A Student’s Guide to the Honor’s Program of the Department of Biological Sciences at the University of Mary Washington
Preface

Whether a student becomes a teacher, a hospital administrator, a physician, a laboratory technician, or a basic scientist, the undergraduate scientific research experience offers benefits to the student that go well beyond that of traditional coursework. By focusing on an original scientific question or problem, the scientific research experience promotes creative and analytical thinking, and because the ultimate goal of a research project is to uncover new information, the research process helps students better understand how to ask scientific questions, how to recognize scientific problems and how to develop new scientific ideas. The scientific research process requires students to apply their understanding of the natural world and integrate complex but interrelated information, promoting a better understanding of the complex way in which the natural world works. Thus, undergraduate research is an integral part of the curriculum of The Department of Biological Sciences at the University of Mary Washington.

Undergraduate research in the Department of Biological Sciences happens in several contexts. While most courses in the Department’s curriculum incorporate elements of the research process, such as creating hypotheses, making predictions, collecting data and drawing conclusions, into student assignments, two courses are designed specifically to engage students in research work. URES 197 (Undergraduate Research) is a course in which students complete basic research tasks usually connected to a faculty member’s research work. Students can undertake more-advanced independent research projects under the supervision of a department faculty member by enrolling in Biol 491, Special Problems in Biology. In addition to these courses, select students can engage in summer research projects as part of the Summer Science Institute, a 10-week summertime research experience involving the natural sciences departments, Math, and Computer Science.

The most challenging and potentially most rewarding research opportunity in the Department of Biological Sciences is Honors research. The Departmental Honors Research Program is designed to lead the undergraduate researcher through a true, complete research project, from the development of an original research question and the drafting of a formal research proposal, through the collection and analysis of data, to drawing formal conclusions that add new knowledge to our understanding of the biological world. The Honors student is required to write a formal thesis, a copy of which is held in the library’s collection, and deliver an oral presentation to department faculty and other interested parties.

A student interested in participating in the Honors program should consider the program’s eligibility and acceptance criteria and understand the requirements of the
program (see below). They need to seek out a department faculty member who would be interested in taking them on as an Honors research student. Then, they must enroll in Biology 481, *Readings in the Biological Sciences*, a course designed to introduce the student to the research topic and through which the student, in consultation with and guidance by that faculty member, will develop an original research question and design a viable research project.

Like the professional scientist, prospective Honors students must consider some very practical issues when developing a viable research project. For example, is the cost of doing the project reasonable? Are the tools and equipment required to complete the project available? Can the laboratory and/or field skills required by the project be learned? Can the research work and thesis writing be completed within the Honors research timeline? Can the student commit the time and effort needed to complete the project?

The requirements for Honors research are stringent and the work-load is demanding. Students who seek out this level of undergraduate education are usually those that look forward to the challenges and are exhilarated by the experience. In the final outcome, those who complete the program, no matter what their future profession, attain a level of understanding of the biological world, develop a set of research skills and experience a sense of satisfaction beyond that typically gained from non-Honors research.
Introduction

The Honors Research Program of the Department of Biological Sciences (Departmental Honors) is a research-intensive program designed to offer a special set of opportunities and challenges to students who have demonstrated the ability to master complex biological concepts, think analytically and are likely to successfully engage in an independent research environment.

The program’s principle activity is a senior-level research project completed in fulfillment of the requirements of two semesters of Biol 491 to be taken during the Honors student’s final two 15-week semesters as an enrolled biology major at UMW.

Program Overview

For acceptance into the program, a student must:

1) meet specific eligibility requirements (described below),

2) satisfactorily complete Biol 481 (as a prerequisite for Biol 491), and

3) submit to the Proposal Review Committee an Honors Program Application and an Honors Research Proposal that meets the requirements described below.

Once accepted into the program, a three-member Research Review Committee will be established to oversee the student’s progress through the program.

To successfully complete the requirements of the program, students accepted into the program must:

1) successfully complete the research project,

2) successfully fulfill any other requirements set forth in Biol 491

3) write an Honors Thesis that meets the requirements described below,

4) deliver an oral Honors Presentation to the Department faculty, and

5) have a 3.00 overall UMW cumulative GPA and a 3.25 cumulative GPA in the Biology major at graduation.
**Student Eligibility & Acceptance Criteria**

For acceptance into the Honors Program, a student must meet the following eligibility requirements.

