

**Guidelines for Preliminary Qualifying Examination
Harvard Biophysics Graduate Program
Updated August 2, 2022**

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THE GOAL

The primary goal of the Preliminary Qualifying Examination (PQE) is to ensure that you have achieved a high standard of scientific scholarship and skills that are critical for successful completion of your Ph.D. dissertation and beyond. In addition to assessing your foundation in the principles of biophysics, the PQE will test your ability to:

- Develop a hypothesis-based, technology-driven, and/or computationally driven research plan likely to advance a field
- Prepare a compelling research plan comprising a set of (typically 3) specific aims to test these hypotheses or technological/computational approaches
- Review the literature in order to develop and provide the motivation for your proposed research
- Develop creative and forward-thinking aim(s) that will advance a field
- Prepare a written proposal
- Orally present and defend your proposal

EXAM FORMAT

The PQE is based on an off-topic proposal developed independently by the student. Students are to introduce the field of the proposal, including a discussion of the current state-of-the-art and a clear statement of what the students considers to be the next significant step(s) in the field. “Off-topic” means the proposal is not to be based on the student’s current, past, or potential dissertation research. Students are not expected to generate any new data for their examination. Specific questions of how far “off-topic” or how related to your planned dissertation topic your PQE topic can come should be addressed to Program Co-Chairs Rachelle and/or Martha.

EXAM COMMITTEE SELECTION

The exam is administered by three faculty members. PQE chairs are experienced in serving as examiners on Biophysics PQEs and have served on at least 2 prior Biophysics PQEs. The exam chair is responsible for keeping the exam on course and running on time, ensuring that examiners pursue an appropriate line of questions, and completing the PQE report form. Students will discuss their selection of committee members with Biophysics Program Co-Chairs Rachelle and/or Martha, prior to finalizing the committee membership. **At least two of three PQE committee members must come from the following list of Biophysics faculty. All PQE examiners must be Harvard tenure-track faculty. Faculty members eligible to serve as an exam Chair are indicated below in red font (this list will be reviewed and updated on an annual basis):**

Jonathan Abraham
Mark L. Andermann
Haribabu Arthanari
Stephen C. Blacklow
Martha L. Bulyk
Stephen Buratowski
Luke H. Chao
George M. Church
Adam E. Cohen
Josefina del Marmol

Michael M. Desai
Michael T.H. Do
Florian Engert
Conor L. Evans
Rachelle Gaudet
Stephen C. Harrison
Doeke Romke Hekstra
Sun Hur
Gabriel Kreiman
Andrew C. Kruse

Maria K. Lehtinen
Joseph J. Loparo
Debora S. Marks
Venkatesh N. Murthy
Cengiz Pehlevan
Nicholas Polizzi
Mara G. Prentiss
Maxim Prigozhin
Sharad Ramanathan
Tom A. Rapoport

Bruce R. Rosen
Aravinthan Samuel
Eugene I Shakhnovich
Sichen Susan Shao
Radhika Subramanian
Shamil R. Sunyaev
Gerhard Wagner
Johannes C. Walter
Wesley P. Wong
Hao Wu
Xin Zhou
Xiaowei Zhuang
Karen Adelman
John A. Assad
Brian J. Bacsikai
Michael Baym
Alan Brown
Ciprian Catana
Fei Chen

James J. Chou
Benjamin de Bivort
Vladimir Denic
Abigail Sloan Devlin
Min Dong
Jan Drugowitsch
Michael J. Eck
Georges El Fakhri
Ethan C. Garner
Hopi Hoekstra
Jeffrey Holt
Sahand Hormoz
Naama Kanarek
Tomas Kirchhausen
Nancy Kleckner
Galit Lahav
Wei-Chung Allen Lee
Tami D. Lieberman
David R. Liu

Ying Lu
Leonid A. Mirny
Danesh Moazed
Andrew W. Murray
Daniel J. Needleman
Bence Olveczky
David Pellman
Gary Ruvkun
Bernardo L. Sabatini
Chris Sander
Alex K. Shalek
William M. Shih
Pamela A. Silver
Timothy A. Springer
Lawrence L. Wald
Amanda Whipple
Peng Yin

Try to pick faculty whose expertise fits closely with your topic. However, this is not a necessary condition for a fair exam. Some committees might include faculty with expertise in the broad area of the student's project but not exactly the same system or topic. You should therefore strive to make the proposal accessible to anyone in the general area of the project. Students should contact the potential committee members directly to inquire about their willingness to serve on the committee. **We strongly recommend that you secure the exam chair first.** If you are having difficulty finding examiners, please contact the program office for recommendations.

