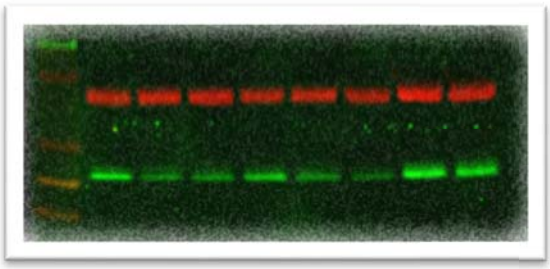
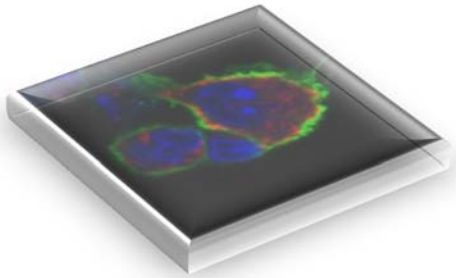
THE UNIVERSITY OF ARIZONA

DEPARTMENT OF
CELLULAR AND MOLECULAR MEDICINE

GRADUATE HANDBOOK
(PhD, MS & Certificate programs)





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INTRODUCTION

This handbook summarizes the graduate student requirements for the Ph.D. and MS degrees in Cellular and Molecular Medicine (CMM) and the Graduate Certificate in Biomedical Sciences. It is meant to assist students in understanding and fulfilling graduate school requirements. However it is not all-inclusive and does NOT serve as a contractual document. The student should also utilize resources made available by the Graduate College, including the Graduate Catalog and the Graduate College Handbook. The Dissertation Advisor and the Advisory or Dissertation Committee will serve as guides and mentors. The Graduate Studies Director and the Graduate Studies Committee will also provide guidance and oversee student progress. It is important for students to realize that successful completion of a graduate degree or Certificate program in CMM is their responsibility. Each student must be focused and self-motivated to reach his/her goals.

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PhD Degree Program

Objectives

The primary goal of this training program is to foster the development of scientists and educators who are prepared for lifetime participation in scholarly and intellectual pursuits. The program normally admits applicants for the Ph. D. or M. D./Ph. D. only. A student graduating with a Ph. D. in Cellular and Molecular Medicine will receive advanced training in two areas:

1. Research. Students receiving a Ph.D. in Cellular and Molecular Medicine will excel at conducting independent and active biomedical research programs. Career paths for graduates might include academic research and teaching positions, the biotechnology industry, law, journalism, public policy, or comparable endeavors requiring advanced expertise in and knowledge of biomedical research. Students in our program should demonstrate independent and critical thinking about scientific problems, and will show the ability to develop original ideas into substantive hypotheses. To test these hypotheses, graduates of our program will be proficient in an array of modern biomedical research techniques. Students will complete a dissertation that is a complete piece of scholarly work suitable for publication in high-quality, peer-reviewed journals. It is expected that at the time of graduation, all students will be first author on a least one published peer reviewed paper in their field of study.

2. Teaching. Teaching is an important component of student training, and excellence in teaching is highly valued. Students will gain teaching experience in the laboratory and through departmental journal clubs and seminars. In additions, students may do an optional teaching assistantship.

Administration

The Graduate Studies Committee (GSC) for the PhD program, with the approval of the Department Head, administers all aspects of the graduate program including recruiting, admissions, setting of policy, student advising, approval of Qualifying and Comprehensive Examinations, and other matters relevant to graduate education. Lonnie Lybarger (lybarger@email.arizona.edu; 626-1044) is the GSC Director and serves as the Graduate Advisor of the program. Administrative support is provided by Audrey Pallette, Program Coordinator, Sr. (apallett@email.arizona.edu; 626-6084).

The GSC currently includes the following members:

Jean Wilson, PhD	Greg Rogers, PhD	Samantha Harris , PhD
Paul Krieg, PhD	Lonnie Lybarger, PhD	

Prerequisites and Remedial Coursework

Students entering the Ph.D. program in the Department of Cellular and Molecular Medicine should have a strong background in science and math. Courses in biology, biochemistry, molecular biology, chemistry, physics, and math constitute excellent undergraduate training. Courses in cell biology, developmental biology, genetics, and statistics are also useful. Academic preparation in other areas of science may also provide an excellent background, and the program welcomes students with diverse backgrounds

and majors. After entering the program, a student may, under the direction of the GSC, take remedial courses in particular subjects.

