CMB PRELIMINARY EXAMS

The CMB preliminary examination involves students writing an original research proposal (written component) and defending it before a committee of CMB faculty members (oral component). The written and oral components of the preliminary examination must each be passed before a student achieves candidacy for the Ph.D. degree.

What is being evaluated?

The preliminary exam ("prelim") tests the student's ability to reason analytically and to develop ideas and experimental approaches. The exam gives the student an opportunity to demonstrate creativity, imagination and knowledge of one area of current research. The purpose of the prelim exam is to evaluate the student's ability to think and plan independently in a scientific manner, and to ascertain the student's background knowledge.

Timeline

The prelim is to be completed in the student's 2nd/G1 year. The specific timing/dates of the process will be announced in each academic year. Requests for extensions must be submitted in writing to the CMB Program Director. The entire process should take approximately 8 weeks. A general timeline is below.

Oct/Nov	Student meets with Prelim Coordinator; student submits proposal topic in the form of a title and brief abstract (one paragraph) to Coordinator
Early Nov	Deadline for Coordinator to approve student's prelim proposal topic
Mid Nov	Draft of Specific Aims Page submitted to Prelim Coordinator; student submits names of 2 CMB faculty who have agreed to serve on the student's prelim committee and who will be present during exam period
Mid Nov	Coordinator identifies 2 additional CMB faculty who have agreed to serve on the student's prelim committee and who will be present during exam; Coordinator obtains agreement of one committee member to serve as chair.
Early Dec	Deadline for Coordinator to approve student's Specific Aims page. Coordinator submits approved Specific Aims page to the student's committee.
Early Dec	The student should receive feedback from the Committee on the Specific Aims from the Chair. At the Chair's discretion, the student may meet with Chair during this time to discuss Committee's feedback on specific aims.
Early Dec	Deadline for Committee to approve Specific Aims page; chair communicates approval to student and student begins writing proposal If committee cannot approve Specific Aims page December deadline, a period (between Dec and Jan) is set aside for further revisions.

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1st Week Feb	Student submits full written proposal to committee
1st Week Feb	Committee evaluates written proposal; If serious problems are found with the written proposal, this should be communicated to the student, the coordinator and the Director; the timing of the oral exam may be delayed.
February/March	Oral Prelim Exam Period. All oral exams should be scheduled during this interval unless the committee finds it necessary to delay the exam or there are unavoidable scheduling difficulties.

Choosing a Topic

The specific project for the prelim proposal should be focused and mechanistic, involving the development of one or more hypothesis and should propose experimental approaches that will critically test the hypotheses. The project should be related to the mentor's research area and should be chosen in consultation with the mentor, unless a strong case for an independent proposal is made by the student and agreed to by the mentor and prelim coordinator.

The specific project can be based on the student's research, and should represent the ***original ideas of the student*** synthesized from interactions with the mentor. It is strongly advised, therefore, that from the time the student joins the mentor's lab, the student should be engaged in a) mastering the literature and methodologies relevant to the likely prelim project; and b) involved in intensive discussions with the mentor about the directions and aims of the student's dissertation research.

Approval of Topic

The student will meet with and discuss a proposed prelim topic with the prelim coordinator by first submitting a title and brief abstract. This abstract should include background information, information concerning how the project evolves from the previous studies (the rationale) and the hypothesis or hypotheses to be tested. It may include a brief overview of experimental approaches to be taken.

As a general guideline, the proposal is expected to be of sufficient quality to develop into a dissertation project, but it is not required that the Proposal develop into the student's dissertation project.

Submission of Specific Aims

Once the topic is approved, the student will write a draft of the Abstract/Specific Aims page for review by the prelim coordinator.

The student should develop the aims independent of the mentor. The aims should not be identical to the aims of any current or pending grant in the mentor's lab, although it is recognized that the aims may be similar to the mentor's aims.

Once the student has begun drafting the specific aims, the student should not discuss the content of the written prelim or planned oral presentation with the mentor until the oral exam is completed.

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The student may of course continue to talk to the mentor about ongoing research in the lab. The purpose of the exam is for the student to develop an independent proposal based on the experience of the student in the lab. The scope of the work proposed should be appropriate for a Ph.D. candidate to accomplish in 3-4 years with the goal of publishing at least 2 first-author papers based on the research.