1) A student must be a junior-level biology major.
   - Issues of eligibility of transfer students will be taken up by the department faculty on a case-by-case basis.
   - Students who have selected biology as a minor are NOT eligible. They should seek an Honors program in their major.
   - Students who have a special major and whose research advisor is a member of the biology faculty ARE eligible.

2) A student must have a 3.00 overall UMW cumulative GPA and a 3.25 cumulative GPA in the Biology Major at the beginning of their final two 15-week semesters at UMW. A student must maintain these GPAs at graduation.
   - GPA calculations exclude Biol 481 and Biol 491.
   - The GPA of transfer students will be examined at the time the transfer student’s eligibility is taken up by the Department faculty.

3) A student must have satisfactorily completed Biol 481
   - Biol 481 is a prerequisite for Biol 491.
   - Students co-enrolled in Biol 481 and Biol 491 in the first semester of their senior year are eligible as long as they submit the Honors Program Application and Honors Research Proposal by the deadline specified below.

4) A student must submit an Honors Program Application and an Honors Research Proposal (one paper copy and one electronic copy) to the Proposal Review Committee. Appendix A is a copy of the Honors Program Application. Appendix B describes the requirements for the Honors Research proposal.

**The Honors Program Application and Honors Research Proposal**

An Honors Program Application and Honors Research Proposal must be submitted to the Proposal Review Committee prior to the start of the student’s final two 15-week semesters at UMW and according to the following dates:

- **Fall semester** – July 15th
- **Spring semester** – November 30th
- **Summer semester** – April 5th.
If you plan to request honor research status, it is in your best interest to submit your proposal for Honors review before you start your research. The Honors Proposal Review Committee may provide comments that improve your research plans. But, in addition, an Honors proposal submitted after you begin your research can be rejected.

The Honors Program Application is provided in Appendix A of this document. The application will provide a list of the Biology Major Courses completed by the student and course grades, the student’s current overall UMW GPA and Biology Major GPA, and signatures of the student, the student’s Honors research advisor, and the Proposal Review Committee chair.

The Honors Research Proposal is the document that formally describes the Honors research project to be pursued in partial fulfillment of the requirements for Honors. The proposal must be a well-written document that clearly and concisely describes the research to be done. Moreover, the research idea expressed in the proposal must have a reasonable / acceptable degree of originality. That is, the research idea must aim to contribute new information to the field. This does not mean the research idea must be an original idea of the student. Rather, it is understood that the idea will likely be developed through collaboration of the student and his / her research mentor. In addition, the requirement for originality does not mean the research cannot be part of a team project. On the contrary, the proposed research idea can be a part of a larger project involving other investigators, as long as the individual student’s project has unique and specific objectives.

The proposal must include these sections (details are given in Appendix B): a problem statement or hypothesis, objectives, a literature-based rationale, expected results, a description of experimental design, literature cited, and budget.

The Proposal Review Committee will review the proposal and report to the student prior to the first day of classes for the next semester. Acceptance will be based on student eligibility and criteria for a satisfactory research proposal described above. There are three possible outcomes of eligibility and proposal review:

1) Accepted. The student meets all eligibility requirements and the proposal is deemed satisfactory. The project has a reasonable chance of being completed during the coming academic year. The student is accepted into the Honors program and Honors research could begin immediately. The student should work with his / her research advisor to assemble a Research Review Committee.

2) Provisional Acceptance. The student meets all eligibility requirements but revisions need to be made to the proposal. The project has a reasonable chance of being completed during the coming academic year. The student is accepted into the Honors program and Honors research could begin immediately, but the student needs to submit a revised proposal within 4
weeks or lose Honors status. The student should work with his / her research advisor to assemble a Research Review Committee.

3) Rejected. An Honors request can be rejected for any of the following reasons. The student does not meet all eligibility requirements. The project does not have a reasonable chance of being completed during the coming academic year. The proposal for research does not and cannot meet the expectation for Honors Biology research. Any rejected proposal will be returned with significant comments. If it is possible for a student to address satisfactorily address these comments, a new proposal can still be submitted.