Application Materials

Students interested pursuing a Ph.D. in Cellular and Molecular Medicine must apply through the Arizona Biological and Biomedical Sciences (ABBS) program, a unified recruiting and admissions process for numerous graduate programs at the University of Arizona. Visit the ABBS website for additional information about the admissions process and to initiate an application: http://abbs.arizona.eduThe following items are required for upload as part of the application process:

Transcripts of all college and university work

GRE results *(general exam is required and subject exam is optional)*

Statement of Purpose

Contact information for at least three people willing to write a letter of recommendation on your behalf. You should select individuals who are familiar with your work *(one of these letters should be from your research advisor, if applicable)*. Potential letter writers will be contacted directly from the Graduate College with instructions on letter submission.

International Applicants

International applicants must demonstrate proficiency in spoken and written English. All Graduate Assistant's (GA) whose native language is not English and who do not have a degree from a U.S. institution must have a minimum score of 550 (paper-based) or 213 (computer-based) on the Test of English as a Foreign Language (TOEFL) before their appointment as a GA.

According to Graduate College requirements, international students whose native language is not English must complete an English proficiency test IF they plan to serve as a Teaching Assistant. Details can be found here:

https://grad.arizona.edu/funding/ga/english-speaking-proficiency-evaluation

Financial Support

Every student who does not hold an individual fellowship receives an annual stipend, distributed through the department, in the form of a teaching or research assistantship or associateship. Stipend levels for assistantships are standardized and are set by the GSC and the Department Head. Presently the stipend for all Ph.D. graduate students is $25,000 per year. As a Graduate Assistant (GA) or Research Assistant (RA,) individual health insurance is paid for by the University of Arizona. It is the student's responsibility to enroll in the plan, through UA Access, each major semester (Fall or Spring) that coverage is desired. The enrollment deadlines are listed at the web site below and students cannot add, cancel, or change their insurance coverage after these dates.

http://www.health.arizona.edu/webfiles/insurance_gradbenefit.html

Students matriculating through the ABBS program will initially be admitted to the ABBS Preprogram in the Graduate College. Each student will be supported by funds from the ABBS program while performing three eight-week laboratory rotations. Following the third rotation, each student will choose a major advisor and laboratory. Students will enter a specific graduate program based upon the primary affiliation of their major advisor and the student's scientific interests. Students entering laboratories of CMM faculty will therefore normally enter the CMM Graduate Program. Upon entering the CMM graduate program, each student will be supported by funds provided by their major advisor.

In the extraordinary event that the major advisor is unable to provide support for the student, the advisor and/or the student may petition the Department Head for supplemental funding. If such a request is approved, support may be provided in the form of a teaching assistantship, in which case the student may be required to assist in teaching a departmental course.

Coursework

The Graduate College requires each student to have a total of at least 63 units before graduation: at least 36 units in the major (CMM), at least 9 units in the minor, and at least 18 dissertation units. At least half of the units taken in the major and in the minor must be in graded courses. Requirements for the minor vary among departments, so students must check with the minor department they choose in order to determine the specific requirements. A CMM doctoral student may choose to major and minor in Cellular and Molecular Medicine for an "**Interdisciplinary Minor**" in Cellular and Molecular Medicine". This minor consists of at least 9 units, at least half of which must be in formal graded coursework, in any area of cellular and molecular biology/medicine (excluding major course work, seminars, and lab rotations). Consistent with Graduate College requirements, at least one half the units used on the Doctoral Plan of Study must be in courses in which regular grades (A, B, C) have been earned. The Doctoral Plan of Study lists the student's coursework taken and planned, and should be submitted to the Graduate College once you join the Program (it can be amended if your course plans change); it must be submitted prior to taking the Comprehensive Exam.

In order to allow the maximum flexibility in the student's program of study, the CMM Graduate Program keeps the number of specified courses for the major to a minimum. This allows the student, major advisor, and advisory committee to tailor the student's courses to his/her area of research. Those courses that are required reflect the Program's commitment to providing students with a foundation for understanding the biological mechanisms of human disease.

The following are required:

1. Principles of Cell Biology (CMM/MCB 577; Fall semester). All students must take this course, preferably in the first year in the program. The student must receive a grade of "B" or higher in order to remain in good standing in the program.

2. Ethics requirement: Within the first two years, all students must take Science, Society, & Ethics (MCB 695e; one unit course offered in the Spring semester), or PHCL 595B, Scientific Writing Strategies, Skills and Ethics (two unit course offered in the fall semester).

