

The Accelerated Master's Degree in Molecular and Cellular Biology

Student Handbook

Updated January 2022

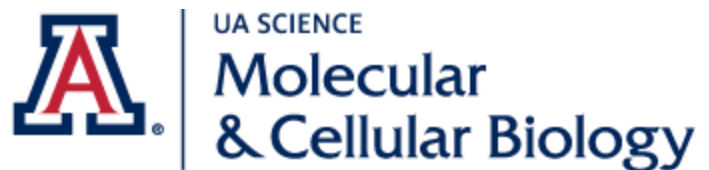


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BASIC INFORMATION

Overview

The Accelerated Master's Program (AMP) in Molecular and Cellular Biology (MCB) is a program designed to enable advanced UA undergraduate students to complete both the Bachelor of Science degree as well as the Master of Science degree in MCB in a total of 5 years. This program is not open to UA students who have already completed a Bachelor's degree or an advanced degree, or to students from other institutions; it is only available to current UA undergraduates.

Who should pursue the AMP?

The MCB AMP is well-suited for students who aim to gain research experience at the graduate level, including pre-med students who may conduct research in the future, students who would like to evaluate their passion for research before pursuing a Ph.D. program, and others who might find graduate-level research experience beneficial for a future career or position.

Eligibility Criteria

To be considered eligible to apply for the Accelerated Master's Program in MCB, students must meet the following criteria **at the time of application**:

- Be a continuing UA undergraduate, having at least one full semester remaining prior to receiving their Bachelor's degree. (Students may not submit an application to the AMP if they are graduating in that same semester.)
- Have a minimum cumulative UA GPA of 3.300.
- Have completed a minimum of 75 units of undergraduate course work, including college credits from the U of A, other colleges/universities, and AP/IB/CLEP exam credit. Students must have completed 90 units prior to beginning the AMP.
- Have completed at least 12 units in their major at UA.
- Have completed MCB 301, 304, and 305 or equivalents. It is acceptable for one of these courses to be in progress at the time of application to the AMP.
- It is expected that students will complete their Bachelor's in a total of four years, and that they will be able to complete the necessary graduate classes and research over the course of their senior year plus one additional year (a total of five years from the time of entrance to the U of A).
- It is expected that students being admitted into the MCB AMP find a research lab in which they wish to complete their Master's Thesis. A lab and PI must be confirmed in the semester prior to graduating with your Bachelor's degree, in order to continue in the program. It is recommended students have one year of research experience in their lab.

Applying to the AMP

Applications for the AMP are accepted twice a year, once in November (for students graduating with their Bachelor's in the following May or later), and once in April (for students graduating in the following December or later). Students are encouraged to apply during their junior year so that they are able to take graduate-level courses throughout their senior year. Seniors are welcome to apply, but if accepted, they would be required to condense their starting graduate-level work (approximately two graduate courses) into the final semester of their senior year.

Applications for the AMP are submitted directly to the UA Graduate College: <http://grad.arizona.edu/admissions/apply-now>. For “Choose the type of application,” select “Molecular and Cellular Biology M.S.-Accelerated Master’s Program.” For the “AMP Application Authorization Code” please contact Kara Dyson, at kdyson@email.arizona.edu, to receive the code; and for “Choose the Program of Study”, select “Molecular and Cellular Biology (MS).” There is \$75 fee to apply for the AMP.

Research and the AMP

AMP students are welcome to have a research advisor who is housed in a different UA department. However, it is imperative that the advisor is a tenure-track faculty member, and that the content of the research that the student is conducting (or will conduct) is focused on using a molecular and cellular approach to addressing a biological question.

Ideally, the research that a student conducts during his or her time as an undergraduate will serve as a foundation upon which the Master’s Thesis will be built. Hence, it is highly preferable that a student’s undergraduate research advisor will continue as the student’s graduate thesis advisor, and that the student’s thesis will be a culmination of the research that the student has done throughout his or her time as an undergraduate and graduate student. However, if a student opts to secure a different research advisor for the AMP, the student must do so before beginning the program and obtain approval from the AMP Director regarding the change.

