 15: faculty feedback due, and vote pass, conditional pass, fail
 - e. Mar 29: revision due to committee (if needed)
 - f. Apr 5: faculty feedback on revision due and vote on written proposal
 - g. May 1: oral comprehensive exam, and faculty vote on oral exam.

Detailed guide for written document:

The written proposal, including figures and tables but excluding references, should be in the format of an NIH F31 fellowship proposal (see below). The submitted document should be proofed carefully for grammar and spelling. A well-written, defensible proposal is the major requirement for passing the written preliminary exam.

General formatting requirements:

Font type/size - Arial, Helvetica, Palatino Linotype, or Georgia typeface, size 11 or larger, black font color

Line spacing - No more than 6 lines of type within a vertical space of 1 inch and only single column formatting

Page size – 8.5 x 11 inches

Margins - 0.5 inch on all sides

Title – Limited to 200 characters

Proposal Summary/Abstract – Limited to 30 lines of text

State the project's broad, long-term objectives and specific aims

Specific Aims - Limited to 1 page

State the goals of the proposed research and summarize the expected outcome, including the impact the results of the proposed research will exert on the research field involved.

Research Strategy - Limited to 6 pages total. In all sections described below, you must include in-text citations at the appropriate locations to acknowledge your sources, either using author names and publication dates, or numbering, to match the bibliography.

Significance (usually not more than a half page)

- Explain the importance of the problem or critical barrier to progress in the field that the proposed project addresses.
- Explain how the proposed project will improve scientific knowledge, technical capability, and/or clinical practice in one or more broad fields.
- Describe how the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field will be changed.

Innovation (usually not more than a half page)

- Explain how the application challenges and seeks to shift current research or clinical practice paradigms.
- Describe any novel theoretical concepts, approaches or methodologies, instrumentation or interventions to be developed or used, and any advantage over existing methodologies, instrumentation, or interventions.
- Explain any refinements, improvements, or new applications of theoretical concepts, approaches or methodologies, instrumentation, or interventions.

Approach

- Describe the overall strategy, methodology, and analyses to be used to accomplish the specific aims of the project. Unless addressed separately in the Resource Sharing Plan, include how the data will be collected, analyzed, and interpreted as well as any resource sharing plans as appropriate.
- Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the aims.
- If the project is in the early stages of development, describe any strategy to establish feasibility, and address the management of any high risk aspects of the proposed work.
- Point out any procedures, situations, or materials that may be hazardous to personnel and precautions to be exercised.

Bibliography & References Cited - No page limit

Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication.

*****Upon completion of the written exam, submit a *Qualifying Written Exam Report* form (available on the BMCB website) to the BMCB graduate program coordinator.

2. Information and guidelines for the oral comprehensive exam

The student's supervisory committee is responsible for administering the oral examination. All members of the committee must be in attendance at the examination, and other faculty members are not permitted to attend. To schedule the oral exam, the student is required to complete the **Announcement of Doctoral Comprehensive Exam** form at least two weeks before the examination is scheduled. This form is completed online via GradPath in your UAccess Student account. No student will be allowed to officially schedule the oral exam unless the written exam has been passed although a tentative date can be arranged at any time with the supervisory committee. The student is responsible for scheduling the room for the oral exam. The oral portion of the preliminary exam generally will consist of two components: (1) a defense of the original research proposal; and (2) questions concerning general knowledge within the field of biochemistry and/or molecular and cellular biology. The defense of the research proposal will test the student's ability to generate original ideas and to defend the adequacy of the proposal for solving the problems addressed. It is expected that the student will demonstrate a reasonable knowledge of the literature and special techniques in the field.

The general questioning portion may account for up to 50% of the oral examination. The general questions will primarily be derived from both the core and elective courses that the student has taken. Additional questions pertaining to the questions from the written portion of the examination may also be asked.