3. 2 or more credits (credit-hours) from a course(s) in bioinformatics/computational biology. Course options include, but are not limited to:

MCB 580	Intro to Systems Biology (Fall)
ECOL 553L	Functional and Evolutionary Genomics (Fall)
MCB 516A	Statistical Bioinformatics and Genomic Analysis (Fall)

4. Select at least ONE course from among the following:

CMM 595H	Problems in Biology of Complex Diseases (Spring)
CMM 695D	Human Genetic Disease Colloquium (Fall)
PATH 515	Mechanisms of Human Disease (Spring)
CBIO 552	Cancer Biology Survey Course (Fall)
MCB 572a	Cell Systems (Fall)

Remaining credits required by the Graduate College are met through electives courses. These could include (but are not limited to) any of the courses listed above and the following recommended electives:

PSIO584/MCB 584	Cardiovascular Muscle Biology and Disease (Spring)
IMB 521	Scientific Writing and Research Integrity (Fall)
CMM 479/579	Art of Scientific Discovery (Fall)
CMM 565a (Spring)	Fundamentals of Light Microscopy and Electronic Imaging
CMM 556	Developmental Biology (Fall)
CMM 596A	Seminar in Cardiovascular Development (Spring and Fall)
CMM 596B	Seminar in Protein Trafficking (Fall and Spring)
CMM 596C	Topics in Cancer and the Cytoskeleton (Fall and Spring)

5. For students that wish to do the optional teaching experience (see below), they may take one or more courses in anticipation of teaching in the course the following year

Additional courses for the Major will be chosen by the student with advice from the major advisor and the advisory committee, or the GSC in the case of first-year students.

Teaching

There is no requirement for a teaching experience for doctoral students. However, if a student is interested in gaining experience in this area, there are opportunities to do a teaching assistantship (T/A). This requires the approval of the student's Mentor and of the Course Coordinator for the course in which the student wants to T/A. Below are some options for teaching experiences. Additional options may also be appropriate but require approval of the Director of Graduate Studies.

1. CMM 565a: Fundamentals of Light Microscopy and Imaging (Spring). The student can arrange with the instructor to be a teaching assistant (T/A) in this course. The course must be taken for a grade in preparation for the T/A experience.

2. Medical School Histology or Gross Anatomy. The student can elect to be a T/A in medical school Histology or Gross Anatomy. The Department teaches compressed summer courses (during Summer Pre) in Histology (CMM 510) and Gross Anatomy (CMM 501), one of which must be taken in preparation for the T/A experience.

3. CMM/MCB 577 Principles of Cell Biology. The student can arrange with the instructor to be a teaching assistant (T/A) in this course. The course must be taken for a grade in preparation for the T/A experience.

4. CMM 595H Problems in Biology of Complex Diseases. This is one of the elective courses for CMM. Students that take the course can then T/A for one semester. Contact the Course Director to discuss further.

5. PSIO584/MCB 584 Cardiovascular Muscle Biology and Disease. This is one of the elective courses for CMM. Students that take the course can then T/A for one semester. Contact the Course Director to discuss further.

6. Undergraduate MCB courses. The student will be a T/A in one of the undergraduate biology courses offered by the Department of Molecular and Cellular Biology. No preparatory coursework is required.

7. Path 515 (Mechanisms of Human Disease). This is one of the elective courses for CMM. Students that take the course can then T/A for one semester. Contact the Course Director to discuss further.

Additional Training Activities

In addition to formal courses, students are required to participate in the following training activities throughout their time in the program. Students may receive course credit for these activities by enrolling in the course(s) noted.

1. Departmental Seminar (CBA 696a). Seminar speakers from around the world are invited to present their research in the weekly departmental seminar. Students are required to attend these seminars. In the event that there is a conflict, i.e., another course on the same day & time, the student must obtain prior approval from both the graduate advisor and the course coordinator to be excused from attending CBA seminars. Otherwise, all CMM students are expected to attend all CMM departmental seminars. Students will also have opportunities to participate in informal discussions with the speakers. The graduate students as a group invite and host one speaker each year.

2. Cell and Developmental Biology Journal Club (CBA 595a). Students and faculty present and critically evaluate papers from the current scientific literature. (Fall Semester)

3. Student Seminar (CBA 696b). Students annually present the results of their ongoing research to fellow students and faculty. (Spring semester)

Qualifying Examination

In accordance with Graduate College regulations, all students must pass a Qualifying Examination in order to demonstrate the ability to undertake work leading to a doctorate. This exam must be taken within the first year. The Qualifying Exam in this program consists of satisfactory participation in the departmental journal club.

Advisor and Advisory Committee

Students joining laboratories of CMM faculty following their third rotation will normally enter the CMM Graduate Program. Upon entering the CMM graduate program, each student will be supported by funds provided by the faculty head of the laboratory, who will serve as their major advisor. The advisor normally must be a member of the extended faculty of the Department of Cellular and Molecular Medicine, although with the approval of the GSC in exceptional cases alternative arrangements may be made. The advisor is expected to provide stipend support for the student, normally in the form of a research assistantship from a research grant or a traineeship from a training grant. In cases in which the student receives a fellowship from a source outside the university, the advisor is expected to provide any supplemental funds necessary to bring the student's total stipend to a departmental-standard level; arrangements should be made with the department on an individual basis.

