



MASTER OF SCIENCE IN BIOLOGY
PROGRAM

Thesis Proposal Guide

UNIVERSITY OF GUAM

Unibetsedât Guahan

**COLLEGE OF NATURAL AND APPLIED SCIENCES
MASTER OF SCIENCE IN BIOLOGY**

Thesis Proposal Guide

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Overview

G The Master of Science Degree in Biology Program is designed to serve those students who are pursuing a research-oriented career at the master's level, those using the master's degree as a stepping stone to a doctorate, a career in natural resource management or environmental consulting, and biology teachers who have fulfilled requirements for teacher's certification but seek a broader knowledge of biology.

PROGRAM LEARNING OUTCOMES

Upon successful completion of the Program, students will demonstrate the following:

- G** The ability to conceive, conduct, and report original research;
- G** The ability to analyze data and design experiments using standard statistical procedures;
- G** The ability to write technical scientific reports and articles;
- G** Knowledge of basic organismal and ecological principles;
- G** Knowledge of basic cellular- and molecular-level principles;
- G** Knowledge of the latest advances in the student's chosen area of biological study; and
- G** The ability to disseminate scientific concepts and research findings in a variety of formats (e.g., written and oral).

The first step is the preparation and defense of a thesis proposal, which should be done within 12 months of entering the Program. The proposal consists of a written document outlining the proposed thesis work. The document is edited and approved by the student's thesis committee; this thesis proposal guideline outlines the necessary components comprising the document. Oral defense of the approved proposal is via a public seminar open to the University community and subject to final approval from the thesis committee.

A thesis proposal can be thought of as a contract between the student and their committee that demonstrates the candidate's command over the field of biology, and their ability to conduct independent, defensible research that is of high quality and accepted by one's field. The thesis committee, particularly the thesis committee Chair, guides the student throughout the development of the research problem, data acquisition and analysis, and writing the thesis.

Proposal Structure

G The Master of Science in Biology (MS Biology) thesis proposal must demonstrate thorough knowledge of the chosen research question and offer an original contribution to the field of biology. Most students base their study on two foundations: their existing knowledge and experience in a particular specialty, and a desire to expand their knowledge in one or more biological field.

Written proposals should accomplish the following:

- 6 Define the area of research to be studied;
- 6 Clearly articulate a set of research objectives to be addressed or a refutable hypothesis to be tested;
- 6 Review the relevant primary literature, identify a knowledge gap, and explain how previous findings relate (complement/contradict) to the planned study;
- 6 Present a detailed, chronological outline of the methods being proposed to test the hypothesis;
- 6 Define how each data set will be analyzed, defining relevant equations, models, programs, and techniques; and
- 6 Describe what outcomes are expected if the project is completed.

Thesis proposal documents are edited and approved by the student's thesis committee and must comprise Introduction, Methods, and Literature Cited sections. Additional sections (e.g., Abstract, Preliminary Results) may also be included, after discussion with the thesis committee. The total length of proposal documents may vary, but as a guide they should be between 10-20 pages, annexes included.

Required Elements

Introduction

6 *An Introduction is meant to capture the reader's attention and convince her/him that this is an exciting, worthwhile endeavor based on sound science that contributes to the body of scientific knowledge. It is where the student demonstrates their knowledge of the current state of science in their selected field of study.*

The **Introduction** section is where the student:

presents the overall topic;
explains why it is relevant and important; and
discusses previous work related to various aspects of the research question(s).

Students should not underestimate the time necessary to become familiarized with the relevant literature, and understand that not all literature read will make it into this section. It is common to have several related topics contributing to a particular field of study that need to be understood but do not contribute to the logical flow of the proposal document.

An introduction must be thorough enough to present alternative views, logically organized so it is clear how previous studies relate to each other and, most importantly, should explicitly state how the proposed research makes an original contribution to the current state of the field. Summaries of previous work should be concise, consistent, and logical, and should avoid redundancy while not presenting a laundry list of related findings in chronological order.

Hypotheses are presented in the last paragraph of the Introduction, and should follow a logical presentation of a gap defined in the body of knowledge that the study is addressing. The student may elect to include an overall **Statement of Purpose**, which

may help to clarify the overall objective of the study if more than one hypothesis is to be tested. Hypotheses are presented as both null and alternative statements.

Most paragraphs in scientific writing have a three-part structure: an opening topic sentence, a body of information which discusses the topic sentence, and a conclusion that ties the entire paragraph together. This is standard for paragraphs regardless of whether they are narrating, describing, comparing, contrasting, or analyzing information. Each part plays an important role in effectively communicating with the reader. The topic sentence defines the paragraph, provides background, or creates a logical transition from the previous paragraph. The body then discusses the supporting knowledge, using facts, arguments, analyses, examples, and other supporting information. Finally, the conclusion summarizes the connections between the information presented and states the paragraph's controlling idea. Paragraphs must also display consistency in verb tense, point of view, plurality, and subject-verb agreement. Finally, paragraphs must show coherence and connection with each other. This may be achieved via topic and conclusion sentences, which facilitate flow and serve as transitions between paragraphs.