The student's dissertation advisor(s) is permitted to attend the exam, but does not take part in the exam directly.

THE PROPOSAL

Students are expected to propose work that will advance understanding within the relevant field, and proposals that restrict themselves entirely to obvious extensions of existing work will not be given a clear pass. For aims that have been inspired by the ideas of others, we expect students to cite the sources of ideas and/or information derived from personal communication. The proposal should be designed so that you can realistically complete the work in approximately four years. The proposal should be structured into ~3 specific aims; while the aims are expected to relate to each other, the aims should not depend upon each other. If you propose to develop a new technology or analysis method, one of your aims must also be to apply the new methodology to investigate a specific biological question. You are expected to have a strong command of the primary literature related to your proposal topic. Assume that you would have the necessary budget for the proposed research (within reason; such as access to the equipment necessary).

Input/Advice

Students are expected to develop their own proposal without input from their dissertation advisor. You are permitted to seek advice from graduate students, postdocs, research staff, or other faculty as you work to develop and craft the proposal and prepare for the oral exam. **However**, faculty are **NOT** permitted to read proposal drafts for students, are **NOT** allowed to edit the proposal, and are **NOT** allowed to give detailed feedback about proposals. Also, you should **NOT** consult faculty whom you plan to have on your PQE examination committee for things beyond broad-stroke questions such as feasibility (and not for such things as specific experimental design, etc.) Students are permitted to inform their advisor about the general content of their proposal, but are **NOT** permitted to obtain their

advisor's feedback on their proposal. You may **NOT** use work that you have submitted for courses or at another institution.

Students are required to submit a 2-page outline of the proposal to Co-Chairs Rachelle and Martha **by mid-late Fall of the G2 year** for their approval prior to moving forward with writing the full proposal. **Do not skip this step.** The outline level is the place where they will be happy to make suggestions and help head off any major problems/ issues that they may notice. Many students find choosing a topic and developing a set of specific aims to be the most difficult part of the process. To help organize your ideas and present them in a way that will elicit the most useful feedback from the Co-Chairs, consider formatting your outline similarly to the Specific Aims page of an NIH-style proposal (you can find examples on the web, or ask advisors or peers for examples from grant or fellowship applications). **The final proposal must be defended by May 31st of a student's G2 year.**

Guidelines for Organization and Writing of the Proposal

Contents

You need to include the following sections, with suggested lengths in parentheses:

- Abstract (~1/2 page)
- Statement of Specific Aims (a small number of very specific goals which serve as landmarks for evaluation of the progress and to test the hypothesis) (~1/2 page)
- Background and Significance (how does your proposed research go beyond the current literature and why is it important to investigate) (~5 pages for these two sections)
- A clear Description of your experimental (or analysis) design for each Specific Aim, anticipated outcomes and your interpretation of the results, potential challenges or pitfall, and alternative approaches. Be sure to describe what positive and negative controls you would use. State how the results would answer the question(s) of your hypothesis (6-12 pages)
- Conclusions (summarizing how your aims synergize into expected outcomes) (~1/2 page)
- Literature Cited (full references with titles) (does not count towards the page limit)

Format

- The proposal should be 12-15 double-spaced pages (maximum limit is 15 pages), including figures and/or tables but exclusive of the references.
- Use 11 point Helvetica or Arial font.
- Margins must be at least 1/2 inch all around.
- Figures with legends are expected, and are highly encouraged because they generally add clarity to the proposal.
- Tables may also be included for purposes of clarification.

The Biophysics Program Co-Chairs Rachelle and Martha are available to answer questions, clarify expectations, and provide guidance at any point during the PQE preparation process. The Biophysics Program will also hold an organized PQE Q&A session(s) during the Fall term. Examples of successful written proposals are available from Michele in the Biophysics office.

ORAL EXAM

The oral exam will last approximately 2 hours. Students should prepare a presentation of the proposal. We recommend that you prepare for just a ~30-min presentation, as you will be interrupted with questions throughout the exam. Although it is appropriate to give a brief introduction, it is assumed that the examining committee will have read the proposal. During the exam, you will present on the background and motivation for your proposal, your hypotheses, experimental and/or

mathematical/computational approaches, anticipated outcomes and your interpretation of them, and potential challenges or pitfalls and alternative approaches. The oral exam will concentrate on your thorough understanding of the field, your knowledge of material directly relevant to the proposal, and your ability to evaluate past and future experiments critically. Questions testing your knowledge may be framed within or outside the context of your proposal. Examiners may ask questions at any time during the examination.

The oral exam generally begins with the student out of the room. At this time, the exam chair will brief the examiners on the student's academic background (if the dissertation advisor is present, they may comment on the student's research) and issues that may have come up in the written proposal are discussed (if there are fatal flaws we would expect and request that the examiners contact us before the date of the scheduled exam).