After selecting a major advisor, the student selects a minor field and an advisory committee. This should be done in consultation with the student's advisor. According to Graduate College policy, the advisory committee must include at least 2 faculty members who have appointments in and represent the student's major department, and 2 additional faculty members, at least one of whom has an appointment in the minor department. The advisory committee normally will be chaired by the student's major advisor, although another committee member may be selected as chair by the committee. Students are urged to select advisory committees during the summer after the first year in the program. The advisory committee will serve as the student's comprehensive examination committee. Students must fill out the Advisory Committee Form (available on the CMM website) and receive approval for the composition of the Committee prior to their first Committee meeting.

Students are urged to meet with their advisory committees often, and must meet with them at least once per year, in order to seek their advice and approval for the selection of courses, the composition and administration of the Comprehensive Exam, and advice about the student's research project and dissertation. Each meeting will include an opportunity for the student to meet with their committee without their major advisor present. The chair of the advisory committee is expected to submit a summary report of any committee meeting to the GSC for inclusion in the student's file. (This and other forms are available for download on the Department website: http://cmm.arizona.edu/graduate-program/forms)

Each student will meet with the Graduate Studies Committee once per year to review progress toward their PhD. This is also an opportunity for the student to raise any issue(s) of concern. Following the meeting, each student will receive a letter summarizing their progress and any outcomes from the meeting.

Comprehensive Examination for Advancement to Candidacy for PhD Students

The exam is intended to test the breadth and the depth of the student's knowledge in his/her area of research and in related areas of science. The exam consists of two parts, a written examination and an oral examination. The written exam is in the form of an NIH-style grant proposal based on the research area of the student. The oral examination covers the student's project and general knowledge.

TIMING

Students may begin working on the proposal at any time, but the proposal must be submitted to student's Committee by **August 1 of the student's second year (Summer between 2nd and 3rd years). Failure to meet this deadline may result in dismissal from the Program**. Thus, it is essential that students assemble their committees during their second year. Also, a Doctoral Plan of Study must be completed and submitted to the Graduate College before the exam may be taken (forms and instructions available online through My Grad College; https://grad.arizona.edu/gc/).

Note: students should have a meeting of their Advisory Committee prior to submitting the written exam. This is to ensure that the Committee and the student understand the process and expectations.

Written Exam

Document. The student will prepare an NIH-style research grant based on the student's own project. The style and general content of the grant will conform to NIH guidelines for R01 and R21 grants, with the exception of the page limit. The body of the grant (Research Strategy) may be up to 10 pages, not including the Specific Aims page and References. Note that the Research Strategy section includes the Significance, Innovation, and Approach sub-sections. It is anticipated that the student will spend two to three months writing their grant proposal.

This proposal is prepared without direct scientific input from the Advisor, though mentorship on general aspects of grant writing is acceptable from the Advisor and from others (faculty, students, and postdocs). Further, it must not overlap significantly with proposed research from the Advisor. In other words, the student's proposal must not represent a simple reworking of proposed research in the Advisor's grants. The intention is that the student will take his/her current project and propose the next reasonable steps. Preliminary data are not required, but may be included if available. As a guideline, the students may review the style and content of sample grants available from NIH:

(http://www.niaid.nih.gov/researchfunding/grant/pages/appsamples.aspx).

It is highly recommended that students attend one of the grant writing courses or workshops available to graduate students in the College of Medicine, prior to the Comprehensive Exam. A workshop is available through the Cancer Biology graduate program. Immunobiology sponsors a grant writing course each Fall (IMB 521) with participation from CMM faculty; this is an excellent opportunity for students to learn writing skills while they develop their proposals. It is recommended that students take this course in the Fall of their second year.

Review and Outcomes. The proposal will be reviewed by the student's Graduate Advisory Committee, excluding the Advisor/Mentor. The initial level of review of the student's proposal is a simple vote for "pass" (proceed to the oral exam), "provisional pass" (minor revisions which must be approved before scheduling oral exam), or "fail" (one opportunity to rewrite the proposal). Reviewers should make every effort to complete the review within two weeks, and send their votes to the student's Advisor. The standard for review is not competitiveness for funding in a Study Section. Rather, reviewers should decide whether the student has produced a quality document in which he/she has delineated an important scientific question and offered a reasonable experimental plan to address the question, while considering the interpretations and limitations of the results. If rewrites are required, the timetable for completion should be discussed with the Committee and should not exceed 6 months. General suggestions for rewrites may be provided by the committee members. Once the student has received a grade of "pass" from a majority of the committee members, the student may proceed to the oral portion of the exam. Ideally, the oral exam will occur within 1 month of passing the written exam. The student should not schedule the oral examination until he/she has passed the written examination.