Introductions are often the lengthiest sections of the proposal; a limit of eight pages (double spaced) is suggested. As a guide, Introductions should include a minimum of 20 to 30 of the most important (highly cited) publications in the field. It is essential to avoid the mistake that recent work is the only pertinent information. The student must demonstrate knowledge of key historical articles that define current theory. As an example, many of the seminal studies on coral reef ecology were done in the 1960s and 1970s. It is important to remember that a well-constructed and thoughtful Introduction should not have to be significantly altered for the final thesis; thus, it is worth the effort to write it well during the proposal stage.

Methods

G *The Methods section should outline the technical aspects for the plan of work, including the broad design of activities to be undertaken and, where appropriate, provide a clear description of experimental methods and statistical procedures used for an unbiased evaluation of success.*

Proposers should address the following in their **Methods**:

- G** When, where, and how study organisms will be obtained and handled;
- G** Clear descriptions of what, where, and when experiments will be conducted, and by who;
- G** The design of experiments (i.e., number of study replicates and samples, measurements to be taken, equipment or apparatus to be used, description of study site(s), and number of times the study will be repeated), including an appropriate power analysis for each (if necessary); and
- G** The statistical methods that will be used, their appropriateness in analyzing such data, and how results will be interpreted (both + and -).

This section should include a detailed plan of how the research objectives/hypotheses will be addressed. Organization is key, particularly if multiple experiments or studies are proposed. Statistical design is an important aspect of this; depending on the nature of the thesis, statistical tests should be presented either with the experimental design or discussed separately in logical sequence at the end of the section. Schematics, diagrams, and other visual representations help outline experimental designs, particularly if manipulation of independent variables is anticipated. Aspects such as study site(s), number of replicates, study species, and methods of processing, treating, and analyzing data should be included with as much detail as possible. It is important to keep in mind that plans can, and do, change. Faculty are well aware of experimental adversity and do not expect all answers at this early stage. What is expected is that the student demonstrates that these details have been thought through with enough detail that anticipated problems have been addressed with alternative strategies. If changes are needed later on, they will be discussed with the thesis committee.

NOTE: *The student is responsible for what is written in the document, including knowledge of methods and the background information. Statements that cannot be defended should not be included. For example, if a statement is made about using a particular technique, then the student should demonstrate a basic knowledge of the principles and applications of this technique.*

Literature Cited

G The breadth of literature included should be fairly exhaustive, relevant to the overarching topic, and come from a broad diversity of journals (in terms of impact factor), including seminal papers, controversies (if any), and the most recent advances in the field. Publications from grey literature, such as technical reports, are useful sources of data as well. Including most of the papers that have contributed to the intellectual innovation of a proposal ensure thoroughness and speaks to the proposer's ability to complete the outlined tasks. Before writing a proposal document, an immersion in the literature and copious note-taking are highly recommended. It is also essential to cross-check the in-text citations with the Literature Cited list of references as a final edit of the proposal document.

In-text citations:

Include an in-text citation when you refer to, summarize, paraphrase, or quote from another source. For every in-text citation in your paper, there must be a corresponding entry in your reference list. In-text references should immediately follow the title, word, or phrase to which they are directly relevant, rather than appearing at the end of long clauses or sentences. In-text references should always precede punctuation marks and the APA citation format should be used. APA in-text citation style uses the author's last name and the year of publication, for example: (Field, 2005). For one or two authors, all names are cited; for more than two authors, "et al." (Latin, for "and others") is used after the first authors name. Below are some illustrative examples of using in-text citations.

When the author's name is in parentheses:

"One study found that the most important element in comprehending non-native speech is familiarity with the topic (Gass & Varonis, 1984)."

When the author's name is part of the narrative:

"Gass and Varonis (1984) found that the most important element in comprehending non-native speech is familiarity with the topic."

Separating each work with semi-colons when there are multiple authors cited:

"Research shows that listening to a particular accent improves comprehension of accented speech in general (Gass & Varonis, 1984; Krech-Thomas et al., 2004)."

Literature Cited section:

A **Literature Cited** or **References** section should fully acknowledge all references cited in the document, including grey literature and websites. The following link provides a standardized format for various types of documents that may be encountered and cited in science: https://www.nlm.nih.gov/bsd/uniform_requirements.html.