UA Graduate College’s Policies Regarding the AMP

Students will be considered undergraduates until they complete their undergraduate requirements, which should be no later than the end of their fourth year. Students must take at least 12 of their graduate credits while in graduate status. In other words:

- During years 1-3 (or approximately 0-90 credits) students will be taking undergraduate coursework and charged at the undergraduate rate.
- Once admitted to AMP, during the senior (or transition) year, they may take up to 12 units of graduate coursework, which may apply toward both the bachelor’s and the master’s degrees. Students will be charged at the undergraduate rate and retain eligibility for undergraduate scholarships.
- After completion of all bachelors' requirements, students will be granted graduate status, be charged at the graduate tuition rate, and be eligible for graduate assistantships.
- Should a student have completed 12 graduate credits but not yet completed the undergraduate degree, they will be considered to have graduate status for financial aid and tuition purposes. They will no longer be eligible for undergraduate scholarships, nor will they be eligible for graduate assistantships.
- At least 12 graduate credits must be taken while in graduate status, after completing all degree requirements for the bachelor’s. A total of 30 graduate credits must be taken for the Master’s degree.
- Students should be encouraged to complete their undergraduate requirements as soon as possible, but not later than one semester before receiving their master’s.

THE ACCELERATED MASTER'S PROGRAM: UNDERGRAD STATUS

The AMP program is unique in that it permits students to apply up to 12 units of 500-level course work taken as an undergraduate towards both the Master's and Bachelor's degrees. Hence, the program essentially allows undergraduate students to start on their Master's degree early, before they graduate with their Bachelor's degree.

Curriculum

The M.S. degree in MCB requires that students complete a minimum of 30 graduate units, including the Master's Thesis and at least 15 regularly graded units of course work, with a minimum cumulative GPA of 3.000. Only grades of C or better in graduate course work satisfy requirements for the degree.

The course requirements consist of a minimum of 19 units of regularly graded courses:

- MCB 572a – Cell Systems (4 units), offered every fall
- BIOC 568 – Nucleic Acids (4 units), offered every spring
- MCB 546 – Genetic and Molecular Networks (4 units), offered every spring
- MCB 595– Journal Club (1 unit) for two semesters, offered every semester
- MCB 596 – Seminar (1 unit) for two semesters, offered every semester
- A minimum of 3 regularly graded units of graduate-level elective course work. Approved elective courses include, but are not limited to BIOC 565 (Proteins and Enzymes), BIOC 585A (Biological Structures I), BIOC 585B (Biological Structures II), MCB 588 (Principles of Cellular and Molecular Neurobiology), ECOL 553 (Functional and Evolutionary Genomics), MCB 580 (Introduction to Systems Biology), CBIO 552 (Cancer Biology), CMM 577 (Principles of Cell Biology), MCB 582 (Modeling Human Disease), and PLS 539 (Methods in Cell Biology and Genomics). Substitutions for these elective courses may be approved by the student's Master's committee.

In addition, the following pass/fail graded courses are required:

1. MCB 910 – Thesis (3 units), for two semesters, offered every semester

Any remaining graduate units may be fulfilled by additional, pass/fail graded graduate-level courses, such as MCB 900 (Research), MCB 695E (Science, Society and Ethics), and MCB 696A (Lab Presentations and Discussion). Similar to the regularly graded coursework, substitutions for these elective courses may be approved by the student's Master's committee.

Creating a Master's Committee

Once accepted to the AMP, a student's first priority is to set up their Master's Committee. The committee is a group of three individuals who will guide students in selecting elective courses, and will eventually be the committee before which a student will conduct his/her Master's Thesis defense. Two members of the committee must be tenure-track UA faculty members (that is, faculty members who hold the title of Assistant Professor, Associate Professor, or Professor). The third member is permitted to hold a different title, but must be approved by the UA Graduate College (contact the AMP Program Coordinator for directions on how to request approval). The primary research advisor will serve as a student's Master's Committee Chair (if tenure-track) or co-chair (if not tenure-track). At least two of the committee members

must hold a primary appointment in Molecular and Cellular Biology. To allow for proper guidance and oversight, the Master's thesis committee must be assembled before the final semester of the fourth year.

To create a committee, students should first approach their research advisor for suggestions for members. Students can then approach those professors and simply ask if they would be willing to serve on their committee. Students can then contact their committee members as needed (usually by a group e-mail), especially when inquiring about graduate elective courses to take.