Each participating committee member will also provide written feedback in the NIH Summary Statement format (Significance, Innovation, and Approach sections, only). The intention of the written critique is to provide constructive feedback on the proposal, as well as to provide the student with a sense of how grants are reviewed by Study Sections. Numerical scores are not necessary. Given the early stage of the students, some flaws and shortcomings in the proposal are anticipated and acceptable. The critiques should point out strengths and weaknesses in the course of providing helpful feedback. Instructions and critique forms for the Comprehensive Exam process should be provided to the Committee members at the time of proposal submission. The critique form is available on the CMM website: http://cmm.arizona.edu/graduate-program/forms. It is most helpful to the student if this feedback is provided prior to the oral exam.

Oral Exam

Format. The oral exam will consist of two basic parts: i) questions focused on the research project of the student, and ii) questions to assess general knowledge and critical-thinking skills. The student will prepare a simple presentation focused on the written proposal, and this presentation will serve as a launching point for questions. Per Graduate College rules, the exam must be a minimum of one hour, and may not exceed three hours. Students should schedule a 3-hour block for the exam, even though the exam may take less time. It is strongly recommended that the student use the time between the written and oral exams to review coursework and topics related to the student's research field.

Students must follow Graduate College policies in scheduling and taking the oral exam. In particular, the student must select a time and location, and must file the **appropriate forms** to the Graduate College (available online through GradPath). A member of the committee (other than the advisor) will act as a reporter to ensure that the exam is administered fairly and file the report with the Graduate College. According to Graduate College policy, the exam should test the student across the breadth of their discipline, and should not focus solely or primarily on the student's research project.

Outcomes. Students are awarded a pass/fail for the exam. According to Graduate College policy, "More than one negative or abstaining vote will result in failure of the exam." A minimum of four committee members must be present for the exam. Note: the student's

Advisor is not required to attend the oral exam. The Advisor may be present, but should have minimal input during the questioning of the student. If the Advisor is not present, care must be taken to ensure that Graduate College requirements are met: A minimum of four committee member, at least three of whom must be tenured, or tenure-track UA faculty. In some cases, exceptions can be made with *prior approval* from the Graduate College.

Failure of the oral examination may be grounds for dismissal from the graduate program. However, the student's advisory committee may allow the student to retake the exam. According to Graduate College policy, a student may take the oral Comprehensive Exam only twice. The timing of the retake can be determined with the input of the committee.

Preparation. The student is responsible for submitting through GradPath the necessary forms for the exam, prior to the exam. The Preliminary Exam packet is available online from the Graduate College (http://grad.arizona.edu/forms/).

Dissertation Proposal

(NOTE: this requirement only applies to CMM students who completed the Comprehensive Exam PRIOR to October, 2012).

Following completion of the Comprehensive Examination, the student can retain his/her advisory committee as their dissertation committee, or can reconfigure the committee as needed to better match the research focus of the dissertation project.

After passing the written and oral portions of the Comprehensive Exam, the student must prepare a written dissertation proposal that will be submitted to the dissertation committee within six months following completion of the Comprehensive Exam. The proposal must follow the NIH grant format and must include a budget and budget justification; the length should conform to NIH guidelines. The proposal should be conceived and written with input from the advisory committee. The final document must be approved by the major professor before distribution to the dissertation committee. The student should defend and discuss the proposal during a meeting with their committee.

The requirement for a written proposal in the form of an NIH grant proposal has two purposes. First, it provides the student's advisory committee with a reasonably detailed basis for discussion of his/her planned research. Second, it enables the student to gain the experience of preparing a grant proposal. The dissertation proposal should therefore be evaluated by the student's dissertation committee on the basis of both scientific content and clarity of writing.

Dissertation Defense

In order to receive a Ph.D., the student must write and defend a Ph. D. dissertation. This will be a scholarly work reviewing in depth the field in which the student has done his/her research, and a thorough and critical exposition of the student's research. The dissertation must be prepared according to Graduate College requirements, with input from the student's advisor and dissertation committee. At the discretion of the dissertation committee, the dissertation may take the form of several published papers,

with an expanded introduction and discussion. **The dissertation must be submitted to the dissertation committee at least three weeks prior to the dissertation defense.**

The final step for a student completing the Ph. D. is the defense of the dissertation. The student must give a formal presentation of his/her research in a one-hour seminar that is open to the University community. This public seminar is followed by a closed defense with the dissertation committee. Students should consult with Audrey Pallette when making arrangements for the dissertation defense.

