

Thesis format

The Honors program encourages candidates to format their thesis following a journal in their field. Most journal websites will have *Instructions for Authors* that provide detailed formatting guidelines. The thesis should include the following sections with separate headings. Except for the title page, all the text should be double spaced, with a font size of 12. Consult with your research mentor

Title page. The title page should use the template provided by the Honors program and specified by the candidate's college. It should show the title, the student author, and the mentor's name and departmental affiliation. See template at the end of this document.

Abstract. (250 words maximum) The abstract should be on its own, separate page. The abstract should summarize the results and conclusions of the paper, including the broader significance of the research. In the abstract, as well as elsewhere in the thesis, the author should use active voice and the first person singular ("I") -- not the first person plural ("we"), except for those experiments or results that were truly obtained in collaboration with someone else. You may switch to passive voice (e.g. "xxx was measured..." as opposed to "I measured...") only if the authorship has been clearly established in an earlier sentence, usually in the same paragraph by use of "I". Note that the suggested use of the first person singular is in contrast to modern scientific publications, which almost invariably have multiple authors and thus use the first person plural "we".

Introduction. The introduction should state the reason for conducting the research, the nature of the problem and/or hypotheses addressed in the paper, and outline essential background from the field. The introduction should provide enough background for a reader who is knowledgeable in modern biology, but not expert in this particular field, to understand the thesis research and the results. The introduction should explain any field-specific concepts, methodologies, or assumptions necessary to understand why the study was undertaken, and what the objective(s) of the study were (or what hypotheses were being tested). Writing a good introduction usually requires citing perhaps twenty or more published papers. Note that introductions are not comprehensive literature reviews, but rather discuss the most relevant work.

Materials and Methods. This section should explain in detail the source of the starting materials and the experimental design (i.e. how the experiments were done, data were collected, and results were analyzed). Also included in the Materials and Methods should be a paragraph explaining what statistical tests were used to analyze the data and to gauge their statistical significance. This section, which can be placed either after the Introduction and before the Results, or at the end after the Discussion (varies across journals), should be detailed enough so that someone in a different lab but with the same equipment and reagents could repeat the results. Rather than a detailed description of some experimental approaches, papers that fully describe the methods that you used may be cited. However, it is almost always appropriate also to summarize in a couple of sentences the most important methods. For example: "Proteins were purified after expression in *E. coli* as described in ref X. Briefly, after induction of protein expression, lysates were fractionated by ultracentrifugation to remove ribosomes and debris, and then submitted to ion exchange chromatography, with XX assay used to identify the purified protein."

Results. This section is the meat of the thesis. It should be organized with separate headings for the different experiments or measurements that were carried out, perhaps with one or a few paragraphs each. Every paragraph should have an easily understandable topic sentence (usually the first sentence) telling the reader what the paragraph is about. Paragraphs should not be longer than about one page (double spaced).

Discussion. This section may be combined with the Results section (“Results and Discussion”) if this type of presentation makes the data and interpretations easier to follow. The Discussion often is the most challenging to write. Frequently in scientific papers the first short paragraph of this section briefly again summarizes what the Results have shown, but this is not required. The Discussion should not repeat what has already appeared in the text of the Results, but instead should take up the bigger issues raised by the data that are presented. For example: How firm are the interpretations, or what are their limitations? Are other interpretations possible, and if so, what experiments might address this in the future? How do the data and the conclusions fit with other published work? If the results contradict something that was published earlier, how could the contradictions be resolved? At the end of the Discussion, it is often suitable to write a paragraph describing how this work could be continued profitably by others. It will strengthen the thesis if the candidate spends time discussing results with lab members in advance of writing, and/or presents the results in a lab meeting and asks for feedback on the validity of conclusions.