It is common for the student to give a five- to ten-minute overview of the research proposal followed by questions from the committee centered about a defense of the research proposal (1-1½ hours). The best way to study for the examination is to: (1) know the proposal thoroughly, including all related topics; (2) review all class notes and lecture material from all the classes taken as a graduate student up to that point, especially the core course material; (3) review the general principles of biochemistry and molecular and cellular biology; and (4) be familiar with the recent literature (particularly in the fields represented by the committee members). **It is important to plan your studying to ensure that you have sufficient time to review all of the necessary material. Early on, identify the material that you want to cover and then systematically go through it.** It is an excellent idea to have at least one "practice oral exam" with other graduate students and postdocs about two weeks before the scheduled exam. This can be very helpful in identifying your weaknesses and give you practice thinking on your feet.

Print the *Qualifying Oral Exam Report* form (available on the BMCB website) prior to your exam. Submit the signed form to the BMCB graduate program coordinator upon completion of the exam.

3. Recommended time frame for the preliminary exam

When	What
1 st Year/Fall	(1) Core courses, and (2) Rotations.
1 st Year/Spring	(1) Core courses, (2) Rotations (3) Select dissertation advisor and supervisory committee
Summer	Research.
2 nd Year/Fall	(1) Research, (2) Elective/minor class, (3) arrange committee by November 1, (4) hold first committee meeting by end of the fall semester; discuss timetable for second-year examinations and classes. ¹
2 nd Year/Spring	(1) Research, (2) Elective/minor class, (3) Written preliminary exam to be completed by March 1. (4) Oral comprehensive exam completed by May 1.

¹Requires that a minimum of three supervisory committee members be present.

Remember that the Graduate College requires seven working days between applying for and taking the oral examination.

4. BMCB program and University policies regarding the oral comprehensive exam

- If the oral comprehensive exam is passed with no deficiencies:
 1. You will be advanced to Doctoral Candidacy by the Graduate College.
- If the oral comprehensive exam is failed on the first attempt:
 1. You may be given a chance to retake all, or part, of the exam after four months.
 2. You may be asked to leave the program with no chance for a second attempt.
- If the oral comprehensive exam is failed on the second attempt the supervisory committee will decide on one of the following options:
 1. Recommend dismissal from the Ph.D. graduate program and Graduate College.
 2. Recommend dismissal with a Master's degree.
 3. Recommend dismissal following the writing of a Master's thesis.

If option 2 or 3 is decided upon, the student must file a Change of Degree request with the Graduate College. To obtain a Master's degree, students must have completed 30 units of course work. No minor is required.

If the committee recommends dismissal from the program, the chair of the committee must draft a letter detailing the reasons for the recommendation to the Director of the Graduate Program, with a copy to the student and to the advisor. The Director of the Graduate Program, in consultation with the BMCB executive committee, must submit a decision on the recommendation to the student within one week.

G. Dissertation and Final Defense

Note: We expect students to strive toward publishing two first-author papers from their dissertation research.

1. General description of the dissertation and final oral defense

There are two formats possible for the dissertation. Option 1 follows the more traditional style with an introduction, materials and methods, results, and discussion sections. Option 2 is available to students who have published papers in which they are the primary author. The format for Option 2 is based on inclusion of the published article(s) as the actual dissertation. Both of these options are described on pages 26-27. A formal defense of the dissertation research constitutes the final examination. This consists of a public seminar by the candidate followed by an oral examination by the candidate’s committee and other interested faculty. Be sure to bring all the necessary paperwork to the examination that requires signatures from members of the supervisory committee. This includes the multiple cover pages to the dissertation if all of the final revisions have already been made.

There are a number of requirements that must be met to satisfy both the department and the Graduate College. Ultimately, you will earn your degree by meeting all the requirements of the Graduate College, which by design incorporates program requirements. **It is very important to familiarize yourself with the most current Graduate College guidelines, specifically with regard to preparation of the dissertation.** See the *Manual for Dissertations* on the Graduate College website at <http://grad.arizona.edu/current-students>. Samples and templates are available in the manual.