Program of Study/Timetable

Students will be strongly encouraged to complete the Ph. D. in five years or less. Therefore, the GSC suggests that each student adhere to the plan of study, or timetable, outlined below.

First year

- Attend Graduate Teaching Assistant Orientation
- Perform and complete research rotations; join a lab and graduate program
- Take "Principles of Cell Biology"
- Take "Science, Society & Ethics" (MCB 695e)

End of first year/ beginning of second year

- Choose a minor
- Choose an advisory committee (complete appropriate Program and GradPath forms)
- Choose a teaching discipline and take necessary coursework

Second year (end of year)

- Submit doctoral Plan of Study Form through GradPath (this can be done earlier, but must be completed prior to the Comprehensive Exam)
- Take Comprehensive Exam (requires submission of exam forms through GradPath prior to the oral exam)

Third, Fourth, and Fifth years

- Complete experiments
- Write manuscripts
- Write, submit, and defend dissertation

A more detailed timetable, the Graduate Student Checklist to Degree, is available from Audrey Pallette.

Satisfactory Academic Progress

Any student who falls one full semester behind the Graduate Student Checklist to Degree will be required to meet with the GSC to discuss any impediments to the student's progress and strategies for improving progress.

Any student who falls one full year behind the Graduate Student Checklist to Degree will be considered not to be making satisfactory academic progress, will be required to

meet again with the GSC, and may be converted to non-degree status or dismissed from the graduate program.

Appendix - Fellowships, Scholarships, and Supplements to Stipends

Students are strongly encouraged to seek outside fellowships or scholarships for their graduate studies. These awards represent a financial benefit to the student and lab, and are important marks of distinction on a student's *cv*. If a fellowship or scholarship provides a stipend higher than the departmental standard, the student will receive the full stipend provided by the fellowship. If a fellowship or scholarship provides less than the full departmental standard, the student may request supplemental funding from his/her advisor.

A student may accept a cash scholarship in addition to his/her stipend. Such scholarships represent a supplement (addition) to the stipend, rather than a replacement/subsidy of the regular stipend. Many scholarship agencies require that awards be made in addition to the regular stipend. In exceptional cases only, such as a lapse in funding of the supporting Advisor, scholarships may be used to pay a portion of the regular stipend.

Note: Some fellowship/scholarship applications only permit a limited number of applicants from a given graduate program. In such cases, the Graduate Studies Committee will determine which interested students may apply, based on the likelihood for success of the potential applicants.

MD/PhD Program Guidelines/Policies

For information regarding the specific policies for MD/PhD students in CMM, contact the Director of the Graduate Studies Committee for CMM.

CMM Minor

This information is for students in other graduate programs (non-CMM) that desire a Minor in CMM. There are no strict requirements for the Minor so that students have a good deal of flexibility to take courses that meet their needs. 9 credits are required that fit with the "CMM theme". Any plan for the CMM minor should include at least some of the CMM core courses (http://cmm.arizona.edu/education/courses). However, there could be additional courses that would be appropriate. Interested students should consult with the Director of the CMM Graduate Studies Committee to develop a plan for the CMM Minor.

Master's Program
(for students accepted into the PhD program)

In unusual cases, a student may terminate the PhD program and receive a M.S. degree. If a student wishes to receive a terminal Master's degree, he/she must notify the advisor, the advisory committee, and the GSC. In order to receive a terminal M.S., the student must demonstrate mastery of a subject beyond the undergraduate level. Thus, students choosing this option must *earn* the M.S. degree. The following requirements, and any additional ones required by the student's advisory committee, must be met:

1. **Coursework**. The student must complete at least 30 units of coursework in the major, at least half of which must be graded. There is no requirement for thesis or dissertation units for a terminal M.S. degree.

2. **Comprehensive Exam**. For a student to be considered for a terminal M.S. degree, he/she must have successfully passed the Comprehensive Exam.

3. **Thesis**. The student must submit to his/her advisor and advisory committee a written thesis. The thesis must describe a body of scientific research completed by the student in his/her course of study, or an approved substitute, and must be submitted to the advisor and advisory committee in the format of a publishable, scholarly paper.

4. **Thesis defense**. The thesis must be defended in an oral exam administered by a committee of at least three CMM faculty members, normally selected from the student's advisory committee by the student and his/her advisor.

Note that stipend support is not guaranteed when a student opts for the M.S. track and support for completion of the degree must be determined in consultation with the Advisor.

Master's Program
(for students accepted directly into the MS program)

Objectives

This Master's program is designed to educate students at the graduate level in biomedical sciences, with an emphasis on training in basic and translational clinical research, and to provide students with an advanced understanding of human anatomy and functional histology and cell biology.