**Honors Research Community**

Each biology Honors student will register for Special Problems in Biology (Biol 491) for at least two semesters, typically the two semesters of senior year. Ten weeks of full time research during the summer will substitute for one fifteen week semester of Biol 491. During the last semester of Honors research (i.e. the spring semester of senior year), each Honors research student will participate in an Honors research colloquium. This colloquium is designed to improve each student’s research and his / her development as a scientist. Generally speaking the goal of these meetings is to create a community of undergraduate researchers akin to the research community in any research laboratory or work place. This community is meant to provide support and critical feedback for each researcher. Practically speaking the community and meetings will help Honors researchers keep abreast of research requirements during the final semester of their project. The objective of these meetings is for all researchers to 1) discuss research problems and solutions, 2) present preliminary and / or final results, 3) discuss interpretation of data, and 4) present and discuss writing progress.

In addition to Honors researchers, all department independent researchers will be invited to participate in this research colloquium. All researchers and at least one faculty mentor will meet at least every 2 weeks during the semester. The objective of the first meeting, during the first week of the semester, will be to plan the schedule and colloquium objectives for the rest of the semester.

**Completing Honors Research**

A research project, in general, is considered complete when concepts, results, and conclusions are reported to the science community. The written record of Honors research (i.e. Honors thesis) will be due before the last day of finals before graduation. Each Honors thesis will conform to the format described and outlined in Appendix C and it must be signed by all members of the Honors Research Review Committee.

Each Honors researcher will also report his / her research in an oral presentation open to the public. The public presentation on the Honors student’s research and the biological concepts pertinent to his / her research will be scheduled sometime before or
during exam week. At the discretion of the student’s committee, the committee may ask the student questions after the public presentation.

The deadline for notifying the Office of Student Records of recipients of Departmental Honors is the last day of exams of the semester in which the student graduates. The student's adviser shall notify the department chairperson of the research review committee’s decision in time that a letter can be written to the Office of Student Records. The student must prepare 2 copies of his / her final thesis with original signatures on each copy. The student must submit these copies to the department Chair by the last day of final exams.

Departmental Honors are noted at the top of each Honors student’s transcript. Each student that earns Departmental Honors will receive a certificate with his / her diploma. The certificate states:

\[
\text{UNIVERSITY OF MARY WASHINGTON} \\
\text{confers} \\
\text{Departmental Honors} \\
\text{in Biological Sciences upon} \\
\text{Student’s name} \\
\text{for distinguished scholarship in the major program at the University of Mary Washington.} \\
\text{Given at Commencement in Fredericksburg, Virginia, the eighth day of May, two thousand ten.}
\]
Honors Research Timeline / Deadlines

- Honors Research Application and Research Proposal due to department chair no later than July 15 during the summer prior to the student’s last two semesters before graduation.

- Check point 1 due the last week of the fall semester before graduation.

- Check point 2 due before spring break during the last semester before graduation.

- Completed, draft copy of thesis to research mentor / advisor 18 business days before oral presentation / thesis defense.

- Mark-up copy of thesis to student 14 business days before oral presentation / thesis defense.

- Completed, draft copy of thesis to each committee member 10 business days before oral presentation / thesis defense.

- Mark-up copies of thesis to student 5 business days before oral presentation / thesis defense.

- Completed, edited copy of thesis to each committee member 24 hours before oral presentation / thesis defense.

- Oral presentation scheduled on or before the next to last day of finals of the semester in which the student graduates. Final mark-up copy of thesis back to student.

- Final signed copy of thesis due to department chair by noon on the last day of finals of the semester in which the student graduates.
Program Administration

The Proposal Review Committee

The Department will have a Proposal Review Committee that reads, evaluates and makes decisions on approving Honors research proposals.

- The committee will have five members, three of which will be tenured faculty. Committee membership will be open to faculty eligible to supervise Honors research. Each member would have a 2-year term. Members will rotate through so the composition of the committee gains new members every year.

- A member of the committee whose own student has submitted an Honors proposal will be excluded from consideration of that Honors research proposal. The four remaining members of the proposal review committee will deliberate and decide. In the case of a tie vote, the Department Chair will be called in to break the tie.

- The Proposal Review Committee Chair will be selected from the tenured members of the committee and will have a 1-year term.

The Work of the Proposal Review Committee:

- Each year, eligible students will apply for admittance to the Honors Program by submitting an Honors Program Application Form (Appendix A) and an Honors Research Proposal to the chair of the committee no later than
  - Fall semester – July 15th
  - Spring semester – November 30th
  - Summer semester – April 5th.

