COLLEGE OF MEDICINE TUCSON

Cellular & Molecular Medicine

MASTER'S & CERTIFICATE PROGRAMS

Graduate Handbook

THE UNIVERSITY OF ARIZONA

INTRODUCTION

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

TABLE OF CONTENTS

MASTER OF SCIENCE (M.S.) PROGRAM

Objectives

The Master's Program in Cellular and Molecular Medicine is designed to educate students at the graduate level in biomedical sciences, with an emphasis on training in basic and translational 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 Advisory Committee, with the approval of the Department Head, administers all aspects of the graduate program including student recruitment, admissions, policy, student advising, approval of theses, and other matters relevant to graduate education. Dr. Lonnie Lybarger (lybarger@arizona.edu) is the Committee Chair and serves as the Director of Graduate Studies for the CMM-MS and Certificate programs. Administrative support is provided by S`asha Verdugo, Program Coordinator, Senior (sasha@arizona.edu; 520-626-3184).

Title	Name
Program Director	Lonnie Lybarger, PhD
Department Head	Sakthivel Sadayappan, PhD, MBA
Master's Advisory Committee Members	David Bear, PhD; Chris Pappas, PhD; Lonnie Lybarger, PhD; Ritu Pandey, PhD; James Proffitt, PhD; Valerie Schaibley, PhD; Stefanie Novak, PhD, and Haley O'Brien, PhD
Graduate Program Coordinator	Sasha Verdugo, Senior Program Coordinator

Application Materials

Students interested in pursuing a M.S. in Cellular and Molecular Medicine must apply through GradApp, which is linked closely to the University of Arizona Graduate College. That website can be found here. Students are encouraged to visit the CMM website prior to applying for more detailed information about the admissions process and program requirements.

The following items are required as part of the application process to the CMM-MS Program:

1. Transcripts of all college and university work.
2. Personal Statement (up to 500 words) - Explain your motivation for pursuing graduate school, including your career goals after completion of the degree. Explain why the CMM MS Program is a good match for you – specifically, explain what you expect to gain from and contribute to the program. You may address any weaknesses and/or challenges, and how these were overcome, within the personal statement.

3. Skills Statement (up to 200 words) - Describe the relevant skills, experiences, and/or accomplishments that demonstrate your readiness and potential for this graduate program.
4. CV/resume - upload a copy of your curriculum vitae/resume in PDF format.
5. The Department of Cellular & Molecular Medicine requires each applicant to have a minimum of 3 letters of recommendation submitted on their behalf. Ideally, these letters should be written by professors, research or professional supervisors, etc. that can speak about your academic and research ability. Potential letter writers will be contacted directly from the Graduate College with instructions on letter submission.
6. International applicants will be considered for admission. All applicants must meet the requirements of the Graduate College concerning proficiency in the English language. Information on English proficiency tests at the University of Arizona can be found at the UA Admissions site.
7. Test scores for the GRE, the MCAT, or the DAT are optional and are not required for admissions, but applicants can choose to upload test results if they like.

Additionally, per the UA Graduate College, all applicants must have a minimum GPA of 3.0 to be considered for entrance to the UA Graduate School. Information on how Admission GPA is calculated can be found on the UA Graduate College's website.

Please note that admission to the CMM's Medical Science Track (otherwise known as P-MAP) is separate from the standard CMM Master's Program and requires application through a separate mechanism.

Prospective Students interested in applying for the P-MAP Program can find more information about qualifications and the application process HERE.

International Applicants

International applicants born in a country where the native language is not English must demonstrate proficiency in both spoken and written English. Details about the application requirements and process can be found HERE.

The minimum scores accepted for each of these tests can be found here.

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. Students are responsible for all expenses related to completion of the degree requirements, including tuition, mandatory fees, program fees, and course fees where applicable. Here are two resources, which are a good jumping off point for researching financial aid opportunities:

- https://financialaid.arizona.edu/scholarshipuniverse
- https://grad.arizona.edu/funding

The Graduate College offers a limited number of awards in the form of Grad Access Fellowships (GAF's) - these are competitive, need-based awards for newly admitted students – learn more about the eligibility criteria here: https://grad.arizona.edu/funding/opportunities/graduate-access-fellowship-or-tuition-scholarship-awards. Additionally, the Graduate College has limited Financial Hardship Funds available for domestic graduate degree-seeking students who are experiencing a catastrophic, exceptional and unexpected temporary financial difficulty or emergency that is impeding their degree completion in a timely manner. For more information: https://webforms.grad.arizona.edu/application-graduate-college-financial-hardship-funds

Coursework for the CMM-M.S. track

The Master's degree in Cellular and Molecular Medicine requires a minimum of 30 units of credit. Students must achieve a cumulative grade-point average of 3.0 or higher in their graduate career to meet the degree requirement and remain in good standing in the program.