Figures and/or Tables. These present the data collected. As the results are described, the text should refer to each figure or table. Every figure and table must be referred to at least once some place in the text, usually in the Results but perhaps also in the Materials and Methods or Discussion. The order in which the figures are mentioned in the text determines the numbering of the figure. For example, as in journal articles, one cannot refer to “Figure 4” before one has described “Figure 3”. Graphs should have error bars or some other way of indicating statistical significance. Each Figure should have a legend that describes what is in the figure. The legend should include a short sentence about statistics. For example: “Error bars indicate standard deviation from the mean, $N = 6$ ”. In some cases, e.g. pictures such as fluorescence images of a cell, it will be necessary to say that this picture is a representative example of N such pictures that were taken. The pixel size of pictures should be reduced so that they are not unnecessarily large, to keep the megabytes of the thesis to a reasonable value. The figures or tables, with their legends, may be integrated with (interdigitated with) the text, or they may be placed after the text at the end of the thesis. In most journals, figures and tables are provided at the end of the manuscript submission. However, if you choose, you can integrate figures and tables throughout the manuscript if it makes it easier for the reviewers to read.

Acknowledgements. This short paragraph after the Discussion should give credit to those who helped in the research, including financial support, technical support, and intellectual support.

Citations (Bibliography or Reference List). Any of a variety of styles can be used for references, but the list should include all of the authors of every paper (not only the first one or two authors followed by “et al”), the date published, the full title, and of course the journal name, volume and page number. Generally it is best to use a referencing style that is common in journals in which this kind of research would be published. Whatever citation style is used, it should be the same throughout the thesis. It will be highly advantageous to use a reference manager application like EndNote or one of the similar open access applications (Mendeley or Zotero). See [<http://guides.library.cornell.edu/c.php?g=412004&p=2807644>] or the Mann workshops calendar for training sessions. Most theses have approximately two dozen or more citations, although the number may vary a lot depending on the scientific field. One common style for the reference list is that the papers appear alphabetically by first author (e.g. starting with “1. Adamson, . . . , and then “2. Bailey . . .”, etc.) Then the text refers to the paper by its number (e.g. “Cells were grown in DMEM medium as described in [3]”). Another common style is to number the references by the order in which they appear in the text. Still another common style is not to use numbers at all, e.g. “Cells were grown in DMEM medium as described in [Smith et al 2006].” Once you pick the style, the Citation Manager application will do all the formatting for you.

Submission of the thesis. The thesis should be submitted electronically to the honors group leader via Canvas, both as a Word document and as a PDF. If doing thesis by committee also email the thesis to your entire committee. Please use the following convention for naming the files: “LASTNAMEfirstname thesis”, for example: “SMITHjudy thesis”. Using this convention facilitates any manual sorting of the theses. If the file size is too large for Cornell email, please use Cornell DropBox. The final version of thesis, after making revisions suggested by reviewers, should be submitted to the honors Canvas site as a Turnitin.

Contribution of others to the thesis. Theses authored by more than one student are not acceptable. The thesis may include some figures or tables or diagrams from other people’s work (either published or unpublished), if the purpose is clarity of presentation of the student’s own results. But in each such case it is critically important to write an attribution in the legend, i.e. who is the author of the data and where was this published, e.g. “This figure is reproduced from Figure 2 [or perhaps ‘modified from Figure 2’] in reference 6”; or “This diagram was modified from one drawn by Nancy Smith”; or “This experiment was done by Paul Jones”; or “These data were obtained with help from Paul Jones”.

HELPFUL RESOURCES

Research in the Biological and Life Sciences: A Guide for Undergraduates-this guide is newly designed for Biology by Mann Library Life Sciences Librarians for Research.

Mann Library Training Workshops-Topics include Citation Management Software (Mendeley, Endnote, Zotero), Excel, Data Management, Advanced Searching in PubMed and Web of Science, Poster-making.

Statistical Resources-<http://mannlib.cornell.edu/equipmentsoftware/software/statistical-resources>.
Individual consultations available to address your data analysis needs.

Mann Library Individual Research Consultations.

Plagiarism and Copyright, Mann Library Guide (referenced above).

Recognizing and Avoiding Plagiarism, Cornell College of Arts & Sciences.

Honors Thesis General Formatting

8.5 x 11 inch pages with 1 inch margin on left side and sensible page numbering.

Title Page:

The title of each honors thesis should include the following items, centered from side to side and spaced on full page:

Thesis Title

Honors Thesis
Presented to the College of Agriculture and Life Sciences (or Arts and Sciences),
Cornell University
in Partial Fulfillment of the Requirements for the
Biological Sciences Honors Program

by

[**author's name**, *Note: the author's name should appear as it does in the university's official records.*]

[**date**, e.g., May 2020]

[**research faculty mentor name**]