Note: It is the policy of Pharm 502 that mentors be involved in evaluation of the written proposal the student develops in this course, a situation that is in some ways counter, in spirit, to the CMB prelim process. The program asks that mentors and students limit mentor involvement in development of the Pharm 502 proposal to light editing and commentary.

Format of Specific Aims Page

The Specific Aims Page should be in the format of an NIH research grant application and should consist of: (1) an abstract that provides key background information, establishes the question(s) to be addressed and the hypothesis/hypotheses posed to evaluate the question; and (2) the specific experimental aims that will provide critical tests of the hypothesis/hypotheses. The enumerated specific aims should include a concise statement of each aim followed by a description of the general experimental approach that will be used in pursuing that aim."

This page will serve as the "Specific Aims" page as in an NIH research grant application and will become the first page of the prelim proposal. This page may be revised in response to comments by the committee and can be revised further as the student writes the full proposal.

Preliminary Examination Committee

- Student submits the names of two CMB faculty members who ***have agreed to serve*** on the examining committee at the time that the Specific Aims page is submitted.
- The student's dissertation advisor may not serve as a member of this committee, but can advise the student on selection of faculty for the committee.
- The Prelim Coordinator (one of the CMB directors) appoints two additional members and appoints one prelim committee member to serve as committee chair.

Scheduling the Oral Exam

Once the committee is completed, the coordinator will notify the student. As soon as possible, the student is responsible for arranging a day and time during the designated CMB prelim exam period (typically February) that all members of the committee can attend the oral exam. Email cmbgrad@umich.edu to inform CMB of your date/time for your file; and also to request make sure a room and audiovisual resources are available.

The student is responsible for seeing that each committee member receives a copy of the Specific Aims page. The committee members will review these Specific Aims to determine ultimate feasibility and acceptability of the outlined project. The Preliminary Exam Committee Chair will communicate to the student (YES or NO) within *ONE WEEK* whether the Specific Aims are appropriate. If the Specific Aims are deemed NOT appropriate, the Committee Chair will explain the problems with the proposed

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project and the student will have one opportunity to revise and resubmit the Specific Aim page to the committee within one week.

Committee Roles

Prelim Coordinators (Director/Associate Directors) - helps the student form a Prelim Committee (including appointment of chair and adding 2 members to student's chosen faculty); ensures that the timeline of the Prelim exam is followed; approves prelim topic. Each student will be assigned to work with one of the Prelim Coordinators.

Prelim Committee Chair - represents the Prelim Committee and is responsible for giving feedback to the student on behalf of the committee; runs the oral exam; writes committee summary of outcome of the prelim exam; compiles evaluation feedback and sends to student. The student may meet with the Prelim Committee Chair to discuss/submit the Specific Aims page.

Prelim Committee Members - provide feedback to the chair on the specific aims and may request revisions;. provide written evaluations of both the written and oral proposal; may request a delay in the oral exam if serious problems are found with the written proposal.

Note, the student's lab mentor(s) should have very little role in the prelim as it is a test of the student's abilities and not the faculty's. Mentors should avoid taking an active role in experimental design and proofreading the written proposal.

Written Proposal Guidelines and Format

The written proposal must contain background information and a brief summary of an original experimental approach to a scientific problem of current interest in cellular and molecular biology. ***The proposal should consist of 1 page of Specific Aims, and 6 pages of research strategy. This should be single-spaced, inclusive of figures, but exclusive of references.*** Fonts should not be smaller than Arial 11-point. The written proposal should use the NIH research grant format: i.e. one-page hypothesis and Specific Aims (see "Specific Aims" description above); significance and rationale, including pertinent background; and experimental design and methods, including justification of the approach taken, controls, interpretation of possible results, priority of experiments, limitations, and alternative approaches. A preliminary data section and timeline are not necessary but may be helpful.

The student is responsible for deciding independently on the problem and devising logical and convincing experimental approaches. When writing the proposal and preparing an oral presentation, students may ask peers and faculty for advice on execution of specific techniques or specific interpretation of published work. Faculty can suggest reading materials, but should avoid taking an active part in experimental design. Fellow students (but not faculty) can proofread (for spelling and grammar only) the proposal.

Students can look over copies of previous student proposals, which are kept by the CMB Administrator. It is recommended that the written proposal be hand-delivered to each member of the committee in addition to providing an electronic copy. A copy should also be submitted to the CMB office.

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When in doubt about appropriate boundaries of advice from others, the student is expected to consult with the Prelim Chair or Coordinator.

