

# Molecular Genetics Reclass/Qual Committee Guides

## Basic Protocol for a Pre-Reclassification/Qualification Exam Meeting

1. The assigned Exam Chair will chair the meeting and fill out the meeting evaluation form.
2. The pre-reclass/pre-qual runs like a normal committee meeting, but the student should also provide an outline of the proposal they're planning.
3. The committee should make a recommendation about whether to proceed to the exam, which is recorded on the meeting evaluation. Note that unless the student receives an overall score of "Unsatisfactory (Fail)" for the second time in a row on the evaluation, the final decision as to whether to proceed to the exam is the student's. However, students usually follow the committee's recommendation.
4. If it is recommended to proceed to the exam, time should be dedicated at the end of the meeting for the Exam Chair and committee to provide information about the exam and pose example questions (see below).

## The Exam Chair's Role

- A critical job of the Exam Chair is to normalize the threshold at which students are recommended to *not* proceed to the exam, e.g., if there is no viable path to success in a PhD. When this is the case, it is the most supportive option to be honest with students; this can save both the student and supervisor/committee significant challenge down the road. In many cases, this will mean recommending redirecting to finish an MSc. Even PhD students have the option to transfer to the MSc through a straightforward process (so long as they don't have an MSc from our program already). Students can then ask for the MSc defense committee to recommend admission to the PhD program. The MSc thesis and its defense can serve as both a demonstration that the student is ready for the PhD, and as a critical intellectual experience for the student.
- If the student is proceeding to the reclass/qual exam, the Chair should lead a discussion at the end where the student is made aware of the following:
  - The timing of events and expectations – i.e., what is due and when:
    - Students must submit an exam form (emailed by the department) by April 1<sup>st</sup> at 5:00 pm. This includes timing and exam committee composition, including external examiner, and will allow the department to assign a Designated Examiner (and Exam Chair if the existing Chair is unable to carry over to the exam).
    - Qual/reclass proposals must be emailed to the full exam committee by 5:00 pm on May 1<sup>st</sup>, or 5:00 pm seven days before the exam, whichever is sooner.
    - The exam must take place by May 31<sup>st</sup>.
  - Point them to the Graduate Handbook, which contains specific instructions.
  - Students usually take the entire month of April to put together the proposal. They should not be expected to do experiments during this period, though students should anticipate that lab maintenance tasks (e.g., maintaining cell lines or organisms) may continue.
  - It is allowed (and highly recommended) to consult with other students and lab members on the proposal, the talk, and the exam itself.
  - Supervisor may only provide general feedback on the proposal.



- Most students hold practice talks and practice exams – often more than one. It is particularly helpful if this is done prior to turning in the proposal, and with students who are not in the same lab (especially those outside the student’s area of research), as these sessions often expose gaps in reasoning and highlight missing material. The Graduate Student Association often hosts opportunities for practice exams, but students should also organize their own.
- Tell them what happens at the exam (see below), how the scoring works (i.e., what they’ll be evaluated on), and the fact that there are multiple possible outcomes.
  - Evaluation categories: Proposal content, presentation (clarity/organization), and progress; oral presentation; defence of knowledge related to the proposal, broader knowledge, and scientific thinking; overall assessment
  - Outcomes: Pass, redo exam, redo proposal, redo both, fail: complete MSc, fail: leave program
- Explain that the exam covers anything in the proposal (and all the references), techniques, rationale, alternatives, anything they should know by now as someone who was admitted to the program and has been in it for two years, and hypothetical situations to test their scientific thinking.
- Ask a few sample questions to give an idea of what it’s like (examples are provided at the end of this guide).

## Basic Protocol for a Reclassification/Qualification Examination

1. The Exam Chair confirms that everyone is present.
2. The student leaves room.
  - a. The Exam Chair asks if anyone has anything to talk about
  - b. Review the following:
    - i. The student will be scored in the categories on the form, and everyone will vote independently before any discussion.
    - ii. The first three categories (1A-C) focus on the proposal itself and are mainly independent of the exam.
    - iii. Everyone should make sure that enough questions in each category (3A-C) have been asked, particularly broader knowledge and scientific thinking. Students usually know technical details of their proposal very well but may find scientific thinking (even regarding their own project) and background of all types (including their own project) more challenging.
    - iv. The exam serves multiple purposes. For most students it is a learning experience and a calibration of their project and progress with regards to program expectations. It is also an exam, and students that do poorly on it often struggle throughout the remainder of the degree.
  - c. Determine order of questioning. Usually:
    - i. Student’s choice external
    - ii. Designated Examiner
    - iii. Student committee member #1
    - iv. Student committee member #2
    - v. Exam Chair
    - vi. Supervisors normally do not ask questions, but may ask clarifying questions only
3. Invite the student back in. The Exam Chair should tell them they’ll have 20 minutes to present uninterrupted, followed by up to 70 minutes of questions: 10 minutes for each examiner, with shorter second round optional for the examiners, time permitting.



4. The Exam Chair should time the student presentation. Give a two-minute warning if it looks like they might go long. Announce at 20 minutes, unless they're on the last slide. Do not allow more than 22 minutes.
5. The Exam Chair invites questioners and does the timing. This is not required to be super strict, but give a 9-minute warning and at 12 minutes, interject and recommend moving on to allow a second round.
  - a. The exam cannot exceed 90 minutes, including the student presentation.
6. The student leaves the room.
7. Each member of the exam committee fills out the ballot form *before* discussion.
8. The Exam Chair collects the ballots, summarizes the result, and leads the discussion of results and outcome.
9. Invite student back in and tell them the result.
10. The Exam Chair reports the outcome to the Department via the [Reclass/Qual Results Submission form](#).