- The course requirements for the **MS-Track** can be found HERE.
- The course requirements for the **Medical Track**, which supports the P-MAP program, can be found HERE.

MS students will be required to complete elective units with a grade of C or higher to remain in good standing. In accordance with the policies of the Graduate College, any student whose cumulative GPA falls below 3.0 will be placed on academic probation for the following semester. If the student's cumulative GPA is still below 3.0 at the end of their probationary semester, he/she will be dismissed from the program.

Advisor and Advisory Committee

Each student in the CMM – M.S. program will be assigned a member of the Master's Oversight Committee as their primary academic advisor when they accept admission into our program. A student may change their primary advisor at any time while they are pursuing their degree.

The student's thesis or report committee will consist of a minimum of **three** faculty members: (1) an individual with a faculty appointment within CMM (often, their primary advisor although this is not necessary) and (2) at least two additional faculty members who have expertise related to the student's area(s) of interest. *These individuals do not need to be in CMM*. Additional committee members will be chosen jointly by the student and their primary advisor. A student's advisory committee should be chosen - and the committee should meet - as soon as possible after the student starts working on their thesis or report.

For **thesis committees**, per Graduate College policy, the committee must include a minimum of three members, including at least two members of the Graduate Faculty. A Special Member may serve as the third member of the committee. Each committee must have a chair. The chair of the committee must be a member of the Graduate Faculty with endorsement to chair. If there are co-chairs of the committee, one must be a member of the Graduate Faculty with endorsement to

chair, while the second can be either a member of the Graduate Faculty or Special Member. For **report committees**, three members are needed, with at least one member who holds a faculty appointment in CMM.

For more specific guidelines, please consult with the CMM Graduate Coordinator or with the Graduate College. Definitions and policies for Graduate Faculty, Special Members, *etc*., can be found here: https://grad.arizona.edu/policies/academic-policies/graduate-student-committee-service

GradPath

GradPath is the system used by the UA Graduate College to track student milestones and progress over the course of their graduate career. For MS students, there are **three** forms that must be submitted by the student at various stages and milestones of their graduate career:

1. The Responsible Conduct of Research Statement
2. Plan of Study
3. Master's/Specialist Committee Appointment Form

The fourth form, the Master's/Specialist Completion Confirmation, is filled out and submitted by CMM's Graduate Coordinator upon successful completion and defense of a student's thesis or report.

GradPath forms are housed and designed to be completed online through UAccess Student. These forms can be accessed through the Student Center in UAccess by clicking the dropdown menu in the *Academics* section and scrolling to GradPath forms.

Please visit the Graduate College Website for more information on each form.

Thesis or Report

Every CMM-Masters student, regardless of track, is required to complete a substantial research project and submit a written thesis or report that documents that research. **The report option is compatible only with CMM's Medical Science Track (otherwise known as P-MAP); therefore, most CMM-Masters students undertake theses.** Laboratory, non-laboratory, and hybrid projects will all be considered. A student's research project will be agreed upon by the student and the student's advisory committee (for information on a student's Advisory committee, see above).

As a guideline, a laboratory-based thesis should be in the format of a publishable manuscript for an appropriate journal. A non-laboratory-based thesis should be in the format of a *New England Journal of Medicine* review article. Report-based projects accommodate both laboratory-based research and non-laboratory approaches, including hybrid models, enabling alignment with career objectives. A report offers greater flexibility compared to a thesis and should adhere to a format agreed upon by the report committee. Both theses and reports should be 10,000-

20,000 words in length (not including references). A student's Thesis or Report Committee will guide her/him in the preparation of this document. Per Graduate College and CMM policies, the thesis or report must be archived on the University's open- access website or in the CMM department, respectively, prior to completion of their degree.

Students who will be working in a laboratory **must** complete the University's Online RCR Training.

Students who will be working with patients or non-anonymized patient data must take the University's HIPPA Training.