The student should not approach Prelim Committee members to seek advice on the written proposal prior to the oral exam, but it is recommended that students meet with Prelim Committee members in order to introduce themselves.

The Prelim Committee chair may contact the student if the committee identifies major flaws in the proposal. Requirements to revise the proposal may result in a delay in the oral exam.

Oral Exam

Format of the Oral Exam:

- Prior to the meeting, the committee will provide the chair with written comments on the proposal
- To start, the student will be asked to leave for a few minutes while the committee has a chance to discuss their evaluations of the written proposal and how they wish to organize the examination.
- The student will give a 20-30-minute presentation with PowerPoint slides, of which they may provide the Committee members a printed copy. The presentation should begin with the hypothesis, specific aims, and significance. However, the emphasis in the presentation should be on the experimental approaches to be taken to address the hypothesis.
- The members of the committee may wait until the presentation is over, or may ask questions as points are presented. At the end of the presentation committee members will then ask questions for the remainder of the examination. The total time for the exam should be about 2 hours.

What is tested?

The oral exam tests the student's ability to reason analytically and to develop ideas and defend them in front of other scientists. Thus, the emphasis is on hypothesis testing and experimental design. The student should have broad knowledge of the foundational literature of the field and should be familiar with the key past experiments performed that led to the hypothesis, and the important basic concepts.

(i.e. if studying a membrane receptor, the student must know aspects of that receptor binding, whether the cell type is appropriate for studying that receptor, whether antibodies or cDNAs have been made to that receptor).

Students should be familiar enough with techniques to understand theoretical basis, and appropriateness and limitations in addressing the hypothesis being tested. Consulting methods papers, such as those in *Methods in Enzymology* or *Methods in Cell Biology*, is recommended to ensure that the student thoroughly understands the details, strengths and weaknesses of experimental procedures that are central to the proposal. Detailed knowledge of things like buffer ingredients and incubation times is less important, unless they are vital to the interpretation of results.

(E.g. if proposing PCR, one should know how PCR works, whether the starting materials are available, whether PCR is the best approach, and the limitations of using PCR. One does not need to know the

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exact ions needed for the PCR reaction to take place, nor the incubation time of the step. In contrast, if one were studying ion channels, one would be expected to know the ion concentrations in the buffers to be used to measure ion transport.)

Furthermore, the curriculum for all CMB students is based on a solid foundation in biochemistry, genetics and cell biology, and students should demonstrate a breadth of knowledge in these areas if

relevant coursework had been completed. The committee will discuss whether the student has displayed sufficient depth and breadth of scientific knowledge, insight into experimental design, and ability to think critically, analytically and quantitatively, to predict a high likelihood of success in pursuit of a Ph.D. dissertation.

Don't Forget to Practice!

It is highly recommended that the student hold at least one practice exam with students or postdocs who have relevant expertise. The participants should question the student in a realistic fashion.

Evaluation and Outcomes:

The written and oral exams will be evaluated separately by the committee. A student will either receive a pass, a conditional pass or a fail on each component (written and oral) and the committee will also decide on an overall grade.

- Unconditional Pass: No further action is necessary.
- Conditional Pass: Remediation as requested by the committee. Instructions for remediation should be communicated orally to the student by the chair immediately after the exam and also in writing not later than a week after the exam. These instructions should be communicated to the CMB Director and Prelim Coordinator as well.
- Failure: The Committee Chair will discuss the situation with the CMB Director and the student and a plan for retaking the exam will be formulated. This plan will be discussed with the student and the mentor. The student will have up to six months to prepare for retaking the exam. The length of time allotted reflects the fact that students who fail the exam usually need to fill in substantial gaps in their preparation.

The committee members will provide the Chair with written comments on the oral exam not later than ***one day after the exam***. The chair will use the evaluations of the written and oral exam and write a summary evaluation of both parts of the exam and the committee's discussion. This summary should include separate overall grades for the written and oral that have been agreed upon by the committee, as well as the overall grade. The chair should submit the evaluations and summary to the Prelim Coordinator, the CMB Director and the CMB office (cmbgrad@umich.edu) ***within one week of the exam***. The CMB Director will forward the evaluations to the student and the student's mentor.

The report and outcome of the Preliminary Exam represent a recommendation to the CMB Program Committee concerning advancement to candidacy for the Ph.D.