Because students taking the examination are developing a proposal that is outside their thesis topic, some naiveté about experimental details may be expected. The closer the chosen topic is to the student's own experimental studies, the greater the expectation that the student should understand the nuances of the experiments. It is entirely possible that flaws in a written proposal may be overcome by a student's ability to recognize them when they are pointed out during the oral exam and to propose alternative approaches to fix the flaws.

SCHEDULING THE EXAM

It is Harvard Biophysics' & GSAS's policy that students must complete the PQE by May 31st of the G2 year. Most students take the exam during the summer after their G1 year or during the G2 year. You may take the exam either before or after selecting your dissertation advisor; if you have already selected your dissertation advisor, that professor may not serve on your committee. It is in students' best interests to complete the PQE sooner rather than later in the G2 year, as you will gain valuable experience and skills that will be useful in your research. Please note that selecting your committee members and scheduling the exam may take much longer than expected, and so you should plan well in advance (2-4 months). Students may schedule their oral exam, or may instead ask Michele for assistance in scheduling the exam. The web tools Doodle and when2meet are excellent aids in polling people's availability for meetings. There is no need to wait on the scheduling process until you have completely finished the writing.

At least two weeks before the PQE, you must submit the final version of your proposal to the PQE exam chair and to the Biophysics Program office. The PQE exam chair will then review the proposal and at least 1 week prior to the scheduled PQE will email the Biophysics Program office with approval or disapproval to proceed with the PQE; this step is meant to catch any fatal flaws in the proposal prior to the oral exam. Once approved, the Biophysics Program office will forward the proposal to the rest of the PQE committee members; Michele will also send your student file and course grades to your committee.

For exams held virtually via Zoom, be sure at the outset of the exam that the exam chair is made the Host or Co-Host of the Zoom meeting. For exams administered in person, Michele can assist with room scheduling for PQEs held at the Longwood campus, or with parking for PQEs held in person at the Longwood or Cambridge campuses. You can book a room for the exam through the eCommons portal under "Services" and fill out the "Room Request Form." You may also book a conference room in your department, if preferred. Once you've confirmed your exam, please email Michele the names of the exam chair & remaining examiners, and the exam date, time, and location.

THE OUTCOMES

The student will be informed of the outcome (Pass, Conditional Pass, or Fail) at the end of the exam, along with comments from the committee. The committee chair will submit a written evaluation in the

form of the completed PQE report form, signed by each committee member, to Michele, who will send a copy to the student, the Biophysics Program Co-Chairs Rachelle and Martha, and the student's dissertation advisor (if the student has one already). In addition to determining the outcome of the exam, examiners will be asked to provide students with short comments on the student's Knowledge base (proposal-related and general) and the strengths and weaknesses of their proposal in the following areas: Significance; Innovation & Creativity; Approach; Written Proposal; Oral Defense.

- **Pass.** No further work on the PQE will be required. The student is admitted to candidacy.
- **Conditional Pass.** A student will receive a conditional pass if the committee feels that he/she would benefit from additional preparation. This may be due to issues that arise in the written proposal, oral exam, or both. The conditions for changing the grade to "pass" will be determined by the exam committee. The student may be asked either to rewrite defined portions of the proposal or in rare instances to take additional course work to compensate for deficiencies. The condition(s) will be given to the student at the end of the exam. The plan will be noted in the evaluation form, along with the expected time frame for when the condition will need to be met. It may be helpful for the student and the chair to communicate by email shortly after the exam in order to make sure that the terms of the condition are clear. A condition that consists of a write-up typically has a 30 day deadline. The student will receive a "pass" once this conditional work is completed to the satisfaction of the exam committee. If it is not completed satisfactorily, the student will receive a fail and be asked to repeat the entire exam.
- **Fail.** A student will receive a fail if there are serious concerns based on the oral exam. In such a case the student may be required to repeat the process or be given a terminal Masters degree. In this case, a follow-up meeting with the exam chair and with Rachelle and/or Martha will be scheduled. After this meeting, a set of recommendations will be made to address the identified issues. The student will be given the opportunity to retake the oral exam following completion of the recommended work. Because of our very high admissions criteria, we do not believe that the PQE is a culling process. Most students pass the PQE without qualifications. If a student fails a second time, the student will be required to withdraw from the program.

AFTER PASSING THE PQE

The student should assemble a Dissertation Advisory Committee (DAC) and schedule the first DAC meeting to occur within 6 months after passing the PQE. Please see the Harvard Biophysics Program's DAC Guidelines for more information.