2. List of specific steps necessary for graduation

The following list shows the major steps that need to be taken once your dissertation advisor and supervisory committee agree that your dissertation research is defensible:

When	What
Within one year of the defense	Schedule a committee meeting to discuss the content of the thesis and the remaining experiments to be completed.
Three months prior to oral defense	1) Submit a detailed dissertation prospectus to your supervisory committee. Complete a <i>Dissertation Prospectus Approval</i> form (available on BMCB website) and submit to BMCB graduate program coordinator for inclusion in your file. 2) Complete <i>Doctoral Dissertation Committee Appointment</i> form via GradPath in your UAccess Student account. Note: the approved Prospectus form must be submitted before this step can be completed.
Three to five weeks prior to oral defense	Submit a polished draft of the dissertation to the supervisory committee.
Seven days prior to oral defense	Complete the <i>Announcement of Final Oral Defense</i> form via GradPath in your UAccess Student account.
Final Semester	Submit the final dissertation to the Graduate Degree certification office via the electronic submission site at www.etsadmin.com/arizona .

Before the last week of the final semester, clear all fees with the Bursar’s office.

3. Guidelines for preparation of the dissertation

No later than three months before the final oral defense, the candidate must submit a detailed **dissertation prospectus** to the supervisory committee, outlining the research progress to date. Importantly, this document should clearly list those studies that the student feels need to be completed prior to writing the dissertation. **Students will not be allowed to schedule the final oral examination less than three months after submission of the prospectus. However, if extenuating circumstances exist which make it impossible to meet this timetable, the student's advisor and supervisory committee may request a waiver of the three-month period in writing to the BMCB Committee, but only after the prospectus has been submitted.** The candidate then meets with the supervisory committee to discuss the prospectus. The committee reviews this information and helps the candidate to formulate any new plans, if appropriate. It is common for the committee to recommend a limited number of experiments and to make specific recommendations regarding a timetable for writing of the dissertation. It is appropriate at this time to discuss with the committee the two optional dissertation formats and to decide which one will be more appropriate. It is the responsibility of the supervisory committee to decide which of the two program dissertation formats (Option 1 or 2) will be the used by the student.

At a minimum, the student must be a first author on a submitted publication, or make the equivalent contribution to other submitted publications or scholarly work, for the prospectus to be approved.

Once the dissertation is written, the candidate submits a completed, polished draft to each member of the supervisory committee **at least three to five weeks** prior to the final examination. It is your responsibility to be sure that sufficient time is allowed for this polished draft of the dissertation to be read by your supervisory committee. It is anticipated that the supervisory committee will be able to read the dissertation and return it to the candidate within two weeks of receipt. This timing allows you to make any suggested changes, provided they are minor, and to obtain final approval of the penultimate draft prior to the final examination. Then, no later than seven days before the proposed date of the examination, you must complete the *Announcement of Final Oral Defense* form via GradPath in your UAccess Student account. Faculty members cannot approve this form unless they have approved the penultimate draft of the dissertation.

Graduate College policy on the use of copyrighted material is below. You will also find the two different options for the dissertation format that have been approved by the Departments of Biochemistry and Molecular & Cellular Biology.

USE OF COPYRIGHTED MATERIAL IN THESES AND DISSERTATIONS

Use of copyrighted material in your thesis, including illustrations, usually requires written permission from the copyright holder. Start this time-consuming process as early as possible. Play it safe and assume that you must obtain permission if the material is copyrighted. Consult your advisor about this process.

Exceptions, sometimes pertaining to small fractions of a musical score or other document, are governed by the concept of “fair use.” Factors weighed in determining “fair use” include: the purpose of the use, whether commercial or non-profit and educational; the nature of the copyrighted work; the amount and substance of the material used in relation to the entire work; and the effect of

the use upon the potential market for or value of the copyrighted work. The “fair use” concept is explained in detail in the *Chicago Manual of Style*. According to the Association of American University Presses, permission is required for quotations that are complete units; for example, an entire poem, letter, book chapter, or an entire map, chart, drawing, or other illustration. Permission to use copyrighted material should be in writing and retained by the author. The release letters should indicate that permission extends to microfilming and publication by University Microfilms, Incorporated (UMI) and that the copyright owners are aware that UMI may sell, on demand, single copies of the thesis, dissertation, or document, including the copyrighted materials, for scholarly purposes. UMI requires copies of permission letters to be attached to the publication agreement and assumes no liability for copyright violations. If permission letters are not supplied, copyrighted materials may not be filmed.