Guidelines for Thesis or Report Units

CMM requires each Master's student to earn a minimum of five thesis (CMM 910) or report (CMM 909) units during their tenure in the program. The intention of these units is to award credit for the time students spend working on their thesis or report, and to help them stay on track to complete this milestone in a timely, efficient manner. The policies below describe the milestones to earn each thesis or report unit and are meant to guide students and their faculty mentors through the thesis or report process.

These guidelines require that students begin work on their theses well before the semester in which they intend to graduate. It is understood, however, that thesis or report work (especially laboratory-based research) does not always follow an expected schedule. Expectations for thesis/report progress should be discussed and agreed upon by the faculty advisor and the student each semester.

First unit – the student will identify a thesis or report advisor and members to serve on their thesis or report committee. With their committee's input, the student will select a thesis or report topic (literature- or lab-based) and develop an outline for the thesis or report to be presented to the committee at the first meeting.

Second unit – the student will provide the advisor/committee with a draft of the introduction section of the thesis or report.

Third unit – the student will provide the advisor/committee with a draft of the results/synthesis section of the thesis or report. Students should include figures or placeholders for figures in the draft at this stage. This draft should include revisions of the introduction section of the thesis or report (should the committee have provided any). If there has not been a thesis or report committee meeting within this past year, a meeting should be convened with the committee to discuss progress and timetables for the project.

Fourth unit – the student will provide the advisor/committee with a full draft of their thesis or report (including any revisions provided by the committee). If there has not been a thesis or report committee meeting within this past year, a meeting should be convened with the committee to discuss progress and timetables.

Fifth unit – Defend thesis or report, make any required revisions, and submit final document to the library for cataloging. If a student is not ready to defend, they should meet with their committee and make a plan to complete the thesis or report.

Note that there is no cap on the number of thesis units; students may take more than 5, in total, by the time they graduate.

Important additional policies:

- No more than **three** thesis or report units may be taken in one term. Therefore, the thesis or report process will cover at least two terms.
- Masters reports are only compatible with CMM's Medical Science Track (otherwise known as P- MAP).

For more information on CMM's thesis or report process or about the guidelines above, please seek out CMM's Graduate Coordinators and/or Director of Graduate Studies. There are additional documents to guide students, including a 'Masters Thesis and Report Handbook' included below as Appendix A.

CMM Department Program Fees – Program fees will be assessed every term a student is enrolled in the program, regardless of whether the student is enrolled in classes with the CMM prefix that term.

Important items to note about CMM's program fees:

- These fees are *in addition* to tuition and student mandatory fees.
- The amount of program fees assessed is directly related to the number of units taken in each term.
- Program fees apply to *all* UA courses taken while a student is active in the program, not just courses bearing the CMM prefix.
    - Example: a CMM-MS student registers for 6 units of CMM courses, and an additional 4-unit ECON class. They will still be assessed CMM program fees on all 10 units.

For more information regarding CMM Department Program Fees, please refer to the document: *Statement of Acknowledgment Regarding CMM Program Fees* that is available from the Program Coordinator.

GRADUATE CERTIFICATE IN BIOMEDICAL SCIENCES

The Graduate Certificate in Biomedical Sciences is designed to provide students with an advanced understanding of human anatomy and functional histology and cell biology, with an emphasis on training in basic and translational clinical research.

A bachelor's degree is a prerequisite for entering the certificate program. Students may apply to the certificate program prior to receiving their bachelor's degree but must have received the degree and be able to provide an official transcript before starting the certificate program. While it is expected that an 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 for admission.

The Graduate Certificate requires a minimum of 12 units of credit to complete: 10+ units of required coursework, and 2+ units of electives. As of June, 2021, our program the Certificate is open for Fall, Spring and Summer admissions. Per UA Graduate College guidelines, up to 3 units may be transferred from another institution. Every student will be required to complete the following courses with a cumulative grade-point average of 3.0 or higher:

The **course requirements** for the Certificate can be found HERE.

It is now possible to complete the Certificate on-line by selecting all on-line options from the list of required and elective courses. In accordance with the policies set forth by the UA Graduate College, students must maintain an overall grade-point average (GPA) of 3.0 to remain in good standing with the program. Any student whose cumulative GPA falls below 3.0 will be placed on academic 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.