Creating a Draft of the Plan of Study

Students should consult with their research advisor and committee to discuss suggestions regarding 500-level course work to be taken during the senior year. The Plan of Study is essentially a list of courses that a student has taken or is planning to take to complete the Master's degree, including courses that the Master's Committee has approved for elective course work and any substitutions the Committee has approved for core courses. After solidifying their Master's committee, AMP students should work with their thesis supervisor to create an unofficial draft of their Plan of Study and have their committee members review it. Students should also review their Plan of Study draft with the AMP program coordinator to determine if any modifications are required. This draft Plan of Study should be completed and fully reviewed no later than the end of the final semester of the fourth year.

Recommended Schedule of Classes

This is a sample plan for the AMP (courses in italics are graduate-level courses):

Sample Plan: Students Applying Junior Year

YEAR ONE: Undergraduate Work	
ENGL 101..... 3	ENGL 102..... 3
MATH 122A..... 1	MATH 129 or MATH 263..... 3
MATH 122B..... 4	CHEM 152..... 4
CHEM 151..... 4	ECOL 182R..... 3
Tier One Gen Ed..... <u>3</u>	ECOL 182L..... <u>1</u>
15	14
YEAR TWO: Undergraduate Work	
CHEM 241A..... 3	CHEM 241B..... 3
CHEM 243A..... 1	CHEM 243B..... 1
MCB 181R..... 3	MCB 301..... 4
MCB 181L..... 1	Tier One Gen Ed..... 3
Tier One Gen Ed..... 3	Research (MCB 392 or 399H)..... <u>3</u>
Second Language Course..... <u>4</u>	14
15	
<i>* start involvement in research</i>	
YEAR THREE: Undergraduate Work	
MCB 304..... 4	MCB 305..... 4
Physics 102/181..... 4	Physics 103/182..... 4
Tier One Gen Ed..... 3	BIOC 385..... 3
Free Elective..... 3	Research (MCB 492 or 499H)..... <u>3</u>
Research (MCB 492 or 499H)..... <u>3</u>	14
17	
<i>*AMP applications due in April</i>	
YEAR FOUR: AMP (Year One Undergrad and Grad Work)	
<i>MCB Core Elec. (MCB 572A)</i>4	<i>MCB Elec. (MCB 546)</i> 4
MCB Lab/Research/Thesis (498H)..... 3	MCB Writing/Thesis (498H)..... 3
Tier Two Gen Ed (x2)..... 6	Tier Two Gen Ed..... 3
Upper Div. Free Elective..... <u>3</u>	Upper Div. Free Elective..... <u>3</u>
16	16
<i>* Bachelor's degree awarded at end of this semester</i>	
YEAR FIVE: AMP (Year Two Graduate Work)	
<i>MCB Graduate Elective</i>4	<i>BIOC 568</i> 4
<i>MCB 595</i>1	<i>MCB Graduate Elective</i> 4
<i>MCB 596</i>1	<i>MCB 595</i> 1
<i>MCB 910 (thesis)</i> <u>3</u>	<i>MCB 596</i> 1
9	<i>MCB 910 (thesis)</i> <u>3</u>
	13
<i>* Master's Plan of Study due before semester begins</i>	<i>* Master's degree awarded at end of this semester</i>

Sample Plan: Students Applying Senior Year

YEAR ONE: Undergraduate Work	
ENGL 1013 MATH 122A.....1 MATH 122B.....4 CHEM 1514 Tier One Gen Ed..... <u>3</u> 15	ENGL 1023 MATH 129 or MATH 263.....3 CHEM 1524 ECOL 182R.....3 ECOL 182L..... <u>1</u> 14
YEAR TWO: Undergraduate Work	
CHEM 241A.....3 CHEM 243A.....1 MCB 181R3 MCB 181L.....1 Tier One Gen Ed.....3 Second Language Course..... <u>4</u> 15	CHEM 241B.....3 CHEM 243B1 MCB 3014 Tier One Gen Ed3 Research (MCB 392 or 399H)..... <u>3</u> 14
* involvement in research recommended	* involvement in research recommended
YEAR THREE: Undergraduate Work	
MCB 3044 Physics 102/181.....4 Tier One Gen Ed.....3 Free Elective3 Research (MCB 492 or 499H)..... <u>3</u> 17	MCB 3054 Physics 103/182.....4 BIOC 3853 Research (MCB 492 or 499H)..... <u>3</u> 14
*involvement in research recommended	* involvement in research necessary
YEAR FOUR: AMP (Year One)	
MCB Core Elec.3 MCB Lab/Research/Thesis (498H)3 Tier Two Gen Ed (x2).....6 Upper Div. Free Elective <u>3</u> 15	MCB Elec. (MCB 546).....4 MCB Grad Elective3 MCB Writing/Thesis (498H).....3 Tier Two Gen Ed <u>3</u> 16
*AMP applications due in November	* Bachelor's degree awarded at end of this semester
YEAR FIVE: AMP (Year Two)	
MCB 572A 4 MCB Graduate Elective..... 3 MCB 595 1 MCB 596 1 MCB 910 (thesis).....<u>3</u> 12	BIOC 568.....4 MCB Graduate Elective3 MCB 595 1 MCB 596 1 MCB 910 (thesis).....<u>3</u> 12
* Master's Plan of Study due before semester begins	* Master's degree awarded at end of this semester