It is polite and good practice to obtain permission to use non-copyrighted material, which may or may not be acknowledged in the text.

For additional information, telephone the Copyright Public Information Office in Washington, DC, (202) 479-0700, weekdays between 8:30 a.m. and 5:00 p.m. EST or write to the Copyright Office, Library of Congress, Washington, DC 20559.

4. Description of two different formats allowed by the program – Options 1 and 2

Dissertation Format Option 1 – Traditional Style of Dissertation

The Graduate College policy states that each department can establish their own guidelines for the dissertation format. However, the final document must adhere to all the Graduate College requirements. A *Manual for Dissertations* can be found at <http://grad.arizona.edu/current-students>. The Departments of Biochemistry and Molecular & Cellular Biology have the following list of guidelines for preparation of a traditional dissertation (please refer to the dissertation manual for order of sections and specifications):

1. The suggested dissertation format should include the following components:
 - Abstract – describing the problem, the results, and the interpretation.
 - Introduction – general introduction to the field and the biological system.
 - Material and Methods – a complete description all in one section.
 - Results and Discussion – should be logically divided into separate chapters with an introductory paragraph at the beginning of each chapter. Each chapter should include a thorough analysis of the data and its implications.
 - Summary – a short synopsis, including future directions that should be taken.
 - Literature Cited – should follow that of the journal *Cell*, with in-text citations, using the author’s name(s) and year published; the full references with titles should be listed alphabetically at the end of the dissertation.

2. Figures and tables should be included in the chapters rather than as an appendix. Permission to use copyrighted material is your responsibility.
3. If appropriate, the dissertation may include portions of manuscripts being prepared for submission, but the text should be your own writing.
4. The supervisory committee has the responsibility for checking the dissertation for adherence to Graduate College specifications and for approving the overall appearance and format ascribed to Option 1.

Dissertation Format Option 2 – Inclusion of Previously Published Papers

1. General description as defined by the Graduate College

At the option of the student and the supervisory committee, an alternate format permitting inclusion of papers published or accepted for publication in scholarly journals may be used. The decision to allow the inclusion of previously published or submitted work in a dissertation is left to the candidate's degree-granting unit (in this case, the supervisory committee).

The alternate format for the dissertation is based on the philosophy developed by the Council of Graduate Schools: "The published work must be logically connected and integrated into the dissertation in a coherent manner. Simply binding reprints or collections of publications together is not acceptable as a dissertation in either format or concept," *The Role and Nature of the Doctoral Dissertation*, Council of Graduate Schools, 1991.

2. BMCB policy for dissertation format Option 2

- a. The student must be a primary author on at least one of the papers.
- b. The following types of publications are acceptable:
 - Any peer-reviewed refereed journal in the biological or physical sciences that is published in English.
 - Non-refereed journals are unacceptable.
 - Conference proceedings are unacceptable.
 - Manuscripts that have been submitted for publication may be included as a separate chapter as long as they have been approved by the supervisory committee and it is clearly stated on the first page of that chapter to which journal (i.e., acceptable journals only, see above) the manuscript has been submitted

The program policy is that a minimum of 20% of the effort on each paper must be attributed to the student. The paper must include data which result solely from the experimental work of the student; gratuitous authorship is unacceptable. This definition of effort includes measurable input toward the writing and intellectual content of the paper. In cases where it is difficult to assign percent effort, it is up to the student's supervisory committee to decide.

At the time of the oral defense of the dissertation, the student must be able to defend all of the work in the dissertation, even in cases of multiple authors. With this stipulation, the program does not perceive a conflict of interest when other committee members are co-authors on the paper.

Required Format

Published papers should be appended. However, in order to provide coherency, the body of the dissertation must include a summary of the student's contribution and a summary of the research. Note that all margin, pagination, and paper restrictions described in the *Manual for Dissertations* apply.

