Revised Guidelines for Writing your MIBO 4960/4970/4980R Research Report

Spring 2020

A major goal of this course is to effectively communicate your scientific findings in writing. A report that describes your research is due at the end of each semester you perform research in the laboratory. This paper should follow the same format as a scientific manuscript and your advisor should be able to supply you with example works. In light of campus research labs closing for the rest of Spring semester 2020, please select one of two modifications to your research report. This report should be reviewed by your research mentor before final electronic submission of .doc or .pdf paper on April 28, 2020, 5:00 PM to Ms. Kim Brown (khbrown@uga.edu)

Your paper should contain the following headers:

Title

Abstract

Introduction  Option 1 – Literature Review included here

Experimental Methods (shorter if Option 1 is chosen)

Results  (shorter if Option 1 is chosen)

Discussion

Option 2 – Proposal of completion

References  (>12 if Option 1 chosen)

Tables

Figures with Figure Legends

-----------------------------------------------------------------------------------------------------------------

Detailed Instructions for Specific Sections

Title and Cover Page – Create a few informative and descriptive titles. A good title can convey the take home message. Select the most appropriate title with advice from your advisor. Include the name(s) of all the contributing authors and the site/department where the work was done. The Cover page should include the following:

- Title of Project
- Name
- Department Where Work Was Performed
- Course
- Instructor
- Date
Abstract – Provide a concise description (less than 300 words) of your research project and findings. Define the scientific problem or hypothesis, principal objective, methodology, results, and conclusions of your study. This section should be clear enough to be readily understood by a general reader with some scientific background. Although this section is first, it is always best to write this section last when your ideas for the rest of the paper have crystalized.

Introduction (2-3 pages, 5 reference minimum) – The introduction is meant to familiarize the reader with the scientific area you are studying. Provide a review of the most relevant literature. The paragraphs should flow from general to specific in terms of importance to your project. Many people begin by describing their model system and its advantages over others. This approach should provide a foundation for describing the overall importance of the specific problem you are addressing. In the final paragraph, state your hypothesis(es) and/or objective(s), and describe the reasoning behind them. Many people end by stating their major, overarching conclusion.

Option 1 Literature Review (4-5 pages; 12 references minimum)
If this is your first semester taking directed research (MIBO 4960R) and/or you have not developed your research project at this point to have significant data to report and discuss, change the Introduction section to a Short Literature Review. A literature review is a survey of a number of scholarly sources related to your research topic. An excerpt from the Royal Literary Fund (rlf.org.uk) explains it best:

- It surveys the literature in your chosen area of study
- It synthesizes the information in that literature into a summary
- It critically analyzes the information gathered by identifying gaps in current knowledge; by showing limitations of theories and points of view; and by formulating areas for further research and reviewing areas of controversy
- It presents the literature in an organized way

A literature review shows your readers that you have an in-depth grasp of your subject; and that you understand where your own research fits into and adds to an existing body of agreed knowledge.

Your final paragraph needs to state your hypothesis(es) and/or objective(s), and to describe the reasoning behind them in relation to the literature review you just outlined.

Experimental Methods – Concisely describe all of the methods used in your study so that another individual could potentially repeat and verify your observations. This section should not be a step-by-step instruction manual unless you have developed a completely new and complex method. Include the names of specialized chemicals, biological materials, and/or other equipment or supplies not typically used by laboratories. Do not include general laboratory supplies and/or equipment. If your project involved the use of buffers and/or solutions, include the final concentrations of all ingredients and final pH (applicable to buffered solutions). If a published procedure was used as a method, provide a brief general description along with a reference to the original procedure. Determining what to include or exclude may not be easy without experience. A good rule of thumb is to ask your peers if they’ve heard of a particular method. If so, you can consider not including detailed descriptions of these methods (i.e. SDS-PAGE, agarose gel electrophoresis, PCR, etc.)
**Results** – Provide an objective view of your results and reserve all data interpretation for the discussion. Refer to figures and tables in numerical order. Use the text to point the reader to the most relevant observations and their essential controls. You may also include results of control experiments and observations that are not presented as part of a formal figure or table. Mark your figures or their legends with appropriate identifying labels for each symbol or abbreviation that was used. Improperly labeled figures are impossible to evaluate. All figures and tables should be placed at the end of the report. The minimum page limit for the report does not include Figures and Tables.

**Discussion (1-2 pages)** – Interpret your findings as they support (or contest) your hypothesis(es) and objective(s). Do not simply restate your results. If you believe that your results are supportive, describe your rationale for this conclusion and describe follow-up experiments that may be necessary. If your results contest your hypothesis, explain possible alternative hypotheses and how you might go about experimentally testing your new hypothesis(es). If your results are inconclusive, describe alternative methodologies that could be used to come to a final conclusion regarding your hypotheses. Keeping in mind that one study will not necessarily answer an overall question, where does your study lead you next? What questions remain? Be creative, and don’t be afraid to speculate.

**Option 2 Proposal for completing research project** (2-3 pages)

If you were well along in your research project and/or you are on a continuation from a previous semester of directed research you may opt for writing a proposal of completion after the Discussion Section.

In your proposal, include the following descriptions:

- The number and types of experiments that could be done hypothetically by you over the rest of the semester assuming you would be working 12 hours per week
- Detail what reagents, equipment, and resources you would need to complete these experiments
- Explain why these experiments would be necessary to help answer the question you are trying to address with your research project

Keep in mind the timeframe of the semester when outlining this proposal as well as what would be available to you in the lab in which you were working.

**References** (5 minimum; >12 for Option 1) – Cite articles that the advisor provides or that you find for yourself that are relevant to your study. Different journals use different formats but for the sake of simplicity, use the “author, date” format, and list referenced articles in alphabetical order at the end of the report. Use only primary literature (original research articles authored by the original investigators) and/or reviews. Do not use a web site or Wikipedia page as a reference! We strongly recommend the use of bibliography software such as EndNote. The UGA library has a site license for EndNote so that it is free to install and use.

**Figures and Tables** – Figures must be numbered consecutively in the order they appear in the text. Do not use raw data as your figures. Graphs should be prepared in a program such as Excel. Figures must contain a figure legend that briefly describes the method(s) used to generate the data. The X and Y axes must be clearly labeled in terms of what was measured and the units used. Unless there is a compelling reason otherwise, for example a logarithmic scale, graphs should begin at zero. When called for, measurements should be made in at least triplicate and have bars indicating standard deviations or another statistical assessment. Tables should have clear and descriptive headers. If the table is complicated, a table legend may be used to describe and define specific features. Photographs of cells should have a scale marker embedded in the image and include a legend that describes the size of the
marker, if it is not embedded in the picture. If the figure includes aligned DNA sequences the use of Courier font is recommended since each letter has an identical width, unlike most other fonts.

**General Formatting Considerations** - Follow the specifications described below:

a. Font – 12 point Arial, Helvetica, Times, or Times New Roman
b. Length – 8 pages, double-spaced (not including figures, tables, reference list, or cover page)
c. Margins – 1 inch (top, bottom, and sides)
d. Page #s – top right or anywhere on the bottom
e. Page Breaks – do not use page breaks between sections!
f. A Header with your name on all pages is highly recommended.