- The Committee Chair will verify GPA calculations for each Honors research applicant.

- The Committee Chair will distribute the applications and proposals to the committee members for review. After review, the committee will meet to decide on acceptance. Acceptance will be based on the eligibility requirements and criteria for a satisfactory research proposal. Students will be notified of the committee decision prior to the first day of classes in the upcoming semester.

- The Committee Chair will compile a folder (Honors research folder) for each Honors student that includes research application, research proposal, and a record of any committee work about students’ research.

Three possible outcomes to the committee’s proposal review:

- Accepted. The student meets all eligibility requirements and the proposal is deemed satisfactory. The project has a reasonable chance of being
completed during the coming academic year. The student is accepted into the Honors program and Honors research could begin immediately.

- Provisionally Accepted. The student meets all eligibility requirements but revisions need to be made to the proposal. The project has a reasonable chance of being completed during the coming academic year. The student is accepted into the Honors program and Honors research could begin immediately, but the student needs to submit a revised proposal within 4 weeks or lose Honors status.

- Rejected. An Honors application can be rejected for any of the following reasons. The proposal for research does not and cannot meet the expectation for Honors Biology research. The student does not meet all eligibility requirements. The project does not have a reasonable chance of being completed during the coming academic year.

Upon acceptance, the Proposal Review Committee Chair will establish a 3-member Research Review Committee for each Honors student, which will include the student’s research advisor plus two others. The other two members of the committee will be determined after consultation with the research advisor, student, and faculty. In the case of interdisciplinary or collaborative research, more members will be added to the Research Review Committee. Committee members may be drawn from outside the department. No one faculty member should be on too many research review committees.

The Research Review Committee

The research advisor is responsible for overseeing the week-to-week progress of the student in terms of the research project and thesis preparation. The responsibilities of the Research Review Committee will be to oversee:

- The progress of the Honors student’s research to make sure satisfactory progress is being made. This would be done according to a specified schedule (see progress checklist in Appendix D).

- To oversee thesis writing.

The committee will check the progress of research at, at least, two points during an Honors student’s research. This is based on a 1 year (fall, spring) research study:

- Check point one: End of the Fall semester. The committee will meet with the student and review research progress. Student should expect to present information on his / her project to date. If satisfactory progress is not being made, the committee will specify what must be done by the second progress check. The kinds of questions each Honors researcher should expect to
The possible outcomes of check point one:

- All members of committee agree that progress is adequate
- At least one member of the committee believes that progress of research is not adequate, but all members can agree on actions that must be completed before the next check point.
- At least one member of the committee believes that the progress of the project suggests that research cannot be completed by spring semester deadlines. Any disagreement among committee members will be arbitrated by the proposal review committee chair.
- All members of the committee agree the project cannot be completed by spring deadlines for Honors and so, Department Honors will not be granted. The student will complete the project as independent research (Biol 491).

The research review committee will send a report on the checkpoint outcome to the proposal review committee chair for inclusion in the student’s honors research file.

Check point two: Spring break. The committee will meet with the student and review research progress. If satisfactory progress has not been made, the student will not be granted Department Honors and the student will complete the project as independent research (Biol 491). At this check point, the student should have completed all/most of his / her research and have some written material for review. Students who still have significant research to complete at spring break will not have sufficient time to analyze data and complete a satisfactory thesis. One committee member should record discussions of research progress, committee advice, and any requirements of the committee for the student. This record will be kept in the student’s Honors research folder.

Possible outcomes of check point two:

- All members of committee agree that progress is adequate
- At least one member of the committee believes that progress of research is not adequate, but all members can agree on actions that must be completed before the final thesis draft.
- At least one member of the committee believes that current state of project suggests that research and writing cannot be completed by final thesis draft deadlines. Any disagreement among committee members will be arbitrated by proposal review committee chair.
- All member of the committee agree the project cannot be completed by final thesis draft deadlines and so, Department Honors will not be granted.
The research review committee will send a report on the checkpoint outcome to the proposal review committee chair for inclusion in the student’s honors research file.

Honors Defense

The Honors defense will be scheduled on or before the next to last day of finals of the semester in which the student graduates. The student and faculty advisor, in consultation with all members of the research review committee, will set the date and time for the defense. We recognize that exam week schedules are full and conflicts arise between individual faculty and Honors defense presentations. As a department we agree that all faculty will make every effort to attend and participate in all Honors presentations. The department chair will provide funds for snacks and drinks during each Honors defense. The proposal review committee chair will arrange for snacks and drinks.