## The Exam Chair's Role

- The Exam Chair, together with the Designated Examiner, serves to normalize expectations and procedures across examinations.
- The Exam Chair is in charge of overseeing the process of the exam so that students have a consistent experience, ensuring that all steps above are followed, and monitoring timing.
- In the questioning round, the Exam Chair should fill in any gaps in questioning from other examiners, if needed, and ensure that all categories on the ballot are covered. If they were also present at the pre-exam meeting, they can also follow up on aspects that needed to be addressed from that meeting.
- The Exam Chair should also collect ballots and lead the discussion of final ruling. Here, the Chair plays an important role in applying consistent standards across the department. As in the pre-exam meeting, it is in the student's interest to give honest feedback and a realistic ruling. If existing progress, performance, and project plans do not indicate that success in the PhD is likely, then the committee should rule accordingly. There are several options besides a direct pass, and while a non-pass outcome can be challenging for a student in the short term, it often saves significant difficulty in the future.
  - A pass means that the exam committee is confident that the student can successfully complete a PhD. The PhD means that the student can function independently as a scientist – i.e., has sufficient knowledge of a broad field, command of a specialty, and the ability to design and execute experiments and analyses, complete tasks, write scientific documents, create figures, and present their work effectively to an audience of other scientists.
  - Re-doing the exam, proposal, or both are possible rulings when performance issues appear to be related to the immediate context of the exam period (e.g., nerves or misunderstanding of expectations), as opposed to overall progress or PhD preparedness. The committee may ask that specific areas of deficit in the evaluation are corrected.
  - When appropriate, committees should consider the option of having the student complete an MSc. This option can be particularly valuable for those who lack either understanding of the project itself or relevant background, or cannot adequately rationalize the approach or interpret the results. This option is available even to PhD students as long as they don't already have an MSc from our program; they can transfer to the MSc, with specific logistics discussed with the department after the ruling (especially for international students). This may also be a challenging option to accept, but is preferable to withdrawal, or proceeding with a PhD that they're not sufficiently prepared for.



- The Exam Chair must ensure that ballots are collected and submitted to the department, along with a final ruling, via the [Reclass/Qual Results Submission form](#). This should occur within 24 hours of the exam.

## The Designated Examiner's Role

- The Designated Examiner, together with the Exam Chair, serves to normalize expectations and procedures across examinations.
- The Exam Chair has primary responsibility for overseeing the execution of the exam, while both the Exam Chair and Designated Examiner share responsibility for ensuring that the student is fairly and comprehensively evaluated in all categories, and that appropriate outcomes are considered (see above), consistently across the department.

## Sample Questions for the Reclassification/Qualification Examination

### Simple questions we ask prospective applicants to the program

- What is the "genetic code"?
- What molecules read the genetic code?
- What is the "central dogma" of molecular biology?
- What is "genetic linkage"?
- What is a protein domain?
- What are the major differences between prokaryotes and eukaryotes?
- What is an "exon"?
- What makes different cell types different from each other?
- How do we "clone" and manipulate DNA in the laboratory?
- How does CRISPR/Cas9 work? Where is this system adapted from?

### Generic questions that can be adapted to most proposals

- Before CRISPR, how did we knock out genes? (Or before anything new, how did we do the same thing – reclass and qualifying proposals often contain the latest-and-greatest; ask how the ancients did the same thing – it's probably in the references, so fair to ask).
- What does BLAST stand for, and what does it do? (or, pick any acronym from the proposal)
- How do you show that XXX is necessary and sufficient for YYY? (e.g. a regulatory element, a gene in a process, etc – most proposals involve some type of functional analysis).
- Definitions, origins, and history of anything in the proposal can be asked.
  - e.g., What is the definition of a promoter vs. an enhancer
- The fundamental requirement of the PhD is to make a contribution to knowledge. PhD students are expected to have commanding expertise in their specialty, as well as an appreciation of the significance of their work in the broader field. Briefly, what is the main contribution that you expect the proposed research will make? How will it contribute to your specialty, and what is the broader significance?

### Questions from the Genomics Unit

- What is the Scientific Method?



- What is thought to be the primary source of new genes and new gene functions?
- Why do genes and proteins often fall into families?
- Homolog, ortholog, paralog – what do these terms mean?
- How was the human genome sequenced?
- What is a genetic map?
- Why do some organisms have much bigger genomes than others?
- How are human disease genes identified?

### Questions from the Genetics Unit

- Describe Mendel's laws
- Describe the chromosomal events of meiosis
- What are hypo, hyper, and neomorphs?
- What was the genetic basis for the one gene:one enzyme hypothesis?
- Define genetic epistasis and provide an example.
- What are chromosomal balancers and why are they useful?
- Describe forward versus reverse genetics
- What information can be gained by producing genetic mosaics?
- What is a maternal effect mutation?
- What are positive and negative genetic interaction?
- Give an example of genetic suppression.

### Questions from the Proteins and Proteomics Unit

- Describe how post-translational modifications can affect protein function.
- Name three different experimental methods to determine macromolecule/protein structure.
- What are intrinsically disordered regions.
- What are short linear interaction motifs. Give a few examples.
- Name 5 reversible post-translational modifications.
- How can we identify the molecular target of a small molecule?
- What method enables identification of newly synthesized proteins?
- Describe a strategy to identify organellar proteomes.
- Provide specific examples of negative controls to incorporate in an immunoprecipitation mass spec experiment.
- What are biomolecular condensates and how do they form.