The order of sections described in the manual applies except that the body of the paper must include two chapters as follows:

1. An introduction that describes the unique contribution of the student's work to the field of study. That uniqueness should be described via the following subsections to the extent they are appropriate.
 - a. Explanation of the problem and its context.
 - b. A review of the literature.
 - c. Explanation of dissertation format. This subsection explains the relationship of the papers that were included and the contribution of the candidate to each of the papers; where doctoral research efforts are part of a larger collaborative project, students must be able to identify one aspect of that project as their own and be able to demonstrate their original contribution. The role that the dissertation author had in the research and production of the published paper(s) should be clearly specified in this section.
2. A chapter labeled "Present Study" that summarizes the methods, results, and conclusions of the research. The chapter should begin with a statement such as: "The methods, results, and conclusions of this study are presented in the papers appended to this dissertation. The following is a summary of the most important findings in these papers."

References for the two chapters described above should follow the "Present Study" chapter.

Appendices:

Two types of appendices are appropriate.

- a. Each paper in the form of a reprint
 - The statement of permission for use of copyrighted material must be placed immediately before the reprint on correct paper.
 - The title page of the journal in which the article appeared should precede the statement of permission.

- University Microfilms, Inc., will not accept a dissertation with double-sided pages (the typical format of a reprint). Therefore, reprints must be copied onto correct bond paper, single-sided, and numbered in sequence.
- b. Supplemental materials that are resources to the methods and results.

These most often include data tables, graphs, maps, and computer printouts that may be reproduced in microfiche form. Restrictions on the uses of certain kinds of computer printout (e.g., no use of striped computer paper) apply.

Multiple Authorship

Multiple authorship of papers that have been published or are to be submitted for publication is allowed. It is the responsibility of the student's doctoral committee to ensure that a dissertation represents the original, individual efforts of the candidate. It is recommended that the majority of the student's committee not be co-authors on papers included in the dissertation.

Requirements for Contemporaneous Enrollment and Research

The research that is described in the published paper(s) that are part of the dissertation must have been conducted during the time the candidate was enrolled in his or her current degree program and cannot have been submitted toward any other degree at the University of Arizona or elsewhere.

H. Advanced Student Evaluation

At the end of the fifth year, the director of the graduate program and the graduate program coordinator will meet with individual students and their advisors together to assess the status for remaining publications and plans for completion of the degree. A timeline will be drawn for both and must take into account the trajectory of the student up until this point. Failure to achieve these goals will result in a warning status for the student. If the student has not yet collected sufficient data to plan a publication, the development plan must include additional committee meetings over the course of the coming year (one meeting every 6 months). In addition, the BMCB executive committee may choose one of its members to serve as an ad hoc member of the thesis committee during a warning period to provide additional oversight on forward progress toward the degree.

I. Warning Status

The purpose of the warning status is to address problems identified by the student's advisor, committee or graduate program that have remained unresolved through the normal mentoring procedures in the program and to find a solution.

Students experiencing significant delays or more significant issues in progressing toward their degrees may be placed on warning status for a period of not more than one year. Examples include, but are not limited to, issues with:

- Completion of coursework in accordance with program guidelines
- Completion of preliminary examination in accordance with program guidelines
- Completion of oral examination in accordance with program guidelines
- Satisfactory progress in meeting research goals as judged by supervisory committee
- Scheduling annual committee meetings in accordance with program guidelines

For students, who have not yet been admitted to candidacy, the director(s) of the BMCB graduate program, in consultation with the BMCB executive committee, can place students on warning status for failure to maintain the grade point average required for good standing in the program or for failure to successfully complete the preliminary and oral examinations according to the timeline detailed in the program handbook.

For students who are not making satisfactory progress in their research (either pre- or post-candidacy), the chair of the thesis committee must call a meeting of the committee, including both the student and the advisor, to discuss the situation. If the committee concurs with the request for warning status, the deficiencies and a plan for rectifying them by a specific deadline determined by the committee (typically within one semester) must be detailed in a written letter to the student, which is also copied to the director of the graduate program. The director of the graduate program, in consultation with the BMCB executive committee, will write a separate letter to the student, the advisor, the committee, and the Graduate College to detail the consequences of not meeting the requirements of the plan by the specified deadline. The consequences can include the immediate removal of funding and enrollment in the program in rare circumstances dictated by the severity of the problem and in accordance with university policy.

By the specified deadline, the student must convene another committee meeting to discuss progress toward the goals outlined in the original notification letter. The committee must evaluate the student's progress and notify both the student and the director of the graduate program in writing of their recommendation. If the student has made satisfactory progress, the committee may recommend that the student return to good standing. If the progress is promising but not complete, the committee may recommend extension of the warning for one additional semester. If the progress is unsatisfactory, the committee should recommend removal from the program. At any point in this process, the student may explore opportunities in other laboratories or programs. The director of the graduate program, in consultation with the BMCB executive committee, will notify the student, the advisor, the committee and the Graduate College of his/her decision on the continuing status of the student.

In all cases, attention should be given to the particular difficulties being faced by the student. If necessary, the student should be advised to explore a leave of absence (see Section T).

J. Student Appeal of Warning Status

Within one week of notification of warning status, the student may appeal this decision in writing to the department head of the degree granting program: Chemistry and Biochemistry for the Biochemistry Ph.D., and Molecular and Cellular Biology for the MCB Ph.D. The appeal should specifically address all of the points raised in the warning status notification letter.

K. Annual Research Retreat

The annual joint retreat, held in the fall, is a time set aside to mingle with colleagues socially and to share your progress and ideas with other students, postdocs, and faculty. It is expected that you will avail yourself of this opportunity and, barring exceptional circumstances, formally present your ongoing research in the form of a poster or talk (see presentation schedule in section C). When

presenting in either format, the goal should be one of sharing the excitement as well as the rationale of your goals and approach.

L. Personal and/or Medical Leave

The program realizes that there are personal and/or medical reasons for a student to require a limited break in their studies. Although the University has no formal policy for such contingencies, the program recognizes the general policies of the Federal Family and Medical Leave Act of 1993 and will allow students to take a break in their studies without applying for a formal University leave of absence. Under the federal policy, a personal or medical absence of 12 work weeks can be arranged for: (1) the birth of a child and to care for such child*, (2) to care for another individual in the student's household or immediate family, or (3) the student's own health conditions. Arrangements for such an absence should be discussed with your advisor and the Chair of the BMCB committee in advance of the proposed absence. Stipend during such an absence is not guaranteed and is dependent on availability of funds on a case-by-case basis. However, we want to assure you that efforts will be made to find solutions that will not jeopardize the continuation of your graduate studies.

*The Graduate College offers paid parental leave (up to six weeks) for Graduate Research Assistants (this policy does not extend to Graduate Teaching Assistants). Please see <http://grad.arizona.edu/parentalleave> for eligibility and application information.

M. The Next Step – Finding Postdoctoral Opportunities

Your choices may be directed or modulated by your goals for what you want to do after your postdoctoral training.

1. Are you aiming for a position where you will be conducting and directing research, such as at a university, research institute, or biotech firm? Will your project lead to an independent research program, or will you learn the approaches and skills you need at the next level? Will you have opportunities to help direct students or staff?
2. Do you want to work in the biotech industry? Many companies hire at the postdoctoral level. Others prefer Ph.D. hires to have a variety of experiences that come with the broadening of a postdoctoral experience in an area different from your Ph.D. work. You may have more opportunities to enter the biotech industry at the postdoctoral level, but may limit your ability to “move around” or eventually to be a laboratory director.
3. Are you considering becoming a small college professor? You may want to find out if there will be opportunities to teach or help in courses. You may also want to think carefully about what type of project or area of research you choose as a postdoctoral researcher such that you can later develop research projects to be done by undergraduates perhaps in an environment that does not include all of the equipment and expensive disposable supplies available at a large research university. Some small colleges are well equipped and provide some money for supplies, but very labor intensive projects can be limited by the time that faculty and students can spend on the projects and are usually limited to the summer break.

You may not have formulated **exactly** what your career goals will be and may become stymied in trying to decide **before** you do postdoctoral work. In that case, it is suggested that you choose a postdoctoral experience that leaves the door open to many different opportunities in research and teaching.

The first thing you need to do is decide what you want to work on and why. Choosing something that you are passionately interested in is a good place to start. Thinking about this for several years, perhaps from the time you first start graduate school, is a good idea. If you start thinking about this early, you will have time to change your mind several times and investigate and refine your ideas over time. This choice may not only occupy you for a few postdoctoral years but perhaps may be carried over into whatever position you take after that time. Reading in the topic area is recommended to become familiar with the science and who is doing it. No one knows exactly when they will finish their Ph.D., but getting very serious about planning your postdoctoral experience at least a year and a half before the projected finish date is recommended. At that time, you need to talk with anyone available who knows the area. This includes faculty and postdocs, both in the department and in other departments on campus. Faculty are often willing to help by contacting the people they know to get more information on who might be good postdoctoral advisors in a certain area. Read the papers and talk to as many people as you can about the prospective advisors. Narrow down your list and write to the advisors. Provide them with the names, addresses, phone numbers, and email addresses of at least three references. Follow up your letter with email if you do not hear from them in a reasonable amount of time. If you do not start early, you may limit your choices because some advisors may need more time to fit you into **their** future plans. In addition, you will probably have more choices if you indicate that you are willing and have time to write a fellowship application. Obtaining a fellowship is good because it may give you more freedom of choice in projects during your postdoctoral training, and it will look good on your CV. If a move becomes imperative during the term of the fellowship for personal or other reasons, often fellowships can move with you to a new location and advisor because they have been awarded to **you** and not your advisor.

Other things to consider are your preferences for working conditions, supervision styles, and environment. Big lab or small lab? Famous advisor or young advisor starting out? University, research institute, or company? Will you have the chance to develop an independent project? What is the environment outside of the advisor's lab like? Seminars? Journal clubs? Informal discussions on science? Geographical location? Coordination with a significant other? If you need to coordinate your move with your significant other, plan as far in advance as possible and make some contingency plans for "waiting" time.

Maybe you've decided that you want to skip doing a postdoctoral experience and move directly into the biotech industry or find a teaching job. How do you find out about biotech jobs? Networking seems to be the most fruitful method. Talk to as many faculty here at the University and elsewhere that you know for contacts at companies. Use the web. Subscribe to, go to the library for, or visit some of the local coffee shop/bookstores for the classified ads in the Sunday newspaper of your city or cities of choice. The industry is concentrated in a few locations: Boston area, around D.C., San Francisco Bay area, San Diego, Seattle.

What if you want to go right into teaching? Currently, most small colleges are hiring people that have some postdoctoral experience. But some community, state, and other small colleges may be eager to hire new Ph.D.s. Contact schools that you are interested in directly, especially if you are

going to be restricted by location, e.g., staying in Tucson. Subscribe to or visit the library for *The Chronicle of Higher Education*. The job listings in the *Chronicle* are accessible on the web. Most college teaching jobs are advertised in this weekly periodical.

A last bit of advice is to talk with all of the students that are presently going through this process or have gone through it. You can talk to postdocs that have come from other places, but probably more helpful would be to call and interview students from Arizona that have gone on to postdoctoral positions or jobs elsewhere. Contact Denise Slay at 621-1519 or Lori Boyd at 621-4348 for names, phone numbers, and email addresses. You may have to contact the former Ph.D. advisor for the most recent phone number or email address.

N. Required Forms

For the BMCB Program (available online: <http://bmcb.biology.arizona.edu/current/>)

First Committee Meeting Report
Annual Meeting Report
Annual Meeting Committee Update
Qualifying Written Exam Report
Qualifying Oral Exam Report
Dissertation Prospectus Approval

For the Graduate College: (completed online via your UAccess Student account)

Responsible Conduct of Research Statement
Plan of Study
Comp Exam Committee Appointment
Announcement of Doctoral Comprehensive Exam
Doctoral Dissertation Committee Appointment
Announcement of Final Oral Defense