Timeline



A detailed **Timeline** for the proposed work is a description of the tasks to be undertaken in their appropriate chronological order, along with an estimation of the time needed to accomplish each task. It is a valuable guide, as it demonstrates that the student has discussed the work with his/her committee in enough detail to develop an idea of the time commitment involved. A timeline may be presented as a Gantt chart, as an additional element of the thesis proposal if it is deemed necessary by the student's committee.

Optional Additional Elements

Preliminary Results or Work In Progress



Occasionally, a student may have already begun thesis work prior to the presentation of a proposal. In such cases, there may be **Preliminary Results** or pilot study results that could be presented. Although it is not required that the student present preliminary results, it may be useful to allow comment and feedback from peers and faculty that could improve and guide the work to follow. In such cases, the student may elect to present graphics and/or statistical analyses that supplement written text, presenting these results. In other cases, the student may have begun certain aspects of the work (such as field work), and should describe their progress, to date.

Ethics & Standards

G *Ethics as a foundation.* UOG research is guided by the Research Council, which is responsible for providing advisory services for research-related concerns, including compliance with federal regulations. Misconduct in research refers to fabrication, falsification, plagiarism, mistreatment of research subjects, and other practices “that deviate from those that are commonly accepted within the academic and scientific community for proposing, conducting, exhibiting, or reporting research” (UOG Rules, Regulations and Procedures Manual, 2001).

Students are expected to produce a thesis which is their own original work, thus, a thesis proposal must be authentic and original, with the student as the principal author. However, it is understood that the student's committee comprises a team of advisors and collaborators that may assist the student in various aspects of their work. Other students may also assist in data collection, as field work requires a buddy system for safety purposes. Anyone who assists in any aspect of the work (project conception, data collection, data analysis, logistical support) must be credited and acknowledged. Additional acknowledgements may include other experts in the field who have assisted or advised the project, or who have developed an original protocol or method which is used in the project.

Ethical treatment of humans and animals is guided by UOG's Institutional Review Board (IRB) for human subjects, and by UOG's Institutional Animal Care and Use Committee (IACUC) for vertebrate animal subjects. Research making use of subjects that fall within either category requires the appropriate permit, which must be obtained prior to beginning research. Permitting requires the submission of a proposal to the appropriate board and the approval process can take 1 to 3 months during the school year (the boards do not meet over the summer). This process should be included in the timeline of the proposal, as failure to include it in the research plan can potentially compromise the project. Consult the UOG RRPM for further guidance.

Proposal Preparation

G Pre-Candidates should select their thesis committee as soon as possible, in consultation with the Advisor. Their proposal is presented after the co-approval of research questions and experimental approach by all members of the thesis committee. This requires at least one committee meeting to discuss the research plan. Co-approval should also occur before any substantial field/lab work is conducted, although it is not uncommon for some preliminary or pilot data to be collected early in the process.

The development of a proposal is an iterative process and the product of frequent discussions with the advisor and other prospective committee members. However, the best

use of your committee's time is commenting on the scientific content for which they are subject matter experts, rather than fixing spelling and grammar. Thus, it is customary for the proposal document to be initially edited and approved by the student's thesis committee Chair (Advisor). The student and Advisor should work closely on an outline, suggested background reading, and defining questions and hypotheses. Once the Advisor is comfortable with the document, it is shared with the committee for the next step in the co-approval process. Page 8 provides the template for the title page of the proposal.

The amount and style of input from advisors varies among faculty depending on teaching philosophy. This should be discussed with the Advisor before beginning the proposal to avoid possible conflict over false expectations. Input from committee members should also be negotiated early in proposal development.

Once the proposal has been approved by the committee, the following procedure takes place:

1. Co-approved documents are sent to the Graduate Biology Chair no later than one week (7 days) prior to the oral proposal defense.
2. Oral presentation of the thesis proposal is via a public seminar open to the University community. The presentation should occur within the first 18 months in the program. The oral presentation is done in Powerpoint and should run no longer than 45 mins.
3. The student and thesis committee meet privately after the seminar to discuss any needed changes to the proposed research. Other faculty are welcome to sit in on this meeting, if they choose. The decision is made at that point whether the work should proceed.
4. Upon approval of the proposal by the thesis committee, the committee members sign the Permission for Thesis form.
5. The Graduate Biology Program Chair and Dean of the College of Natural and Applied Sciences sign the Permission for Thesis form and the student attains Candidacy for the M.S. Degree in Biology.
6. The student submits the form to the Graduate School.

Appendix 1: Thesis Proposal Title Page

THESIS TITLE

BY

AUTHOR NAME

**A thesis proposal submitted in partial fulfillment of the
requirements for the degree of**

MASTER OF SCIENCE

IN

BIOLOGY

UNIVERSITY OF GUAM

Date