Administration

The CMM Graduate Certificate and Master's Degree Committee, with the approval of the Department Head, administers all aspects of the graduate program including recruiting, admissions, setting of policy, student advising, approval of Thesis, and other matters relevant to graduate education. David Elliott (elliott@arizona.edu) is the committee Director and serves as the Graduate Advisor of the program. Administrative support is provided by Audrey Pallette, Program Coordinator, Sr. (apallett@email.arizona.edu; 626-6084).

Application Materials

Students interested in pursuing a M.S. in Cellular and Molecular Medicine must apply through the University of Arizona Graduate College. Visit the CMM website for additional information about the admissions process and to initiate an application.

The following items are required for upload as part of the application process:

Transcripts of all college and university work

GRE results *(general exam is required and subject exam is optional)* or MCAT results

Statement of Purpose

Contact information for at least three people willing to write a letter of recommendation on your behalf. You should select individuals who are familiar with your work *(one of these letters should be from your research advisor, if applicable)*. Potential letter writers will be contacted directly from the Graduate College with instructions on letter submission.

International Applicants

International applicants must demonstrate proficiency in spoken and written English. All Graduate Assistant's (GA) whose native language is not English and who do not have a degree from a U.S. institution must have a minimum score of 550 (paper-based) or 213 (computer-based) on the Test of English as a Foreign Language (TOEFL) before their appointment as a GA.

A foreign student whose native languish is not English must, within two years after entering the program, pass an English proficiency test (SPEAK or TSE test) with a score of 50 or higher.

Financial Support

The Cellular and Molecular Medicine CMM Master's Program does not provide financial aid, however students may contact the Financial Aid office for assistance (https://financialaid.arizona.edu/money/). The student is responsible for all expenses related to completion of the degree requirements.

Coursework

The Master's degree will require a minimum of 30 units of credit.

Every student will be required to complete the following courses with a grade of C or better:

CMM 501 ("Human Gross Anatomy;" 4 units each)
CMM 510 ("Human Histology: An Introduction to Pathology;" 3 units)
CMM 565A ("Fundamentals of Light Microscopy and Electronic Imaging;" 3 units)
CMM 577 ("Principles of Cell Biology;" 4 units) or CMM 504 ("Cell Biology of Disease;" 3 units)

One of the following (choose):
CMM 603 ("Current Topics in Biomedical Sciences;" 2 units)
CMM 604 ("Current Topics in Translational Medicine;" 2 units)

One of the following (choose):
PATH 515 ("Mechanisms of Human Disease;" 4 units)
CBIO 552 ("Cancer Biology;" 4 units)

CMM 910 ("Thesis;" 5 units)

The student will be required to complete at least 6 additional units with a grade of C or better. The following courses are recommended:
CMM 595H ("Problems in the Biology of Complex Diseases;" 2 units)
EPID 576A ("Biostatistics in Public Health;" 3 units)
CMM 605 ("Medical Immunology and Infectious Disease;" 4 units)
CMM 695D ("Human Genetic Disease Colloquium;" 3 units)

Other courses in the biomedical sciences and medicine may be appropriate and will be considered. The student will be required to receive approval from his or her advisory committee for his/her final selection of courses. Other courses in the biomedical sciences and medicine may be appropriate and will be considered. The student will be required to receive approval from his/her advisory committee for his/her final selection of courses.

A student must maintain an overall grade-point average (GPA) of 3.0. In accord with the policies of the Graduate College, any student whose cumulative GPA falls below 3.0 will be on probation for the following semester. If the student's cumulative GPA is still below 3.0 at the end of the probationary semester, he/she will be dismissed from the program.

Advisor and Advisory Committee

Each student will be assigned a member of the Oversight Committee as primary advisor when he or she accepts admission into the Master's program. The student's advisory committee will consist of the primary advisor and two additional faculty members who have expertise related to the student's area(s) of interest. The additional committee members will be chosen jointly by the student and the primary advisor. The members of

the student's advisory committee should be chosen, and the committee should meet, as soon as possible after the student enters the Master's program.

Thesis

Every student is required to complete a substantial research project and to submit a written thesis that documents that research. Both laboratory and non-laboratory projects will be considered. The student's research project will be agreed upon by the student and the student's advisory committee (to be made up of at least three faculty members, at least one of whom must be a member of the Master's Advisory Committee). As a guideline, laboratory based thesis should be in the format of a publishable manuscript for an appropriate journal and non-laboratory based thesis should be in the format of a New England Journal of Medicine review article and be 10,000-20,000 words (not including references).

Graduate Certificate in Biomedical Sciences

This certificate program is designed to educate students at the graduate level in biomedical sciences, with an emphasis on training in basic and translational clinical research, and to provide students with an advanced understanding of human anatomy and functional histology and cell biology.

