



## DEPARTMENT OF INTEGRATIVE BIOLOGY

### GUIDELINES FOR Ph.D. QUALIFYING EXAMINATIONS

Where policy in the Graduate Calendar appears to differ with that here, the policy in the Graduate Calendar shall take precedence.

In accordance with University regulations, the Examination Committee will consist of the following five members:

- the Chair of the Graduate Studies Committee, who acts as Chair of the Examination Committee except when s/he is also Chair of the Advisory Committee. In that event, the Department Chair will designate another member of the Graduate Faculty to sit as Chair of the Examination.
- two members of the Graduate Faculty who are not members of the Advisory Committee, in addition to the Chair of the Graduate Studies Committee.
- two members of the Advisory Committee, one of which will normally be the candidate's advisor, unless the advisor cannot attend the examination due to absence from the department.

Normally, at least one member of the Examination Committee must be from outside the department in which the candidate is registered. That person may be a member of the Advisory Committee. The Department Chair assigns the Chair of the Examination Committee, the two Advisory Committee members, and the two members of the Graduate Faculty.

The Chair of the Examination Committee will receive from the Advisory Committee a written evaluation of the quality of the candidate's performance to date in research and of the candidate's potential as a researcher.

The Qualifying Examination process will normally start in the **3<sup>rd</sup> semester** of the Ph.D. program, by submission of the candidate's PhD research proposal by the **14<sup>th</sup> class day** (also for direct entry students). Ph.D. transfer students will start the Qualifying Examination process in their **6<sup>th</sup> semester**, normally the second semester after their transfer to the Ph.D. program. This gives them one semester to further develop a PhD research proposal and get it approved by the Advisory Committee. The IB Chair will set up a relevant QE committee based on the submitted research proposal, which will also form the basis of questions on the candidate's relevant field of research.

In some instances (i.e. absence from the University for research purposes), it may be necessary to defer the Qualifying Examination for one semester. A letter from the Advisory Committee requesting deferral of the exam must be submitted to the Graduate Coordinator by the

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**14<sup>th</sup> class day of the candidate's 3<sup>rd</sup> semester** (or 6<sup>th</sup> semester for transfer students). Requests for deferral beyond one semester will require Department approval.

The advisory committee must approve the submitted PhD research proposal, so it is important that the student plans an advisory committee meeting before the end of the second semester to receive feedback on the PhD research proposal, and incorporate that into the version submitted for the QE.

The Qualifying Exam will be scheduled starting in the month after the deadline for submission of the research proposal.

The material for the Qualifying Exam consists of the background reading indicated on page 4 that defines the general areas of questioning by the Examination Committee. It is expected that all candidates will be familiar with the basis of scientific enquiry, including principles of the scientific method. In addition, candidates will be examined on topics more specific to their specialized area of research as indicated by their PhD research proposal. The candidate should contact members of the Qualifying Examination Committee to discuss aspects of the examination and that particular member's focus.

The Chair of the Examination Committee will be responsible for conducting the oral examination, and has a responsibility to intervene and moderate when appropriate. Qualifying Examinations are closed to all but Graduate Faculty.

The Chair will open the exam by inviting the candidate to give a short oral presentation on the goals of the thesis research, and any results obtained to date. This presentation must be no longer than 20 minutes. Following this presentation, the Chair will open questioning by calling on members of the Examination Committee by turn. The order of questioning is as follows: the 2 Graduate Faculty Members who are not members of the Advisory Committee, the Advisory Committee Member, the Advisor, and finally the Chair. The 2 Graduate Faculty Members (who are not members of the Adv. Comm.) may take as much time for questions as they desire, subject to the reasonable expectation that adequate time will be left for other examiners to ask questions within the time limit of the exam. The entire oral examination should not be longer than 3 hours in duration. If the time is extended, it should be done only to benefit the candidate and enable the Committee to come to a just decision.

**Should the Chair feel that any examiner is taking an inordinate amount of time or the nature of the questions tends to deviate from the "fair limits" of the examination, s/he has the responsibility to intervene and moderate.**

At the end of the question period, the Chair will ask the candidate and members of the faculty who are not members of the Examination Committee to leave the room so that the Examination Committee can proceed with their deliberations.

The Chair will advise members of the Examination Committee regarding the formalities to be followed in making the recommendation to the Dean of Graduate Studies. The Chair will share with the 2 Graduate Faculty the letter regarding the candidate's ability at research from the Advisory Committee, but not until after the Examination Committee's own part of the examination process is concluded. This procedure is intended to prevent prejudging the

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candidate. The Chair may deem it necessary to recall the candidate for a further period of questioning.

The Chair will ask the Examination Committee to vote on the acceptability of the candidate's performance. As a qualifying examination, consideration is to be given not only (1) to the student's knowledge of the subject matter and ability to integrate the material derived from his or her studies, but also (2) to the student's ability and promise in research. The examining committee will determine the relative importance to be given to these two major components of the qualifying examination.