Admission to the Graduate Certificate Program

Students interested in pursuing the Graduate Certificate in Biomedical Sciences must apply through GradApp, which is linked closely to the University of Arizona Graduate College. The application process for the Certificate is the same as the MS.

1. Concurrent enrollment in a degree program is permitted for Graduate Certificate students, **except** for in 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.
2. Up to 3 units of graduate credit may be transferred from other institutions and counted towards the Certificate, at the discretion of the Oversight Committee.
3. Student Advising. Students will receive advising 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 their primary advisor when he or she accepts admission into the certificate program.
4. Every Graduate Certificate student will be required to file a Program of Study form, as specified by the Graduate College. This form can be found in GradPath. Information on accessing the forms in GradPath can be found on page 6 of this handbook.
5. A student in the Biomedical Sciences Graduate Certificate Program may apply to the Master's in Cellular and Molecular Medicine degree program (or any other graduate programs) upon completion of their course of study. This requires completion of a graduate application, and admissions is not guaranteed. For the CMM M.S. Program, course credits that have been taken for the Certificate will, provided the student has remained in good standing academically, 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.

Note that students must complete the forms to finalize the Certificate prior to entering the MS Program, or they will incur program fees from both programs on each unit of coursework taken.

ACADEMIC INTEGRITY

The University of Arizona Student Code of Academic Integrity and other policies apply to students in all CMM programs, and can be found HERE.

Principle: (*from the above website*) Integrity and ethical behavior are expected of every student in all academic work. This Academic Integrity principle stands for honesty in all class work, and ethical conduct in all labs and clinical assignments. This principle is furthered by the Student Code of Conduct and disciplinary procedures established by **ABOR Policies 5-308 through 5-404** (see chapter 5), all provisions of which apply to all University of Arizona students. This Code of Academic Integrity (hereinafter "this 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**. This Code of Academic Integrity shall not apply to the Colleges of Law or to the MD program in the College of Medicine, which have their own honor codes and procedures.

A common issue for graduate students involves 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 considered **plagiarism** (Defined here). The penalties for plagiarism can be very severe; it is advised that all students be sure that they understand the rules, policies, and procedures for Academic Integrity violations. Likewise, the use of **Artificial Intelligence (AI)** resources to answer questions and complete assignments, when the content is misrepresented as the student's own work, is a serious violation of academic integrity.

ADDITIONAL INFORMATION

Student Roles in Program Governance

Student input and feedback are invaluable to building and maintaining strong training programs. Multiple mechanisms are available for students to shape the direction of the M.S. and Certificate Programs.

First, students are contacted annually by the Chair of the Master's Oversight Committee to keep in contact and to offer meetings, as the students request.

Second, students are encouraged *at any time* to meet with members of the Master's Oversight

Committee if they have concerns or ideas regarding the program.

Student Resources

The CMM Department is committed to assisting all students as they participate in its programs. The Programs are designed for flexibility and CMM strives to be as accommodating as possible with respect to personal situations and considerations. Links to information on academic, professional, and personal resources available to graduate students can be found here. This includes information on Academic Services, Policies, and Procedures, Funding, Professional Development Resources, Child Care Subsidies and Family-Friendly Information, and Health, Wellness and Safety information.

Satisfactory Academic Progress and Student Appeals

Academic Progress. Students are required to demonstrate satisfactory academic progress toward degree completion. Beyond maintaining a minimum 3.0 grade-point average, students are assessed for their progress in many ways. In addition to informal feedback from the student's Advisor, course instructors, and advisory committee, students will be formally evaluated using assessment tools that are applied for specific activities during program courses.

Failure to make satisfactory academic progress is grounds for dismissal by the Dean of the Graduate College. The Graduate College will apply the CMM M.S. criteria for satisfactory progress if the program requests a student disqualification. Should the student's Advisor and/or the Master's Oversight Committee determine that the student is not making satisfactory progress, the student will be notified in writing, with a copy also sent to the Graduate College. This written notification will include steps for remediation and a timetable in which to complete the steps; these will be determined by the Advisor in consultation with the Master's Oversight Committee.

Incomplete Policy. If a grade of "incomplete" is assigned to a student in any course, it is the student's responsibility, in conjunction with the Director for that course, to complete this Report of Incomplete Grade. Instructions can be found on the form and they include the development of a plan for timely completion of the requirements for the course. Failure to complete the requirements as stated on the form may constitute a failure to make satisfactory academic progress. In this event, the steps outlined above will be followed.

Student Appeals. Students may appeal or rebut program decisions regarding satisfactory progress. Students should respond to the notification of unsatisfactory progress in writing, through a letter to the Master's Oversight Committee. This will be followed by a meeting with the Committee. The student may also appeal to the Graduate College to determine whether the program followed the established program policies. Graduate College policies for how to appeal program decisions can be found here, along with information on how to deal with other types of potential grievances by graduate students.

APPENDIX A: MASTER'S THESIS & REPORT HANDBOOK

The writing of a graduate thesis or report is a personal process that is different from most academic writing experiences many students have. Distinct from many writing assignments at the undergraduate level, the process of writing a thesis or report is iterative and involves substantial back-and-forth with the Project Advisor and Project Committee. Students typically find that the thesis or report takes much more time and effort than anticipated. Thus, careful long-range planning is an important component of success. The information provided below describes the goals and purpose of the thesis or report, outlines the process of preparing a thesis or report, provides policies and procedures, and offers helpful hints.

Contents

THESIS AND REPORT OVERVIEW AND FORMAT

Theses and Reports in CMM consist of scholarly and thorough treatments of novel research projects. Laboratory, non-laboratory (literature-based) and hybrid projects are options for students. The research project will be agreed upon by the student and the thesis or report committee (comprised of at least three faculty members, at least one of whom must hold a faculty appointment in CMM).

Thesis: As a guideline, a laboratory-based thesis should be in the format of a publishable manuscript for an appropriate journal, typically with an expanded introduction, whereas a non-laboratory-based thesis should be in the format of a full-length review article in a major biomedical journal such as *Cell*, *Nature Cell Biology*, *New England Journal of Medicine*, and others, typically between 10,000-20,000 words (not including references). A good literature-based thesis should convey a student's ability to think scientifically about a problem. Collaboration between you and your advisory committee ensures a structured approach, with the requirement

of including at least two graduate faculty members. A recommended approach is to present in the introduction a key outstanding problem or question in the field and then propose a model with hypothesis to explain the process or disease under study. In the remainder of the thesis, the model should be justified from the literature, and tests of the hypothesis should be offered, with consideration of the potential outcomes. In the discussion/conclusion section, potential future research paths that could follow the proposed research should be discussed. In other words, the thesis is not only an in-depth review of a field, but it also includes a novel, creative, and scholarly contribution to the field. Students are required to think critically about the field, identify gaps in our understanding, and propose new mechanisms to explain the process under study and propose future research to answer important questions.

Report: A report offers greater flexibility compared to a thesis and should adhere to a format agreed upon by the report committee. Report-based projects accommodate both laboratory-based research and non-laboratory approaches, including hybrid models, enabling alignment with career objectives. Collaboration between the student and their advisory committee ensures a structured approach, with the requirement of including at least one graduate faculty member. The report typically spans 10,000 to 20,000 words, although it may vary slightly depending on the project's complexity. While reports primarily focus on professional application rather than necessarily advancing new academic theory, they can incorporate laboratory research, similar to a thesis. However, their flexibility also allows for a concentration on public service applications or policy-oriented solutions by applying existing theories to unresolved issues or addressing real-world challenges. This approach emphasizes practical relevance while maintaining a comprehensive analytical framework.

The introduction section typically consists of a literature review that comprehensively captures the topic of interest and identifies knowledge gaps in the field. In the discussion/conclusion section, potential future research directions that could emerge from the project outcomes should be discussed. In essence, the report serves not only as an in-depth review of a field but also presents novel perspectives that contribute to and expand our collective understanding of the pertinent issues. Students are expected to engage in critical thinking about the field, identify knowledge gaps, elucidate the research process, and propose future research to address critical questions. The comprehensive draft should integrate all findings, include tables and figures, and present a compelling and coherent narrative structure. The defense process ensures clarity of contribution and alignment with professional goals.

THESIS AND REPORT POLICIES

Thesis and Report Units: Students are required to take at least 5 units of "Thesis" (CMM 910) or "Report" (CMM 909) in order to graduate. All 5 units may not be taken within a single term. Benchmarks have been established for each thesis or report unit and can be found in the *Guidelines for Thesis or Report Units* section of the MS Program Handbook. This information should be shared with the faculty advisor responsible for submitting grades for the student's thesis or report units. Note that these are guidelines for thesis progress, but expectations for thesis progress each term should be discussed and agreed upon by the advisor and student.

Basic and Clinical Laboratory-Based Theses and Reports: Students who will be working in a

laboratory **must** complete the University's Online Responsible Conduct of Research Training: RCR training. Likewise, students who will be working with patients or non-anonymized patient data must take the University's Health Insurance Portability and Accountability Act of 1996 (HIPAA) Training: HIPAA info. It might be appropriate for students in research laboratories (basic or clinical) to register for CMM 900 "research" units.

General Requirements: The University of Arizona has several requirements for all MS theses and reports, and students in the CMM program must adhere to them. Links to many of the Graduate College policies are here. Students should familiarize themselves with these policies early in the thesis or report process to save time at the end.

TIMELINE AND STEPS TO THE THESIS AND REPORT

It is essential to observe the following deadlines to successfully complete and defend the thesis or report. This is not a process that can be done quickly! It is the responsibility of the student to organize this process and communicate the deadlines and expectations to the Thesis or report Committee.

1. During the first semester/term in which the student takes initial thesis or report unit(s), the student's Thesis or Report Committee should be selected, and the Thesis or Report Advisor identified. This committee must be approved by the Graduate College using the appropriate form within GradPath. Details on committee composition can be found in the handbook for the CMM MS Program.
2. Students should follow the policy described above to complete each thesis or report unit. This will facilitate interaction between the student and his/her committee members early during the thesis or report process.
3. Early during the semester in which the defense will take place, a meeting of the Thesis or report Committee should be of the held to ensure that the student and committee agree on the student's timeline and progress toward completion.
4. At least **seven weeks** before the thesis or report defense, a complete draft of the thesis or report should be distributed to the committee.
5. **Five weeks** before the defense date, the Thesis or Report Committee will return the edited thesis or report draft along with a recommendation on whether a revised draft will be "defendable".
6. **Two weeks** before the defense date, the polished, fully-formatted thesis or report should be sent to the committee. Note, however, that additional revisions are likely following the defense.
7. All degree requirements including coursework and submission for open-access archiving of the final approved thesis or report (with all requested revisions and fully formatted) must be completed by the date set by the Graduate College for a given semester/term to ensure degree completion within that term. Therefore, the thesis or report defense must occur before this deadline (typically 1-2 weeks) to allow time for final revisions.

THESIS AND REPORT DEFENSES

How to prepare and what to expect for the thesis or report defense:

- The student should prepare a short presentation with slides that gives an overview of the thesis or report topic; this should be designed to take approximately 15-20 minutes. Figures from the thesis or report and additional background figures may be appropriate.
- At the beginning of the meeting, the student may be asked to leave the room briefly so the committee can discuss the process.
- During the presentation and afterward, the committee will ask questions about the thesis or report as well as relevant material from the student's coursework; this could last up to 60 minutes.
- The committee will ask the student to step out of the room while they discuss and vote.
- The committee will inform the student of its decision.
- Even following a "pass" vote, the committee may ask for additional revisions to the thesis or report. In this case, the changes must be approved by the Thesis or Report Advisor or the entire committee, depending the decision of the committee.

If you have any questions, contact your Thesis or Report Advisor well in advance of these deadlines! **Once your thesis or report has received final approval from the committee, please send a PDF copy to the Program Director and Program Coordinator.**

HELPFUL TIPS

Getting Started: A great place to start is by researching the literature on topics you find interesting, perhaps something that piqued your interest in a class. The University of Arizona offers a Institutional Knowledge Map of specialists on campus, who may be helpful resources for you. There is a way to develop a good thesis or report around most topics - you just need to do some digging.

UA students have access to most of the scientific literature. PubMed is a good source to find articles. Google works rather well, too. Begin with some searches using keywords of interest - such as "kinase diabetes". This will probably yield too many hits for most searches. In PubMed, you can enter your search term(s) and add "and review" ("kinase diabetes and review") and it will limit the search to review articles. Review articles are a good place to start, as they will summarize the latest findings in the field and point you to primary research articles.

Next, develop an outline on the selected topic. The outline starts with bullet points of the main sections of your thesis or report. Not just "intro" and "discussion", but a list of the subsections of the intro, for example. What are the major topics you plan to cover in the intro? You can add details to the outline as you do more reading and thinking. Concurrently, through your reading of the literature, identify gaps in our knowledge of the process under study and think about new models and hypotheses that explain a process/disease based on what you read. Consult with members of your committee to guide you in this phase of thesis or report development.

Writing Tips: It takes considerable time and effort to communicate well in writing. This is an essential career skill and part of the purpose of the thesis or report is help students become skillful written communicators. We refers students to Gopen and Swan, 1990, for some starting pointers on scientific writing. A few guiding principles from this source are:

- Provide context for your reader before asking that reader to consider anything new. That means, place appropriate "old information" (material already stated somewhere earlier in document) in the first sentence of any paragraph and then build on that information.
- Follow a grammatical subject as soon as possible with its verb.
- Place at the end of the paragraph, in the stress position, the "new information" you want the reader to remember.
- Keep your language as simple as you can and be accurate - it makes for easier reading. Always think of the reader. What is the main point of a sentence or paragraph or section? Each one should have a single point. Have you conveyed that clearly? Do not write to impress but to inform or persuade.
- Avoid jargon. All fields have their own set of important words but make sure that these are clearly defined and/or explained early in the document. Always define abbreviations. Remember that your reader is unlikely to be an expert in the field that you are writing about.
- Most writing takes several substantive revisions. A good editor to help you find the problems is invaluable.

The University Writing Center provides free drop-in tutoring to get constructive feedback on your writing. They also have professional staff who can provide private fee-based tutoring. While these services cannot address the scientific merit of your writing, they can help with general aspects of professional writing. In addition, the Graduate College links to many resources for writing and publishing. PRISMA is a good resource with suggested standards and guidelines for preparing systematic reviews. Of course, you will also get practice and training in some of your graduate courses, especially CMM 603 (The Art of Scientific Communication).

Bibliographic Tools: It is strongly recommended that you use specialized software – referencing programs - to help you organize you organize your bibliographic information. There are several referencing programs on the market; some popular programs are EndNote Reference Manager, and Mendeley. The University of Arizona BookStores currently offers student pricing on EndNote. The University of Arizona Library system has links to some free resources for referencing and they can help you determine which product may be best for your needs. These programs work with your word processor to make is easy to insert and organize citations. Use of these programs will save a tremendous amount of time and headaches in the long run!

Figures: Figures should be included in your thesis or report. You are welcome and encouraged to create your own figures. However, you can also include published figures in your dissertation, but only with permission. Most journals have a web portal through which you can request permissions. Here is an example from the Nature family of journals: permission portal. Obtaining permissions as-you-go will save you time in the end. Keep copies of your permissions and include them at the end of the thesis or report as an appendix.

Examples theses and reports: It can be helpful to look at examples of theses from former students in the program. Contact the MS Program Director to get copies of CMM MS theses.

Comparison Table: Master's Thesis and Master's Report (differences in bold)

Criteria	Master's Thesis	Master's Report
Project Types	Laboratory-based, Non-laboratory-based, Hybrid	Laboratory-based, Non-laboratory-based, Hybrid
Advisory Committee	Mutual agreement between the student and advisory committee; **at least two members of the Graduate Faculty required.**	Mutual agreement between the student and advisory committee; **at least one member with a faculty appointment in CMM.**
Format Guidelines	**Peer-reviewed journal format**; suggested 10,000–20,000 words	**Agreed upon by the student and advisory committee**; suggested 10,000–20,000 words
Project Scope	Involves **original data collection and/or analysis, hypothesis testing, and is aimed at contributing to an academic field; can be a precursor to Ph.D. research**.	Involves **evaluation or application of existing theories to open questions, clinical trial development/outcomes, public service, public-health outreach, policy frameworks, or literature; output is aligned with professional applications and may not necessarily contribute to academic theory.**
Mandatory Trainings	RCR Training for lab-based; HIPAA Training for patient-related activities	RCR Training for lab-based; HIPAA Training for patient-related activities
Graduate Units	Minimum of five graduate units (**CMM 910**)	Minimum of five graduate units (**CMM 909**)
Unit Milestones	1. Identify committee & topic; 2. Draft introduction; 3. Draft methods/results; 4. Full draft; Defense **& archiving**	1. Identify committee & topic; 2. Draft introduction; 3. Draft methods/results; 4. Full draft; Defense
Additional Policies	Max three units per term; Exceptions subject to approval	Max three units per term; Exceptions subject to approval