Registering For 500-Level Courses as An Undergraduate

Before AMP students have completed their Bachelor's degree, they should register for 500-level courses using the "Undergraduate Enrollment in Graduate Courses" form, which is available from the AMP Program Coordinator. Students are to obtain instructor permission, mark the "Accelerated Master's Program" box for their course work, and have their academic advisor and MCB department head sign off on the form before submitting it to the Graduate College and then finally to the Registrar's Office. One form must be used for each semester for which students wish to register for graduate level courses. Up to 12 units of these courses can be used to apply towards both the Bachelor's degree and the Master's degree.

Senior Degree Check

During the first semester of the fourth year, AMP students, like their regular MCB undergraduate counterparts, should schedule an appointment with an MCB Advisor to complete their official Senior Degree Check. This ensures that students have everything in line to graduate with the Bachelor's degree as planned. The degree check consists simply of paper work that can be completed during a 30-minute meeting with an academic advisor.

Finding Funding as a Graduate Student

In preparation of conversion to graduate status, students may wish to inquire about funding opportunities, as most undergraduate scholarships may not be applied towards graduate standing and funding is generally not provided for Master's students. Students may check with their thesis supervisor regarding any additional funding available through the lab.

The MCB department does not guarantee graduate funding for AMP students.

Should an arrangement be made for students to be a teaching or graduate assistant, they must complete the Graduate Assistants in Teaching Orientation (GATO) before teaching, and the Teacher Assistant Training Online (TATO). For more information, please visit <http://grad.arizona.edu/ta>.

THE ACCELERATED MASTER'S PROGRAM: GRADUATE STATUS

First Steps: Required Forms

Once AMP students have graduated with the Bachelor's degree they will be required to complete a secondary application accessed through GradApp. This application is used purely for the purpose of changing the student status to graduate level. Students will not be required to pay an application fee for the secondary application, nor will they be required to submit a Statement of Purpose, letters of recommendation, or answer supplemental questions. Once this application has been completed, they will be converted to graduate student status, and will be given access to UA's GradPath system (accessible via UAccess Student Center) in order to submit necessary forms throughout their graduate program. The first form that must be submitted is the **Responsible Conduct of Research Form**, which requires only student consent. Secondly, AMP students must submit the official **Master's Plan of Study**, which should be completed after a draft of the Plan of Study has been approved by the thesis supervisor, thesis committee, and the AMP Program Coordinator. The Plan of Study must be submitted before the penultimate semester prior to graduation with the Master's degree. Finally, AMP students must formally submit a **Master's Committee Appointment Form**. The form will automatically be routed to the AMP Program Coordinator to notify the department of students' committee members. If special approval is needed for any of the committee members, this may also be requested via GradPath.

Registering for Graduate Courses as a Grad Student

Once students have solidified their Plan of Study with their committee, they should be clear on exactly what courses they need to register for in order to complete their Master's degree. Students may register for graduate courses using UAccess, with the exception of MCB 910 and 595 and 596; students may register for these courses by contacting the AMP Program Coordinator.

Full-Time Status

Full-time status as a graduate student is defined in any of the following ways:

- Taking 9 units of graduate credit
- Taking 6 units and holding a teaching or research assistantship
- Taking at least 3 units of thesis credit (e.g. MCB 910) only

Satisfactory Academic Progress

In order to remain in good academic standing, students must maintain a cumulative GPA of 3.000 or higher. If a student's cumulative GPA falls below 3.000, then they will be placed on probationary status. If in the following semester, the student is not able to regain a 3.000 or higher GPA, they will be converted to non-degree seeking status by the UA Graduate College.