1. A bachelor's degree is a prerequisite for entering the certificate program. A student may apply to the certificate program prior to receiving his/her bachelor's degree, but must have received the degree before starting the certificate program. While it is expected that the applicant's undergraduate major normally be in the natural sciences, students with degrees in other fields who have sufficient coursework in the natural sciences will be considered.

2. The certificate will require that the student complete a minimum of 12 units of credit, which can include transfer credits as specified below.

    a. Every student will be required to complete the following courses with a grade of C or better:

        CMM 501 ("Human Gross Anatomy;" 4 units)
        CMM 510 ("Human Histology: An Introduction to Pathology;" 3 units)
        CMM 565A ("Fundamentals of Light Microscopy and Electronic Imaging;" 3 units)

    b. The student will be required to complete at least one additional course with a grade of C or better. The following courses are recommended (Other courses in the biomedical sciences and medicine may be appropriate and will be considered. The student will be required to receive approval from his or her advisor for his/her final selection of courses.):

        CMM 577 ("Principles of Cell Biology;" 4 units)
        CMM 595H ("Problems in the Biology of Complex Diseases;" 2 units)
        EPID 576A ("Biostatistics in Public Health;" 3 units)
        EPID 651 ("Bioethics, Regulations, and Repercussions in Research;" 2 units)
        PATH 515 ("Basic Human Pathology;" 4 units)
        CMM 605 ("Medical Immunology and Infectious Disease;" 4 units)

    A student must maintain an overall grade-point average (GPA) of 3.0. In accord with the policies of the Graduate College, any student whose cumulative GPA falls below 3.0 will be on probation for the following semester. If the student's cumulative GPA is still below 3.0 at the end of the probationary semester, he/she will be dismissed from the program.

3. Every applicant must submit scores for either the GRE or the MCAT in order to be considered for admission.

4. International applicants will be considered for admission. All applicants must meet the requirements of the Graduate College concerning proficiency in the English language.

5. Concurrent enrollment in a degree program is permitted, with the exception of the Master's in Cellular and Molecular Medicine degree program. Courses that are counted toward the requirements of the Certificate Program may be counted toward the requirements of the Master's Degree program at the discretion of the degree program.

6. Up to 3 units of graduate credit may be transferred from other institutions, at the discretion of the student's advisory committee.

7. Student Advising. Students will receive advice throughout their time in the certificate program, including advice on courses for the certificate program, career choices, possible future use of the certificate, opportunities for advanced education or professional training, and employment possibilities. Each student will be assigned a member of the Oversight Committee as primary advisor when he or she accepts admission into the certificate program. The student's advisory committee will consist of the primary advisor and two additional faculty members who have expertise related to the student's area(s) of interest. One of these additional faculty members must be a member of the Oversight Committee, but the other may be any University of Arizona faculty member. The additional committee members will be chosen jointly by the student and the primary advisor. The members of the student's advisory committee should be chosen, and the committee should meet, as soon as possible after the student enters the certificate program.
8. Every student will be required to file a Program of Study form, as specified by the Graduate College.
9. A student in the Biomedical Sciences Graduate Certificate Program may apply to the Master's in Cellular and Molecular Medicine degree program, or to the Ph.D. program in Cellular and Molecular Medicine. This process will require completion of a standard application, course credits that have been taken for the Certificate will be counted towards the Master's. Decisions about transfer credit requests will be made on an individual basis by the Admissions Committees of the degree programs.

Academic Integrity

The University of Arizona Student Code of Conduct and other policies apply and can be found on the following website: http://catalog.arizona.edu/policies/974/acacode.htm

Principle: (from the above website) Integrity is expected of every student in all academic work. The guiding principle of academic integrity is that a student's submitted work must be the student's own. This principle is furthered by the student Code of Conduct and disciplinary procedures established by ABOR Policies 5-308 - 5-403, all provisions of which apply to all University of Arizona students. This Code of Academic Integrity (hereinafter "the Code") is intended to fulfill the requirement imposed by ABOR Policy 5-403.A.4 and otherwise to supplement the student Code of Conduct as permitted by ABOR Policy 5-308.C.1.

The most common issues for graduate students involve giving credit for ideas in writing. When answering a question about a paper, students need to paraphrase the language in their own words. It is not appropriate to lift phrases or sentences directly from the paper. Cutting and pasting anything from a document or the internet without attribution is plagiarism (http://www.merriam-webster.com/dictionary/plagiarism & http://www.turnitin.com/assets/en_us/media/plagiarism_spectrum.php). The penalties can be very severe, so be sure that you understand the rules.

Information on the University's policies and procedures concerning Academic Integrity violations can be found at;

http://deanofstudents.arizona.edu/policies-and-codes/code-academic-integrity

http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity