



PEMM

Program in Experimental and Molecular Medicine

Program Guidelines

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PROGRAM IN EXPERIMENTAL AND MOLECULAR MEDICINE

I. ADMINISTRATION OF THE PROGRAM

The Director of PEMM is appointed by the Dean of the Geisel School of Medicine and will serve with a 3-year appointment, which is renewable. The PEMM Director is Chair of the Program Executive Committee (PEC) that has the responsibility to oversee the graduate program. The Program Executive Committee is comprised of the Director (or Co-Directors) of each theme-specific Theme Committee (TEC), plus two graduate student representatives serving 2-year terms (ideally, with one new member appointed each year).

The responsibility of the Program Executive Committee is to oversee all facets of the Program, including the selection and admission of applicants, monitoring the progress of each new student until s/he selects a specific theme and a Thesis Advisor, and reviewing the academic performance of all students in the PEMM program. The Program Executive Committee will also review the activities of the individual themes to ensure adherence to the Program guidelines, to discuss any proposed modifications, and to review the ongoing growth and evolution of the program. Finally, the individual Theme Committees will nominate and approve faculty for appointment to PEMM.

Each theme will appoint its own Theme Committee and Theme Director (or two equal Co-Directors; term limit of 3 years, renewable). The responsibility of each Theme Committee is to provide oversight of the curriculum requirements of the theme, including courses, journal clubs and research-in-progress seminars, approve the composition of a student's Thesis Committee, and oversee the Qualifying Exam. The Theme Director(s) of each Theme Committee will serve as a member(s) of the Program Executive Committee. The Theme Director(s) should maintain communication with all members of the theme and act as the first point of contact for all questions, suggestions and concerns raised by students or faculty.

II. QUALIFICATIONS AND REQUIREMENTS FOR ADMISSION

The basic requirement for admission is a Bachelor's degree demonstrating adequate preparation in chemistry, biology, biochemistry, physics and mathematics. A demonstrated proficiency with the English language is also required. A Graduate Record Examination score is required; however, a Medical College Admissions Test score is an acceptable substitution. In addition, the applicant must arrange for the submission of at least three letters of recommendation directly from referees, an essay describing their career goals and interests in obtaining graduate-level training, all official academic transcripts, and a completed Dartmouth College application form for graduate study. It is the long-standing policy of the College to actively support equality of opportunity for all persons regardless of race or ethnic background, and no student will be denied admission, or be otherwise discriminated against, because of race, color, sex, religion, age, or national or ethnic origin.

A Dartmouth graduate student in another PhD program may apply for transfer into PEMM. Such a potential transfer student must identify a PEMM faculty member as their prospective sponsor; this PEMM faculty member must be able to commit financial support for the student (to enable conduct of their thesis research) and obtain a letter of confirmation from her/his primary department Chairperson assuring the availability of financial support for the transfer student. The requesting student must submit all original Dartmouth application materials (listed above) to the PEMM Administrator, as well as letters of support from the prospective PEMM faculty sponsor and her/his department Chairperson. The Program Executive Committee will consider these application materials in a timely manner and

determine whether the transfer student's qualifications warrant acceptance into PEMM. Following these deliberations, and prior to acceptance of a transfer student into PEMM, the transfer student must also receive formal approval from the former/sending PhD program.

III. REQUIREMENTS FOR A PhD DEGREE

REQUIRED:

- Two terms of core courses (PEMM 101 or BIOC 101, PEMM 102 or BIOL 103)
- Three research rotations in first year (PEMM 141, 142, 143)
- Biostatistics course (PEMM 103)
- Ethical and Responsible Conduct of Research (UNSG 100 for fall term and PEMM 124 for winter term)
- A minimum of four elective courses
- Qualifying Exam- preparation of a written grant proposal and oral defense (PEMM 137)
- Attendance at and participation in Journal Club meetings, Research in Progress (RIP) sessions, and seminars.
 - Students will be expected to present at a Journal Club at least once per year, and present their research annually starting in Year 2 in either a RIP or seminar format.
 - Students are required to attend a PEMM theme-specific Journal Club during their first 2 years in the program. After a student advances to PhD Candidacy (via completion of the Qualifying Exam), he/she has the option of enrolling in a Journal Club outside of PEMM. If a student enrolls in a Journal Club outside of PEMM, the student must obtain documentation from the faculty member who directs that Journal Club to confirm the student's regular attendance throughout the term, and their participation and presentation of a research article.
- Preparation and submission of a written dissertation or thesis followed by its oral presentation and defense

The following courses represent the typical electives for a student in each area of concentration. A typical elective course involves approximately 30 hours of contact time; some courses may involve more hours and count as a 2-credit elective.

Biomedical Physiology & Immunotherapy

PEMM 271 - Advanced Biomedical Sciences (2 course equivalent)

Two additional elective courses

OR

MICR 144- Cellular and Molecular Basis of Immunity

Three additional elective courses

Cancer Biology & Molecular Therapeutics

PEMM 126 - Cancer Biology

Three additional elective courses

Neuroscience

MDED 115 – Geisel Medical School Year 1 Neuroscience course with supplemental experimental neuroscience section (2 course equivalent)

Two additional elective courses

A full-time student must register for 3 course equivalents each term. During the first year of graduate school, this will include a research rotation, and one or two courses. If necessary, the appropriate

thesis research number will be used to maintain the required 3 credits each term. PEMM 297 equals 1 course credit, 298 equals 2 course credits, and 299 equals 3 course credits.

ELECTIVES: An outline of the plan for electives must be developed with the student's Thesis Committee, once established. Electives may be selected from courses offered by the Program, and also by other graduate programs at Dartmouth College. The criteria for approving a course for graduation resides with the student's Thesis Committee.

EXCEPTIONS: Advanced students joining the PEMM program will receive appropriate credit for comparable courses successfully completed in a former graduate program, subject to the approval of the Theme Committee and the Guarini School of Graduate and Advanced Studies Registrar.

THEMES

Each Theme Committee may propose additions or variations to the required graduate program. Additional requirements proposed by specific themes will be reviewed and approved by the Program Executive Committee. Any decrease in requirements would require approval by the Dartmouth College's Council for Graduate Studies. In addition, a student's Thesis Committee may propose additional requirements to enhance a student's training in a particular area.

IV. RESEARCH ROTATIONS

Concept

A brief introduction to specific aspects of research provides the student with a general appreciation of various research areas and approaches. The purpose of the research rotations is to allow the student to obtain basic training in a variety of laboratory techniques and methods, and to identify a faculty member as a potential Thesis Advisor.

Expectation

The rotations will be assigned by the Program Executive Committee, taking into consideration the preferences of the students and availability of working space and resources of the faculty laboratories. The first rotation will be assigned by the Program Executive Committee based on a list of 3 faculty members submitted by the student no later than one month prior to starting the program. The second and third rotation assignments will be determined once the student has had an opportunity to meet with individual faculty to discuss areas of mutual research interest. A list of preferences for both the second and third rotations must be submitted to the Program Administrator no later than one month prior to the end of the first rotation. Preferences for the third rotation may be changed up to one month prior to the start of the third rotation. The Program will make every effort to match assignments with preferences. A delay in selecting a potential third rotation advisor may limit the choices available as a desired advisor may already have committed to a different rotation student.

Students may also rotate through laboratories in other Dartmouth graduate programs outside of PEMM. It is expected that the 3 rotations will be completed by May 31 of the first year. Written justification must be submitted to the Program Executive Committee for permission to extend any one research rotation beyond one quarter/term.

At the end of a rotation, a written report must be submitted to the rotation advisor for discussion and evaluation, and to help in the determination of a grade for the rotation. A copy of the report must be

submitted concurrently to the PEMM Administrator. These reports should generally be between 5 and 10 pages (including figures and/or tables), and written in the form of a scientific publication (see Appendix I for suggested format). A rough draft of this report must be submitted to the rotation advisor before the start of the next rotation; a student will not be permitted to start the next rotation until the first draft has been submitted. The rotation advisor may return the report to the student within 2 weeks with suggested revisions. The final report must be submitted to the rotation advisor as soon as possible but no later than 4 weeks after completion of a rotation. The rotation advisor will submit a copy of the report and a grade High Pass (HP), Pass (P), Low Pass (LP), No Credit (NC) to the PEMM Administrator. Reports submitted after the required time frame will not be eligible for a grade of HP. A student must obtain a passing grade in 3 rotations; a 4th rotation may be taken to achieve this end if necessary, if approved by the Program Executive Committee. It is expected that a Thesis Advisor will be identified from 1 of the 3 rotations; only under exceptional circumstances will a 4th rotation be permitted. If a student has not identified a Thesis Advisor/host lab after 4 lab rotations, the student can be separated from PEMM at the discretion of the Program Executive Committee.

Exemptions

A student with extensive experience in a specific area of research relevant to the graduate training program may petition the Program Executive Committee for an exemption of 1 research rotation.

Identification of Thesis Advisor and Theme

The Thesis Advisor should be identified no later than May 20th of Year 1, and the student should begin his/her thesis research no later than June 1st of Year 1. Students are encouraged to discuss opportunities for joining a thesis lab with their rotation advisors. Joining a lab for conduct of thesis research is a commitment from both the student and the advisor, and both parties must agree to a student joining a lab. Once the student and Thesis Advisor have identified a potential area for the thesis research, and the student has passed his/her Qualifying Exam (see Page 7 below), the student's Thesis Committee must be formed (described below). This Committee will also serve as the Thesis Committee at the time of the defense of the thesis.

PEMM provides financial support for the student's stipend during laboratory rotations, typically through May 31st of Year 1. The Thesis Advisor is responsible for support of the stipend thereafter. The PEMM Program Executive Committee will ask the Thesis Advisor for confirmation that she/he has sufficient funds to support the student's stipend and research expenses. In addition, the Chairperson of the Department in which the advisor holds his/her primary appointment will be asked to verify that alternate funds will be available to cover student's stipend and research expenses at times when/if the Thesis Advisor's funds become insufficient.

All Thesis Advisors, in conjunction with their students, should attempt to secure individual support for each student, either through pre-doctoral fellowships or by the inclusion of salary support as graduate research assistants in grant applications. Graduate students will be encouraged to apply for individual fellowship support during their graduate training period.

Students may choose to perform their thesis research with a faculty member in a Dartmouth graduate program other than PEMM. This may require that the student transfer to the graduate program of that faculty member. An exception to this policy can be made if there are specific circumstances whereby the student and faculty member agree that remaining in PEMM is in the best interests of the student's training. These circumstances must be outlined in a letter to the PEMM Program Executive Committee, which must approve the request before the student can begin the thesis research.

V. RESEARCH ADVISORY COMMITTEE (prior to completion of Qualifying Examination)

Prior to completion of the Qualifying Examination, a student will be advised by a Research Advisory Committee consisting of the PEMM Program Executive Committee and the student's current Rotation/Thesis Advisor. The Research Advisory Committee is not required to meet formally. The Research Advisory Committee will be responsible for oversight of a student's academic progress, and advise the student on issues as they arise. Once a student's Thesis Committee has been formed, the Thesis Committee will be the primary faculty who advise the student.

VI. QUALIFYING EXAMINATION FOR THE Ph.D.

Philosophy and Purpose

Effective writing of grant applications is required for a successful career in research. The grant application component of the graduate program is both a training exercise to help develop grant-writing skills, and a qualifying exam. Learning how to compose a defensible hypothesis is an essential component of the training of a graduate student. Students should be able to develop a novel line of research, propose a hypothesis, and develop a series of experiments to test this hypothesis. A student must be able to defend the proposal at an oral examination. The student should also demonstrate knowledge of the larger field of Experimental and Molecular Medicine reflected in the general area of the proposal and material covered in completed coursework. The ability of a student to accomplish this endeavor will represent the Qualifying Exam, which occurs during a student's 2nd year in the graduate program. Passing the Qualifying Exam advances the student to PhD candidacy.

Selection of Subject

The Qualifying Exam topic will be based on the student's proposed thesis project, or another topic of their choosing. The student will develop Specific Aims for the research proposal. The student is encouraged to interact with his/her Thesis Advisor and the Qualifying Exam Committee members in developing and focusing the Specific Aims. However, the student is responsible for the development of the scientific focus of the proposal. The student will submit the proposal Title and Specific Aims to the Thesis Advisor and Qualifying Exam Committee members according to the timeline outlined below.

Qualifying Exam Committee

The Qualifying Exam Committee will be composed of 3 faculty to be selected by the PEMM Theme Committee overseeing the student's area of specialization. The Theme Committee will designate one of the chosen faculty members to serve as "Chair" of the Qualifying Exam Committee. The student's Thesis Advisor will not serve as a member of the Qualifying Exam Committee. The student is responsible for meeting all deadlines, and for setting a time and place for the Oral Exam. The Chair is responsible for the conduct of the Exam, and for the preparation of correspondence (e.g., critique of the written proposal and reporting progress and results to the Theme Director(s) and the PEMM Administrator).

The student's Thesis Advisor is encouraged to attend the Oral Exam as a non-examining, non-voting, and generally non-contributing observer. At the request of the Qualifying Exam Committee, the Advisor may provide information to clarify an area of confusion; in these situations, the Advisor

serves as a resource to the Committee and may not participate by questioning or answering for the student.

Written Research Proposal – Specific Aims Page

The Specific Aims page should contain an introductory section (typically 0.5 page) that places the experimental aims in context and includes references. The Specific Aims page should include a hypothesis and the proposed experimental approaches/measures, model systems, and/or population/data resources to be used in testing that hypothesis. In addition, students are encouraged to consider and include a brief statement of the impact of their results, assuming successful completion of the proposed aims (typically at the bottom of the page). Minor modifications to the Specific Aims may be made as the written proposal is prepared, but major changes should be approved by the Qualifying Exam Committee. In its final form, the Specific Aims will be the first page of the written proposal; this section is limited to one page. The written Qualifying Exam is modeled after the NIH NRSA F31 grant application, which can be found here: <https://grants.nih.gov/grants/how-to-apply-application...e/fellowship-forms-e.pdf>. During the period of topic selection and development of Specific Aims, students are expected to maintain full-time involvement in coursework and laboratory activities.

The Specific Aims will be reviewed by the student's Qualifying Exam Committee, and revision suggestions will be presented to the student. Revised aims are due as per the timeline detailed on Page 7.

The following are the criteria for evaluation and approval of the Specific Aims:

- i. Is studying and writing about the topic of the proposal likely to be a sound educational experience for the student? The Qualifying Exam should enhance knowledge and understanding in fields related to the student's Ph.D. dissertation project.
- ii. Do the Specific Aims address important questions in the field? The aims should be "hypothesis-driven" rather than descriptive.
- iii. Are the proposed methods reasonable and feasible using current technology? If not, has the student proposed new approaches that have a reasonable probability of succeeding?
- iv. Can the proposed experiments be completed within the timeframe of a student's Ph.D. candidacy?
- v. Is the style and level of detail of the Specific Aims appropriate for a grant application (e.g. [NIH NRSA F31](#))?

Timeline

The deadline for submission of the completed written research proposal will be July 1st, although this does not preclude earlier submission. Early submission of the Specific Aims page is encouraged, as this will provide more time for completion of the grant application. Additional guidelines for preparation of a grant application are included below; [this schedule shows the latest acceptable dates](#). Students may begin the Qualifying Exam process at any time after January 1 in their second year, and thereby extend the amount of time available to them to complete each step. However, feedback from the Qualifying Exam Committee at each step in this process will follow the timeline outlined below.

The entire Qualifying Exam must be completed by October 31st of the student's third year of graduate work. Failure to complete the Exam by this date is grounds for not permitting the student to enroll for the following winter term as a Ph.D. student; exceptions need to be approved by the Theme Director(s). During the time when the written proposal is being prepared, students are expected to discuss their research schedule with their Thesis Advisor, since it is understood that writing the Qualifying Exam will take a considerable amount of time and effort.

No later than May 1st of the student's second year in the Program, the topic and Specific Aims must be approved by the Qualifying Exam Committee members chosen by the Theme Committee Director(s).

Summary of Timeline of Latest Acceptable Dates (starting in Year 2 of a student's graduate study)

January	Orientation of students to grant-writing exercise by theme Director(s)
February 1	Preliminary development of proposal hypothesis and Specific Aims
March 1	Student submits topic and hypothesis to the Theme Director(s)
March	Theme Director(s) selects Qualifying Exam Committee members
April 1	Student submits Specific Aims to Qualifying Exam Committee Chair
April 15	Exam Committee Chair returns feedback to student
May 1	<i>If necessary, revised Specific Aims are submitted to the Qualifying Exam Committee Chair; this will push back the subsequent timeline by 4 weeks</i>
June 15	Student submits completed written proposal to Qualifying Exam Committee Chair
July 1	Qualifying Exam Committee Chair returns feedback to student
July 15	<i>If necessary, revised written proposal is submitted to the Qualifying Exam Committee Chair; this will push back the subsequent timeline by 1 month</i>
August 1-October 31	Oral Qualifying Exam

*Students are encouraged to complete these steps earlier, and the timeline shifts accordingly

The Written Research Proposal – Research Strategy

The written portion of the Qualifying Exam is a research proposal written by the student (see Appendix II for suggestions). The Research Strategy section follows the Specific Aims page. Once the student's topic and Specific Aims page have been approved by the Qualifying Exam Committee, the student completes the written proposal. The proposal should be written entirely by the student. Scientific evaluation of the written proposal is the responsibility of the Qualifying Exam Committee. However, the written proposal should be reviewed by the Thesis Advisor before submission to the Qualifying Exam Committee. The Thesis Advisor should ensure that the proposal conforms to the length and format requirements for NIH grants. Of course, in writing the proposal, the student may not copy from grant applications from the Thesis Advisor or elsewhere; plagiarism is grounds for dismissal from the program.

Written Qualifying Exam Format and Organization

General Format:

- i. The entire research proposal (Specific Aims and Research Strategy) is limited to seven pages, which includes the Specific Aims page, but excludes references cited. No materials may be included in any appendix, and proposals exceeding the page limit will be returned to the student without review.
- ii. Typeface size –NIH rules (11pt min) Arial or Helvetica
- iii. The proposal should be single-spaced.
- iv. Margins must be at least 0.5” on all sides.
- v. All pages should be numbered.

- vi. A list of cited references should be included in a Bibliography after the Research Strategy section. There is no length limit for the reference list. Citations in the reference list should be complete, and contain all authors' names, full title, year of publication, journal, journal volume, and page numbers. The format of the reference list in NIH format should serve as a model. Students are urged to cite original references rather than review articles and should expect that their knowledge of cited reports will be a component of their oral examination.
- vii. Citations in the text of the proposal can either be numbered (e.g., as in the *Nature* style) or use the author/year format (e.g., as in the *Cell* style).
- viii. Inclusion of relevant figures and tables is encouraged. Figures and tables should be embedded in the text.
- ix. The Chair of the Qualifying Exam Committee should examine the proposal for compliance with format requirements as soon as possible after receiving it. Proposals that do not adhere to all format specifications will be returned to the student without evaluation; in such situations, the Chair should provide written guidelines to the student describing why the proposal is being returned. The Chair should also inform the student about the amount of time available for bringing the proposal into compliance with the format requirements. It is anticipated that most modifications needed to bring the proposal into compliance can be completed in less than 1 week. This does not constitute the one permitted revision of the written proposal.

Organization:

The research description should contain the following subsections:

- x. **Specific Aims.** Introduce the topic and provide a very brief background sufficient to place the actual Specific Aims in context. The hypothesis should be clear, the Specific Aims should be listed, and the proposed experimental approaches should be briefly described. In addition, students are encouraged to include a Statement of Impact. The maximum length of this section is 1 page.
- xi. **Significance.** Explain the importance of the problem or question the proposal seeks to address. Describe the scientific premise for the project, including any preliminary data supporting the proposed hypotheses and/or approaches. Explain how completing the proposed project will improve scientific knowledge and impact the field of study. The recommended length of this section is between 0.5 to 1 pages.
- xii. **Innovation.** Describe any novel approaches, methodologies, or theoretical frameworks to be developed or used, and their advantages over existing resources. Explain how the proposal challenges current research paradigms. The recommended length of this section is approximately 0.5 pages.
- xiii. **Approach.** Describe the proposed experiments, specifically the rationale, the methods to be used, and the likely outcomes and interpretations of the experiments. Proposals may contain a "Preliminary Results" section in the Approach since the topic may be based on dissertation research. The experimental plan should be divided into sections that correspond to the Specific Aims. Pre-doctoral fellowship applications propose a body of work that can be completed by a single person in a 3-year period. The recommended length of the Approach section is 4 to 4.5 pages. Provide experimental detail sufficient for reviewers (i.e., the Qualifying Exam Committee members) to understand the experimental approaches planned and possible limitations or concerns with using the planned approaches. Do not provide excessive details of standard techniques and approaches; more detail can be provided for

novel approaches. Students should consult the Chair if they have questions about how much experimental detail to include.

- xiv. **Timeline.** A timeline outlining what work will be done in each year of the grant should be included. The recommended length for this section is <0.25 pages.

Evaluation of the Written Proposal and Oral Examination.

Specific criteria that will be evaluated in the written proposal include:

- a. Adherence to length and format rules. Non-compliant proposals will be returned without review.
- b. Is there sufficient detail to understand and evaluate the proposed experiments?
- c. Is the rationale for each experiment clearly described?
- d. Is sufficient – and not excessive – detail on methodology provided?
- e. Are potential outcomes and interpretations of possible outcomes described?
- f. Have alternative approaches been considered if the method of choice does not work?
- g. Is the grant written in a style appropriate for a research grant?
- h. Is the timetable for the work provided by the student realistic?

The written proposal must be submitted by the established deadline and will be reviewed within 2 weeks by the Qualifying Exam Committee. As outcomes of this review, the Qualifying Exam Committee may recommend an **Oral Examination**, **Deferment**, or **Rejection**. The student will be provided with a written critique highlighting the most important questions and concerns of the Committee regarding the written proposal. It is expected that an Oral Examination (if recommended) will occur within 1 month of this recommendation being communicated to the student.

Deferment: If the Qualifying Exam Committee recommends Deferment, a written critique of the proposal will be synthesized by the Chair based on the concerns and suggestions from all Committee members. The critique should provide feedback to the student on specific areas where the proposal needs improvement. The student is advised to discuss the critique and proposal with the Chair to formulate strategies to address the concerns raised in the written critique. The student is required to revise the written proposal based on the critique, and to submit a revised proposal to the Chair within 1 month. Only 1 instance of Deferment (and 1 re-write of the proposal) is permitted; revised written proposals will be recommended by the Committee for either Oral Examination or Rejection.

Rejection: If the Qualifying Exam Committee recommends Rejection, a written critique of the proposal will be synthesized by the Chair based on the concerns and suggestions from all Committee members. The critique should provide feedback to the student on specific areas where the proposal needs improvement and the reasons for rejection. Only 1 instance of Rejection is permitted; in this case, the student must choose a new topic and immediately repeat the process of developing a new written proposal based on the timeline described herein (with dates adjusted accordingly); if the Qualifying Exam Committee selected for the second written proposal recommends Rejection, the grade for the Oral Examination will be No Credit, the student will be separated from the PhD program, and if it is determined to be appropriate upon review by the Theme Committee and the PEMM Director the student may opt to leave the program with a Master's degree if the requirements have been completed (see sections VIII and IX).

Oral Exam: If recommended for an Oral Exam, the student will present a brief overview of the proposal, including a discussion of the comments in the critique. The student should also be prepared to address any related scientific or technical aspects that the Qualifying Exam Committee may raise. A major goal of the defense is to determine the student's knowledge and ability to "think on his/her feet." The Qualifying Exam Committee will confer in advance of the Oral Exam to define the most pertinent questions that warrant appropriate answers. Based on the student's oral response to these questions during the Oral Exam, and the overall quality of the written application, the Qualifying Exam Committee may recommend outcomes of Pass or No Credit; in the case of Pass, the committee will assign a grade of High Pass (HP), Pass (P), or Low Pass (LP).

A Qualifying Exam Committee decision based on the Oral Exam may be deferred if the Qualifying Exam Committee concludes that the proposal has merit but requires re-writing and/or re-defense. The major reason for such a decision will be that the student would benefit from additional practice at formulating ideas and presenting them in a clear and succinct proposal. The written proposal must then be resubmitted to the Qualifying Exam Committee Chair within 1 month. The Qualifying Exam Committee may recommend outcomes of Pass or No Credit (NC); in the case of Pass, the Qualifying Exam Committee will assign a grade of Pass or Low Pass.

If a student's Qualifying Exam is graded No Credit (NC), either in its written form or after the Oral Exam, the student will be separated from the PhD program; if it is determined to be appropriate upon review by the Theme Committee and the PEMM Director, the student may opt to leave the program with a Master's degree if the requirements have been completed (see sections VIII and IX).

Repeating the Oral Exam: In the event that the student does not pass in their first attempt at the Oral Exam, the student will have 1 opportunity to repeat the Oral Exam. The second administration of the Oral Exam should occur within 1 month after the first Oral Exam. If a second failure occurs, the student will not be advanced to candidacy for the PhD degree, and normally will be unable to remain in the PhD program; in such a case, if it is determined to be appropriate upon review by the Theme Committee and the PEMM Director, the student may opt to leave the program with a Master's degree if the requirements have been completed (see sections VIII and IX).

Guidelines to assist students in preparing for the Oral Exam:

- i. The student should be familiar with the theoretical and factual background relevant to their proposal at a level expected for a second-year PEMM student. All members of the Qualifying Exam Committee are free to ask questions broadly related to the proposal, and to areas that constitute the background for the proposal. The student should be able to place the topic of their proposal in the context of the broad field of integrative biomedical sciences. If the student has been informed by the Qualifying Exam Committee that a revised written proposal still has substantial deficiencies, the student should be prepared to address these during the Oral Exam.
- ii. The student should be conversant with the literature in the field(s) covered by their proposal, including those papers that deal with matters of general significance as well as those that relate directly to the proposed research at a level expected for a 2nd year graduate student. The Qualifying Exam Committee will expect the student to have an appreciation of the

development of ideas (i.e., historical perspective) in this field, and the potential role of current ideas in guiding the field in the future.

- iii. The student should be able to consider and generate alternative approaches, and should be prepared to interpret hypothetical outcomes proposed by the Qualifying Exam Committee members.
- iv. The student should be thoroughly familiar with the technical aspects of their proposal. They should have a solid understanding of the techniques they propose to use. They should be aware of the advantages and limitations of these techniques. They should be prepared to defend why they have chosen a particular technique or approach rather than alternative ones that might be available.
- v. The Committee may also test the following aspects of the student's background and ability:
 - Is the student able to critically evaluate original scientific articles?
 - Has the student designed experiments that address the Specific Aims and which have the potential to add new and useful information to the field of investigation?
- vi. Expectations for Dissertation Research Work during Qualifying Exam:
Prior to submission of the proposed topic and Specific Aims, students are expected to maintain presence in the lab and coursework. It is not acceptable, for example, for students to disappear from the lab for weeks or months for the purpose of generating the Specific Aims for the Qualifying Exam. Students are encouraged to begin the discussions and background reading needed to select a topic early in their second year of study. Once the topic and Specific Aims are approved, students have 8 weeks to prepare and submit the full written proposal. Prior to writing their proposal, students are expected to discuss their research schedule with their Thesis Advisor, since it is understood that writing the full proposal will take a considerable amount of time and effort.
- vii. Students are not permitted to supply food or drinks for faculty during the Oral Exam.

Students should anticipate that several weeks are required to do the background reading needed to select a topic and formulate Specific Aims. It is strongly recommended that students begin this process early, perhaps during the summer between the first and second years of graduate study. The entire process may be completed sooner than the designated dates, and this is encouraged. Departures from the time line for the Qualifying Exam specified herein require the prior approval of the theme Director(s).

VII. THESIS/DISSERTATION RESEARCH

The goal of the PEMM PhD program is to prepare students for successful research careers, whether in an academic, government or industrial environment. This is achieved primarily through the pursuit of an independent research project in the laboratory of a faculty advisor. To ensure that students graduating from the program are of high quality, and consistent with the philosophy that students should make a meaningful contribution to their field, it is expected that, by the time of the Dissertation Defense, the student will have published first-authored, experimentally-based, primary research manuscripts in peer-reviewed journals. Often, the best thesis represents the work contained in two or

more papers (perhaps several published and others submitted), and in such a case, the student will be able to use these as the body of the thesis, which will then be framed by an introduction and final discussion. It is worth emphasizing that a strong publication record is essential to the student in achieving her/his long-term career goals.

Thesis Committee

The student's Thesis Committee is formed upon advancement of the student to PhD candidacy through successful completion of the Qualifying Exam (described above). The Thesis Committee members are selected by the student and the Thesis Advisor, and must include a minimum of four members: the Thesis Advisor; 2 members must be PEMM faculty (one of whom may be the Thesis Advisor); one member must be from another Institution (the latter member is often appointed after the student has been in the program for a couple of years). The Theme Committee must approve the membership of the student's Thesis Committee, and the Theme Director(s) will be an *ex officio* member of all advisory committees. The intent is to assemble a group of consultants with whom the student should meet on a regular basis to discuss aspects of her/his research project and curriculum. The responsibility of the Thesis Committee members should also include attendance at, and evaluation of the student through oral presentations such as journal clubs and research-in-progress seminars, and providing constructive input to further the student's training.

It is the responsibility of the student to inform their Thesis Committee members about the dates of their research-in-progress seminars, to schedule meetings with the Committee at least once annually, and to compose a written report summarizing annual progress and outcomes of the annual meeting (template available on PEMM website). Students are not permitted to supply food or drinks for faculty during Thesis Committee Meetings. This written report should reflect the progress and the problems encountered with the thesis project, the recommendations made by the Thesis Committee, and completed coursework. The written report must be completed by the student and submitted to the PEMM Administrator within 1 week following the Thesis Committee Meeting. The PEMM Administrator will then circulate the report to the Thesis Committee via email for their approval. In the event that the written report is not submitted to the PEMM Administrator within 1 week following the meeting, the student may be placed in Unsatisfactory Standing, and the Guarini School of Graduate and Advanced Studies will be notified. If no report is filed within the academic year it is due, the student may be separated from the PEMM program.

Thesis Defense

The Thesis Committee will evaluate the written thesis and the oral dissertation defense. The Thesis Committee must certify that the student is ready to submit his/her thesis. The thesis will be submitted to the Committee, and a date for the defense seminar will be established. There must be at least 14 days between submission of the written thesis and the defense seminar to permit adequate time for Committee members to review the written thesis. If the Committee determines that the thesis is not ready for oral defense, they may cancel the defense no later than 7 days in advance of the proposed date. The seminar will be open to the public and will be widely announced. The seminar will be followed by a private oral defense of the thesis conducted by the Thesis Committee; students are not permitted to supply food or drinks for faculty during the private oral defense. Corrections to the written thesis must be made within 1 month; a longer time frame must be approved by the Thesis Committee. Recommendations for awarding the PhD degree will be made by the Director of PEMM upon the advice of the Thesis Committee.

VIII. GRADING STANDARDS FOR STUDENTS PURSUING A PhD DEGREE IN THE PROGRAM IN EXPERIMENTAL AND MOLECULAR MEDICINE

The following standards of performance are those expected to be achieved by every student while fulfilling the course requirements for the degree of PhD. Failure to meet these standards may result in separation from the PEMM program. Review of the academic performance of all students will reside with the Program Executive Committee who will be advised by the appropriate Theme Committee.

1. Graduate students shall be graded according to the following scale: High Pass, Pass, Low Pass, No Credit. An “incomplete” grade may be filed under special circumstances, but the requirement must be fulfilled within 1 year.
2. A minimum grade of Pass is expected in all courses and the Qualifying Examination. The Program Executive Committee will review the record of any student who receives a Low Pass or No Credit.
3. A review of performance by the Program Executive Committee will result in one of the following recommendations:
 - (a) No action is necessary
 - (b) The receipt of a Low Pass or No Credit grade constitutes a deficiency that must be rectified either by repetition of the course, special examination, or other arrangement.
 - (c) The student must discontinue pursuit of a PhD degree in the PEMM program.
4. The Program Executive Committee will use the following guidelines for arriving at a recommendation (the term “course” also includes the grade obtained in the Qualifying Exam).
 - (a) If a student receives a grade of Low Pass in a course, the Committee may recommend options 3(a), 3(b) or 3(c).
 - (b) If a student receives a grade of No Credit in any course, or Low Pass in any two courses, options 3(b) or 3(c) must be followed
 - (c) If a student receives a grade of No Credit in any two courses the Committee must recommend option 3(c).
 - (d) If a student receives more than two deficient grades (either Low Pass or No Credit) the Committee must recommend option 3(c).
 - (e) If a student fails to sufficiently improve his/her performance (as judged by the Committee) within 1 academic year after a performance review recommendation, the Committee must recommend option 3(c).
 - (f) If a student receives a grade of No Credit for their Qualifying Examination, the Committee must recommend option 3(c).

IX. TERMINAL MASTER’S DEGREE REQUIREMENTS

The following Master's degree requirements apply to students who matriculated into PEMM after September 30, 2017.

Students who joined PEMM prior to September 30, 2017 will follow the June 2017 version of the PEMM guidelines.

PEMM does not have a formal Master's degree program. However, once enrolled, a student's career goals, expectations, and/or level of performance can change and a student's best interest may be to leave PEMM. Following consultation with the Thesis Advisor and approval of the Program Executive Committee, a student who can no longer continue in the PEMM PhD Program may be considered for pursuit of a Terminal Master's degree. Once approved by the Program Executive Committee, the requirements for the Terminal Master's degree are as outlined below. The judgment of whether or not the student has enough experimental data to write an acceptable Terminal Master's thesis is made by: A) the Program Executive Committee in consultation with the Thesis Advisor if the student has not yet passed his/her Qualifying Examination or has not yet assembled a Thesis Committee; or B) the Thesis Committee if the student has passed his/her Qualifying Examination and assembled a Thesis Committee.

- a. Courses requirements: PEMM 101 or BIOC 101, PEMM 102 or BIOL 103, Biostatistics (PEMM 103), Ethical and Responsible Conduct of Research (UNSG 100 for fall term or PEMM 124 for winter term), and a minimum of two elective courses.
- b. Research-in-Progress (RIP) presentations (see section III): Students in their second year and beyond are required to present a RIP seminar each year (defined as the period from July 1 to June 30) in which the student is enrolled for research credit in two or more terms. In the year in which the student expects to complete his/her thesis and receive the Master's degree, the student must still present a RIP seminar unless the student will present their research findings in a separate seminar format, for which a confirmed date must be sent to the PEMM Administrator before August 15.
- c. Written Thesis: The Master's thesis is to be read and examined by a Committee of three faculty: two Committee members must be members of PEMM, and one may be the Thesis Advisor; a member outside of Dartmouth is optional. The draft written thesis should be given to the Committee at least three weeks prior to the [Guarini School of Graduate and Advanced Studies submission deadline for graduation](#) (noted as "Due date for thesis/dissertation submission to Guarini School Dean's Office" for each quarter term at <https://graduate.dartmouth.edu/academics/academic-calendar>), and the Committee is to return written feedback within two weeks of receipt along with a recommendation that the thesis be accepted, conditionally accepted pending revisions, or rejected. Note: A student receiving a Terminal Master's degree does not participate in the graduation ceremony or proceedings.

The thesis must present a coherent investigation of an original scientific question through work that was performed by the student at Dartmouth while in PEMM under the direct approval and sponsorship of a Dartmouth faculty member.. The Master's thesis will have the standard section components (introduction, materials and methods, results, discussion, literature cited, figures, figure legends, tables, etc.), and must conform to the standards of scholarship generally required for publication in a peer-reviewed academic journal.

- d. Oral Presentation (i.e., Thesis Seminar): In cases in which the student recently (e.g., within the past 6 months) presented their research findings to the PEMM membership, such as at a RIP

session, an Oral Presentation may not be warranted. The requirement for an Oral Presentation will be left to the discretion of the Thesis Committee or, if not yet formed, the Program Executive Committee.

X. MD-PhD DEGREE REQUIREMENTS

Students pursuing an MD-PhD degree begin the combined program by completing the first 2 years of Geisel Medical School (i.e., as a medical student). Students will also have completed 2 summer research rotations; the first rotation takes place in the summer between Medical School Years 1 and 2; the second rotation occurs in the summer following the second year of Medical School. A Thesis Advisor may be chosen after the second rotation. Students that have not successfully identified a Thesis Advisor from either of the first two rotations may opt to take a third research rotation immediately following the second research rotation (i.e., in the fall of their third year at Geisel). Once an MD-PhD student chooses his/her Thesis Advisor, the student formally becomes a member of the PEMM program and begins working full time on his/her PhD.

MD-PhD students are exempt from courses PEMM 101, 102, and 103. Some MD coursework may be considered equivalent to some PEMM coursework, so MD-PhD students may be exempt from some PEMM elective courses. MD-PhD students often take two PEMM courses beyond their MD coursework, and are responsible for completing all other PEMM requirements, which include: (1) a Qualifying Exam, (2) attendance at PEMM program functions, (3) an approved ethics course, (4) a written thesis, and (5) presentation of a thesis seminar and private defense. Program functions include Journal Club participation, Research-in-Progress seminars (RIPs), and program seminars.

XI. VACATION AND LEAVE POLICY

The normal appointment to a position in the PEMM program is full-time with no more than 20 days of annual vacation. This time allowance includes the official holidays granted to Dartmouth College employees. Arrangements for leave must be made in consultation with the student's Thesis Advisor, and should not compromise fulfillment of any obligations regarding coursework or research activities required of the student. It is usually inappropriate to take vacation during the first year in the program because of the need for timely completion of research rotations and selection of a Thesis Advisor. As stipend support becomes the responsibility of the Thesis Advisor upon A) the end of the rotation period and B) mutual agreement to join the Advisor's laboratory for one's thesis research, a vacation that occurs between a rotation and the time of starting thesis work in the Advisor's laboratory may result in a gap in stipend support.

In some instances, it is appropriate for a student to spend time away from Dartmouth in other laboratories, and such experiences should be planned in consultation with the student's Thesis Advisor. Time spent in such activities does not count as vacation.

Under the [child accommodation policy](#), a full-time stipend-supported graduate student is eligible for up to 12 weeks of paid accommodation from his/her graduate program. Please visit the Guarini School's policy for more details: <https://graduate.dartmouth.edu/policy/child-accommodation-policy>.

XII. EMPLOYMENT POLICY

PEMM follows the Guarini School of Graduate and Advanced Studies' employment policy: "Graduate students who are fully supported (a full tuition scholarship and a full stipend) cannot receive additional payment from Dartmouth College for services rendered and cannot accept employment outside the College while enrolled.

Exclusions & Exceptions

Exceptions may be granted in cases of academic or professional benefit or documented financial hardship. Unless a program-specific exception has been approved by the Graduate Council, any exception will normally not exceed eight hours per week and must have the written approval of the graduate student's advisor, department chair or Graduate Program Committee, and the Dean of the School of Graduate and Advanced Studies." Full details are at:

<https://graduate.dartmouth.edu/employment-policy>

XIII. ACADEMIC POLICIES

Students in PEMM must abide by the academic policies set forth by the Guarini School of Graduate and Advanced Studies. These policies can be found at:

<https://graduate.dartmouth.edu/academics/graduate-school-forms/academic-policies>

XIV. STUDENT GRIEVANCE PROCEDURES

The guidelines for the PEMM program have been developed to ensure adequate communication between students and Program faculty. Upon joining PEMM, all students will meet with the PEMM Director and members of the Program Executive Committee who will oversee their progress during the first year. Upon selection of a research theme (associated with the Thesis Advisor's research focus), a student will be overseen by the corresponding Theme Committee. Following successful completion of the Qualifying Examination, the student's Thesis Committee will be formed, and this Committee is mandated to meet with the student at least annually. These guidelines will avoid the situation whereby student progress is being monitored by a single individual without input from other faculty who can provide a broader assessment of progress. This level of oversight protects everyone by helping to ensure a fair, transparent, and justifiable process.

We have also established a grievance process to ensure that student grievances will be investigated fully and fairly, treated confidentially, and decisions rendered in a timely manner. The committee-based grievance process for guiding the PEMM program, while primarily designed to ensure effective mentoring, is also intended to guard against biased treatment of any individual. Note that allegations of scientific misconduct (violations of the academic honor principle), and allegations of professional and personal conduct (e.g, sexual harassment, discrimination, and others described in the [Policies](https://graduate.dartmouth.edu/policies) of the Guarini School of Graduate and Advanced Studies (<https://graduate.dartmouth.edu/policies>) under [code of conduct – non-academic regulations](#)) must be reported to and handled by the Guarini School of Graduate and Advanced Studies.

Link to [Graduate Student Nondiscrimination Grievance Procedures](#)

<https://graduate.dartmouth.edu/policy/graduate-student-nondiscrimination-grievance-procedures>

Link to [Sexual Harassment – Employment Policies and Procedures](#)

<https://graduate.dartmouth.edu/policy/sexual-harassment-%E2%80%93-employment-policies-and-procedures>

Link to [Employee Sexual Misconduct Policy](#)

<https://sexual-respect.dartmouth.edu/policy/employee-sexual-misconduct-policy>

Link to [Consensual Relationships Policy](#)

<https://sexual-respect.dartmouth.edu/policy/consensual-relationships-policy>

When programmatic means to resolve a grievance regarding an academic matter are not feasible or successful, the Guarini School of Graduate and Advanced Studies can be consulted for assistance (item 5 below). When grievances cannot be resolved by speaking directly to the person who bears responsibility for the complaint or who is the alleged cause of the complaint, then the student should discuss the issue with the next closest individual with whom they feel comfortable in addressing their concern. The following steps should be considered to resolve an academic grievance:

1. Speak to the Thesis Advisor
2. Speak to other members of the Thesis Committee, the Theme Committee, or the Program Executive Committee.
3. Speak to the Theme Director(s), the Chair of the department in which the Thesis Advisor resides, and/or the Director of PEMM.
4. If a satisfactory resolution cannot be reached within the PEMM program, the aggrieved student may request a meeting with the Dean of the Guarini School of Graduate and Advanced Studies to discuss the issue.
5. If the Dean of the Guarini School of Graduate and Advanced Studies, working together with the aggrieved student and the appropriate faculty member(s), or a representative(s) of the graduate program, is unable to reach a satisfactory resolution, the student can request in writing a formal hearing and ruling by the Dean of the Guarini School of Graduate and Advanced Studies and the Committee on Student Grievances. Formal hearings are conducted as described in the [Policies](#) of the Guarini School of Graduate and Advanced Studies at <https://graduate.dartmouth.edu/policies> (see section on [Academic and Conduct Regulations](#) at <https://graduate.dartmouth.edu/academics/graduate-registrar/academic-honor-code>).

Appendix I

Guidelines for writing a rotation report

Writing a rotation report is an important exercise in learning how to write a paper. Before you begin to write, get a few papers related to your topic from good journals that use a format similar to what a lab report should be. Examples would be *Cell*, *JBC*, *Genes and Development*, *Cancer Research* and *Molecular and Cellular Biology* (MCB). Short-form journals such as *Science* or *Nature* would not be appropriate. See how these experienced authors present their work and try to present your work in a similar fashion. For example - read their *Introduction* or a sub-section in their *Results* section and then try to pattern your sections after theirs.

Abstract

In 250 words or less (this is usually a real challenge)...

Describe the major question you are trying to answer or problem you are trying to solve. Describe why it is important.

Describe your experimental approach to the problem.

Describe your major result(s)

Describe your major conclusion(s) from the results.

Introduction

Here you should give the background of your project.

Give the history of the problem you are working on to put your work in context. How does it fit into the larger picture of the system you are working in (i.e., role of metalloproteinases in tumor metastasis, initiation of apoptosis by Fas ligand, development of more efficient retroviral vectors, etc.)

Describe previous results from other labs and yours.

Make sure you explain why your question, system and approaches are unique and important. Make your work sound interesting. Make the reader want to read on to find out how you solved your problem or tested your hypothesis. If you can't be excited about your work then other people are unlikely to be.

Describe the system you are using and why it is appropriate for your work.

Results should not be presented in the introduction section although many papers will frequently conclude with a brief statement of what was discovered.

Methods

Succinctly detail the source of materials and the specific methods used. Do not reiterate established methodology, but reference appropriate sources that would provide this detail.

Results

In this section you are essentially telling the story of how you attacked a problem. It should be written to logically guide the reader step by step through your research. Each step should make sense to the reader.

You should have a separate section for each experiment or closely related set of experiments you do.

Each of these should address (and hopefully answer) a specific question or test a specific hypothesis.

Each section should have a specific title (i.e., *Proteins binding to the HSFE* or *Cloning of gene X* or *Effect of the 3' enhancer of gene expression*, etc.)

Each section should contain

1. An explicit statement of the problem or hypothesis to be tested (i.e., In this experiment we tested the hypothesis that ...).
2. A statement of the rationale for your experiment(s) - explain why it is important.
3. A specific description of the experimental approach you used (this differs from the methods).
4. Description of the results of your experiment. Verbally walk the reader through your results, step by step. This often amounts to describing a gel or other figure. Be sure to note the importance and appropriateness of the controls you used.
5. Conclusion - Briefly state how the results of the experiments relate to your original hypothesis or the problem you were trying to address. Have you tested it successfully? What is the outcome of your testing?

The next section should describe the next logical step in your approach to your overall problem. It usually builds on, or follows from, the results of the previous section.

Figures need an explanatory legend, but a good figure can usually be understood simply from looking at the figure if it is appropriately labeled. Cite each figure in the text as Fig. 1, 2, etc.

Discussion

Here you should begin by very briefly (once again) stating the overall goal of your research.

Then pick your most significant and interesting results to highlight and discuss how they are relevant to research in your chosen system as well as beyond the focused scope of your paper.

Each major discussion point will often have its own sub-heading (if there are enough points that need to be discriminated).

For a rotation report you should discuss what the next logical steps in the research would be. If you ran into problems, how would you try to get around them if you were continuing on with the project.

The last paragraph is usually makes a rather grand statement on the relevance and importance of the work.

References

Cite references in appropriate places throughout the report, and list them at the end.

Use a consistent reference style based on a journal format that you choose. A format that includes the title of the article is generally most informative.

References generally include authors, title, Journal, volume, first and last page and year (not always in that order). They rarely include the issue number, month or day of publication.

Length

A rotation report can be concise. We are not looking for a thesis, but a focused and brief report. A typical length might be 5 - 10 pages excluding figures and references.

Appendix II

Specific instructions for student grant applications.

1. Write the grant application using the [NIH NRSA F31](#) format (pages 61-62 of PDF) . This is a 7-page application (Specific Aims is one page maximum; Research Strategy is 6 pages maximum; Bibliography is not counted in the page count). Examples of grant applications will be made available in the PEMM office.
2. An NRSA application should propose 3 years of pre-doctoral work for yourself at full-time effort.
3. Present a testable hypothesis and plan a series of experiments to test it. Justify it as much as possible. Note that a hypothesis does not have to be true; the grant is designed to determine whether it is true. Even if the hypothesis is eventually disproved, the grant should still be able to produce valuable data and future research.
4. The Introduction should provide adequate background to justify the hypothesis. An Introduction that addresses only the area of research but fails to build up to the hypothesis is inappropriate.
5. Each Specific Aim should represent a series of experiments, not a single experiment. A series of experiments means that after your initial experiments, you should discuss the possible outcomes, and propose experiments based on these outcomes. Discuss the potential results of the subsequent experiments as well. Note the pitfalls, and solutions. Discuss alternative hypotheses.
6. Do not base your application on a single initial experiment. A potentially lethal flaw in a proposal results if the first experiments are not possible, and the remainder of the proposal is predicated on the success or specific outcome of the first experiments.
7. Focus most of the experimental section on presentation of the experimental design. Do not go into extensive details of established methodology; a brief comment to confirm that you understand the methods is adequate as long as a reference is provided.
8. Assume that all the necessary resources and equipment will be available to you.
9. When antibodies, cell lines, plasmids etc. are required, assume that if they have been published, they will be provided to you by the authors of that paper. Make sure you cite the source.
10. Discuss the long-range direction of the research program. What future studies might you perform based upon success of the current application?
11. A fundable grant is one that has the greatest probability of generating a significant advance. Reviewers are asked to score significance and innovation. Be sure to demonstrate that your proposal will have a significant impact on human health.