Although it is expected that AMP students will complete the program requirements for both the Bachelor of Science degree and Master of Science degree in MCB in a total of five years, a number of circumstances occurring during the undergraduate years could lead to a longer residence time in the program (i.e., study abroad, leave of absence, etc.). However, registration after two years since matriculating in the UA Graduate College, after graduating with a Bachelor's degree, is not permitted.

The Master's Thesis, Thesis Defense, and Degree Conferral

As students approach the conclusion of their Master's program, students should meet with their research advisor to discuss the completion of the Master's thesis and the upcoming thesis defense. **Students are responsible for making all arrangements for the defense, including a time when all committee members can be present and a location (students may contact Whitney Slay, the MCB Building Manager, at wslay@arizona.edu to reserve a conference room in Life Sciences South).**

In order to submit all materials to the Graduate College by University graduation deadlines, the thesis defense must occur at least one week prior to the end of classes, to allow time for any required revisions and additions to the written thesis. Specific deadlines will be given in the semester students are completing. The student should e-mail the AMP Program Coordinator with the date, time, and location of the defense, as well as the student's thesis title at least two weeks in advance. The Coordinator will then announce the defense to the public so that all interested parties may attend, and then send the student the final Completion of Degree Requirements form, which he/she will need to take to the thesis defense. To allow the thesis committee time to read and evaluate the thesis, a final polished draft of the written thesis should be provided to the committee at least two weeks prior to the defense date. Part of the committee's evaluation of the written thesis will include whether substantial deficiencies exist and progression to an oral defense of the thesis is warranted. The thesis should include an appropriate introduction to the research topic and rationale for the specific research question that has been addressed, a detailed description of the experimental results as well as interpretations of these findings, a description of the methodologies used, and a scholarly discussion of these results and any implications that they might have for future work in this area.

In your final semester, the Program Coordinator will send an email with instructions for thesis defense and also the rubric that will be used by the committee.

The thesis defense will consist of a public oral presentation of the student's research project and results, followed by a closed-door defense of the thesis project with the student and thesis committee. Students should bring with them the Thesis Rubric form (sent from the AMP Program Coordinator) to the thesis defense. ***After the defense, committee members should complete and sign the Thesis Rubric. Your committee chair should email the Thesis Rubric to Kara ASAP. All committee members should also electronically sign the Thesis Approval Page (this will become page 2 of your thesis) which will then be sent automatically to the Graduate College. The Thesis Approval page will be sent to you through Adobe Sign when you notify Kara of your defense date and title.***

A number of outcomes of the written thesis and defense evaluation process are possible:

- If the thesis defense is passed with no deficiencies, then you will be advanced to the Graduate College for conferral of the Master's degree.
- If the thesis defense is passed contingent upon the completion of changes to the written thesis, then you will be advanced to the Graduate College for conferral of the Master's degree only upon satisfying the supervisory committee's recommendations.

- If the written thesis is deemed unacceptable or the defense is failed on the first attempt:
 1. You may be given a chance to rewrite the thesis and reschedule the defense within two months.
 2. You may be asked to leave the program with no chance for a second attempt.
- If the written thesis is deemed unacceptable or the defense is failed on the second attempt, then the supervisory committee will recommend dismissal from the Master's Program and Graduate College.

If the committee recommends dismissal from the program, the supervisory committee must draft a letter detailing the reasons for the recommendation to the Director of the Accelerated

Master's Program with a copy to the student. The Director of the Accelerated Master's Program, in consultation with the MCB department head, must submit a written decision on the recommendation to the student within one week. The student may appeal this decision in writing to the MCB department head. The appeal should specifically address all of the points raised in the Director of the Accelerated Master's Program's letter to the student and must be submitted within one week of this notification.

Upon submission of the Thesis Rubric and Thesis Approval Page, the Coordinator will submit the Master's Completion Certification in GradPath. The Graduate College will then verify the completion of all course work and requirements and finally confer the Master's degree.

Graduation

Students are encouraged to participate in the MCB Department Ceremony, the College of Science Commencement Ceremony, and/or the University of Arizona Commencement Ceremony. Students will be sent information directly through email regarding the commencements; students may find information on the University and college commencement on the university website.