In particular, the evaluation of the candidate's performance during the examination will consider whether s/he has demonstrated the following:

1. a general knowledge of the broad discipline of study and philosophy of science
2. an understanding of the proposed field of research and important areas of study within it
3. an ability to develop a research program that promises a notable advancement or innovation in the discipline with results of importance to a broad range of application
4. an understanding of the methods of science, by:
  - integrating material from relevant sources into a cohesive document
  - describing well-formulated short- and long-term goals
  - assessing the implications, limitations, and assumptions of the statistical procedures to be used
  - describing the analytical techniques and laboratory procedures to be used
  - explicitly incorporating feasibility considerations (time, funding, ...) in the proposal

A candidate is deemed to have passed if not more than one member of the Examination Committee votes negatively. An abstention counts as a negative vote. The Committee will then be asked to sign the Report of the Qualifying Examination Committee, which reports the performance to be Satisfactory or Unsatisfactory.

Where deficiencies are revealed by the oral examination, the Chair will provide the remedial measures required to the candidate in writing within 2 weeks following the exam.

A candidate who does not pass the Qualifying Exam may be given the opportunity for a second oral exam, not later than six months after the failed attempt. The Department Chair, on the advice of the Examination Committee, will decide whether to permit a second examination. The Chair of the Examination Committee will provide to the candidate, by the end of the next full business week following the exam, a written list of the concerns of the Examination Committee that must be addressed before any second examination is attempted.

In the case of failure on the first attempt, the examination may be repeated only once. A second failure results in termination of the candidate's registration in the Faculty of Graduate Studies.

## **PhD QUALIFYING EXAMINATION – INTEGRATIVE BIOLOGY**

### **SUGGESTED BACKGROUND READING**

The background reading provides guidelines for the first evaluation criterion, “A general knowledge of the broad discipline of study and philosophy of science”.

These are suggested background readings only. The oral exam will also cover specialized topics as defined by the student’s research proposal. The student is encouraged to discuss the details and scope of the oral examination with the Chair and members of the Examination Committee.

#### **(a) Area of Research**

**Comparative Physiology** - one of the following or equivalent:

- Hill, R.W. et al. 2008. Animal Physiology. 2nd ed., Sinauer, Sunderland
- Moyes, C.D. & Schulte, P.M. 2008. Principles of Animal Physiology. 2nd ed., Benjamin Cummings, San Francisco

#### **OR**

**Ecology** - one of the following or equivalent:

- Begon, M. et al. 2006. Ecology: From individuals to ecosystems. 4<sup>th</sup> ed., Blackwell
- Malden; Ricklefs, R.E. & Miller, G.L. 2000. Ecology. Freeman, New York

#### **OR**

**Evolutionary Biology** - one of the following or equivalent:

- Futuyuma, D.J. 2009. Evolution. Sinauer, Sunderland
- MA; Pigliucci, M. & Kaplan, J. 2006. Making sense of evolution: The conceptual foundations of evolutionary biology. University of Chicago Press, Chicago

#### **AND**

**(b) History and Philosophy of Science** - one of the following or equivalent:

- Chalmers, A.F. 1999. What is this thing called science? 3rd ed. Hackett Publ., Indianapolis
- Lee, J.A. 2000. The scientific endeavor. Addison Wesley Longman, San Francisco

## FORMATTING THE PhD PROPOSAL FOR THE QUALIFYING EXAMINATION

The qualifying examination committee will use the PhD research proposal as the basis for evaluating the student's competency in areas specific to his/her research area and broader scientific reasoning and methodology. This requires the candidate to include a review of the current literature and important topics in the relevant field, as well as provide details on hypothesis testing/research questions, study design, and statistical methods that would be used to attain the short-term goals. In addition, the candidate must indicate how the proposed research will provide a significant contribution to the field.

**When formatted for the PhD qualifying exam, the Research Proposal should include the following sections:**

**BACKGROUND.** A substantial portion of the proposal should be devoted to placing the proposed research within the context of what is currently happening in the field, and summarizing the relevant prior work in the field.

**GOALS.** Explicitly list both **short term goals** for individual research projects of the PhD, and **long term goals** of the whole PhD research program.

**PROPOSED RESEARCH.** Describe a 4-year research plan that includes a description of the methodology that will be used and explain how it is appropriate and feasible. Acknowledge difficulties honestly and have some ideas for future options.

**SIGNIFICANCE.** Indicate why the research is useful, important, original, and innovative. How will it provide progress to achieving the long-term goals?

The candidate must address two audiences:

- examiners who are very knowledgeable in the field of interest
- examiners who are in the discipline but may have limited knowledge of the specific area in which the candidate is working. The proposal must contain enough depth and detail to satisfy the expert, but the non-expert must also be convinced of the importance and impact of the proposed research.

While all advisors have their own requirements for a PhD proposal, the proposal submitted by the candidate for the QE should address all the above sections within approximately 15 pages of text (1.5 line spaced, font size 12), excluding figures, tables, and references.

The Examination Committee will also receive a statement from the student's Advisory Committee evaluating the student's progress and capability in research (criteria 2, 3, and 4).