CONTACT INFORMATION

Any questions regarding MCB's Accelerated Master's Program may be directed to:

Kara Dyson, M.S.
AMP Program Coordinator and Senior Academic Advisor I
Department of Molecular and Cellular Biology
Life Sciences South, Room 248
kdyson@email.arizona.edu
(520) 621-1073

Dr. Ryan Gutenkunst
Associate Department Head, Associate Professor, and AMP Director
Department of Molecular and Cellular Biology
rgutenk@email.arizona.edu
(520) 626-0569

MCB Assessment
Written Thesis and Oral Defense of the Thesis (AMP)

Student Name: _____ Date: _____

Thesis Committee Member: _____

Directions: Evaluate this student's written thesis and oral defense of the thesis for the criteria described below. Return your completed rubric to the committee chair before leaving the defense.

1. MCB Core Knowledge

Excellent	Satisfactory	Needs Improvement	Unsatisfactory
<p>The student demonstrates a broad and thorough (i.e. can recognize, explain, and extrapolate) knowledge of MCB core curriculum areas (see below) with a level of detail that is appropriate for the stage of his/her training and only minor factual errors:</p> <p>Cell-based processes Higher-order processes Experimental approaches **see attached list of topics in each area</p>	<p>The student demonstrates adequate knowledge (i.e. can recognize and explain) of MCB core curriculum areas (see below) with a level of detail that is appropriate for the stage of his/her training and only minor factual errors:</p> <p>Cell-based processes Higher-order processes Experimental approaches **see attached list of topics in each area</p>	<p>The student has a significant gap in knowledge (i.e. cannot recognize or explain) in one MCB core curriculum areas (see below):</p> <p>Cell-based processes Higher-order processes Experimental approaches **see attached list of topics in each area</p>	<p>The student has significant gaps in knowledge (i.e. cannot recognize or explain) of more than one MCB core curriculum areas (see below):</p> <p>Cell-based processes Higher-order processes Experimental approaches **see attached list of topics in each area</p>

2. Expert Knowledge in an MCB Subfield

Excellent	Satisfactory	Needs Improvement	Unsatisfactory
<p>Comprehensive knowledge of the field that can be recalled and synthesized in response to both direct questions and questions that ask for speculation</p>	<p>Adequate knowledge of the field such that key studies can be recalled and drawn upon in response to direct questions but can only apply this knowledge to questions that ask for speculation only with direction</p>	<p>Baseline knowledge of the field based on a narrow scope of the literature. Can only accurately answer questions with direction and cannot apply this knowledge to questions that ask for speculation.</p>	<p>Inadequate knowledge of the field, including inability to recall key concepts in response to direct questions and inability to speculate</p>

3. Ability to justify his/her research project

Excellent	Satisfactory	Needs Improvement	Unsatisfactory
<p>Identified open and testable research objective and significance to the field</p> <ul style="list-style-type: none"> · provides an effective rationale based on key concepts in the literature and/or preliminary studies · robustly defends these points in response to questions 	<p>Identified open and testable research objective of significance to the field</p> <ul style="list-style-type: none"> · connects this area to previous observations but with some gaps in logic · can defend these points in response to questions with some direction 	<p>Open and testable research objective of significance to the field was not identified</p> <p>or</p> <ul style="list-style-type: none"> · rationale is not clearly defined · student struggles to defend these points even with direction 	<p>Open and testable research objective of significance to the field and rationale were not clearly identified</p> <ul style="list-style-type: none"> · student is unable to defend these points even with direction

4. Ability to identify/develop novel experimental or analytical questions

Excellent	Satisfactory	Needs Improvement	Unsatisfactory
<p>For most of the experiments:</p> <ul style="list-style-type: none"> · can defend how experiments or analyses were capable of resolving the open question(s) · identified appropriate control experiments or analyses · discusses all reasonable interpretations/models and defends those presented · can distinguish between outcomes and interpretations 	<p>For most of the experiments:</p> <ul style="list-style-type: none"> · can defend how experiments or analyses were capable of resolving the open question(s) · identified appropriate control experiments or analyses · discusses all reasonable interpretations/models and defends those presented with direction · can distinguish between outcomes and interpretations with direction 	<p>For most of the experiments:</p> <ul style="list-style-type: none"> · can defend how experiments or analyses were capable of resolving the open question(s) with direction · some crucial control experiments were not conducted · unable to identify all reasonable interpretations/models and/or defend those presented even with direction · conflates outcomes and interpretations 	<p>For most of the experiments:</p> <ul style="list-style-type: none"> · unable to defend how experiments or analyses were capable of resolving the open question(s) <p>and</p> <ul style="list-style-type: none"> · absence of appropriate controls, potential outcomes and their interpretations

5. Ability to draw from and expand knowledge to other fields

Excellent	Satisfactory	Needs Improvement	Unsatisfactory
<p>The student demonstrates the ability to think extemporaneously in response to questions</p> <ul style="list-style-type: none"> · the student can expand beyond his/her research project to make predictions about related fields and/or lines of investigation · the student drew on knowledge from other fields in the execution of his/her own research project 	<p>The student demonstrates the ability think extemporaneously in response to questions</p> <ul style="list-style-type: none"> · the student can expand beyond his/her research project to make predictions about related fields and/or lines of investigation only with direction · the student drew on knowledge from other fields in the execution of his/her own research project 	<p>The student can think extemporaneously in response to questions only with direction</p> <ul style="list-style-type: none"> · the student can expand beyond his/her research project to make predictions about related fields and/or lines of investigation only with direction · the student had limited knowledge from other fields in the execution of his/her own research project 	<p>The student is unable to think extemporaneously in response to questions and the student cannot expand beyond his/her research project to make predictions about related fields and/or lines of investigation and/or was unable to draw on other fields for the execution of his/her own research project</p>

6. Communication in written form

Excellent	Satisfactory	Needs Improvement	Unsatisfactory
<ul style="list-style-type: none"> · demonstrates technical competency in writing with infrequent grammatical errors, which do not invalidate the main points of the proposal · develops a logical and organized thesis 	<ul style="list-style-type: none"> · demonstrates technical competency in writing with minor grammatical errors, which do not invalidate the main points of the thesis <u>or</u> · minor gaps in the logic of the thesis or · <u>minor</u> organizational issues 	<ul style="list-style-type: none"> · occasional grammatical errors that interfere with the clarity of the thesis <u>or</u> · significant gaps in the logic of the thesis <u>or</u> · significant organizational issues 	<p>numerous issues that interfere with clarity including more than one of the following:</p> <ul style="list-style-type: none"> · significant grammatical errors · significant gaps in the logic of the thesis · significant organizational issues

7. Communication in oral Form

Excellent	Satisfactory	Needs Improvement	Unsatisfactory
<p>The student develops clear visual aids to support presentation</p> <ul style="list-style-type: none"> · the student develops a logical and organized presentation · the student's verbal and non-verbal actions effectively support the presentation 	<p>The student's presentation has only minor flaws in clarity of slides, logical organization, verbal or non-verbal actions</p>	<p>The student's presentation has significant flaws in clarity of slides, logical organization, verbal or non-verbal actions, which detract from the effectiveness of the presentation</p>	<p>The student's presentation has multiple significant flaws in clarity of slides, logical organization, verbal or non-verbal actions, which lead to confusion.</p>

**MCB Graduate Program
Core Curriculum**

Cell-based processes

DNA structure/replication/inheritance/transmission of genetic information

Transcription: mechanism and regulation

Translation: mechanism and regulation

Protein biogenesis: post-translational modifications, folding, degradation, interactions

RNA biogenesis: processing, modification, transport, folding, degradation, interactions

Organelles: dynamics, function, replication, transmission

Transport: ions and macromolecules into and out of cells/organelles, organellar movement

Cellular metabolism

Cell Cycle

Signaling

Cytoskeletal structure/dynamics

Cell polarity

Higher-order processes (how cells change)

Cell-cell communication

Cell-environment communication

Cell migration

Evolution

Exposure to/Appreciation for Approaches

Macromolecular structure and dynamics (molecular and cellular levels)

Sequencing, PCR, blotting, imaging, immunological assays, structure/function analysis, kinetics, thermodynamics

Classical genetic dissection

Mutants, complementation, epistasis, genetic discovery (forward and reverse screens)

Systems-level analyses: “omics” extensions, bioinformatics, large-scale comparisons

Bioinformatics, proteomics, nucleic acid ‘omics (genomics, transcriptional profiling), modeling

Organismal events

Lineage tracing

Statistics

Interpretation, hypothesis testing