Honors Program Evaluation

Each faculty member who reads an Honors thesis or who attends an Honors defense will be given an anonymous questionnaire. The purpose of this questionnaire is to evaluate whether or not our Department Honors Research Program meets our stated expectations. The results of this questionnaire are not designed to evaluate individual students’ research.

The questionnaire first will describe the department’s expectations. Second, the questionnaire will ask:
1) Based on department expectations, was this project worthy of Department Honors?
2) Did the student appear knowledgeable about the project’s concepts, procedures, results, and interpretations during his / her oral presentation?
Appendix A

APPLICATION FOR DEPARTMENTAL HONORS
UNIVERSITY OF MARY WASHINGTON
DEPARTMENT OF BIOLOGICAL SCIENCES

This form AND one copy of a research proposal must be submitted to the research proposal committee chair no later than July 15 prior to the last two semesters of student’s senior year.

First, middle, and last name:__________________________________________

Email:__________________________________________
Phone:__________________________________________
Campus Address:__________________________________

Overall GPA (3.0 required):____________

List Courses taken in the major, grade assigned and Major GPA calculation. Consult current UMW catalog for courses included in the major. These calculations should not include Biol481 or 491.
(3.25 required)

Title of proposed project:

I hereby request admission to Honors study in the Department of Biological Sciences during the following semesters:

<table>
<thead>
<tr>
<th>Student</th>
<th>Student Signature</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Honors Advisor</td>
<td>Honors Advisor Signature</td>
<td>Date</td>
</tr>
<tr>
<td>Proposal Review Committee Chair</td>
<td>Department Chair Signature</td>
<td>Date</td>
</tr>
</tbody>
</table>
Appendix B

Honors Research Proposal: Content and Form

Section 1: Statement of Problem or Hypothesis

The research idea expressed in the proposal must be well thought-out and stated in the form of a problem or issue to be addressed, a question to be answered or an hypothesis to be tested. Methods projects, i.e., projects designed to develop a workable scientific protocol or procedure, are acceptable, as long as the research idea is stated as described here. This section should be short. It should contain a brief statement that puts the problem in context of its importance or significance and a brief statement of the problem to be answered or the hypothesis to be tested.

Section 2: Specific Objectives

The specific objectives must be clearly stated, must be unique to the project and must stand on their own, i.e., they must not depend on the work of others to be completed. Be sure to explicitly state what is unique about the proposed research.

Section 3: Literature-based Rationale

A sensible, clearly-written rationale, based on previous work reported in the literature, must be used to support the specific objectives of the proposal. If section 1 does not explicitly state a hypothesis, the rationale must describe the reasoning leading to expected results or predictions.

Section 4: Expected Results or Predictions

Specific objectives will always suggest a specific set of measurable results. A hypothesis driven project will always generate a measurable prediction or predictions. Expected results or predictions must be included in order to judge a student’s ability to reach his/her objectives. In each prediction you state, use the words of the variables you will create and measure and include units for your variables.

Section 5: Experimental Design and Analysis

A concise description of the experimental design of the experiment, including a description of experimental groups, controls, numbers of replicate samples, etc. must be included here. Include a statement of the statistical analyses to be performed and why these analyses are appropriate. Experimental design and analysis must clearly answer the question described by the author and it must conform to the standards of scientific method appropriate for the field of study. Experimental design should restate the measurable variables with their units. Experimental design should NOT include a step-by-step explanation of protocols.
Section 6: Literature Cited


Section 7: Budget

Honors Research Proposal: Some Style Standards

In-text citations
- In-text citations must take the form: (Author date). For example:
  - Fox (1978) investigated the effects of hormones on the nest-building behavior of catbirds.
  - Hormones are known to influence the nest-building behavior of catbirds (Fox 1978).
- Multiple citations should be listed by year of publication, earliest first: (Author date; Author date).
- Use the first author's name and "et al." for in-text citation of works with more than two authors or editors (Author et al. date); list every author or editor in the "End References" list unless there are more than 10 authors.
- All works cited in the text must be listed alphabetically by the last name of the first author in End References; works not cited must not be listed.
- Provide the full names of all journals, do not abbreviate.

Some Examples for Literature Cited:

Personal communications, unpublished data, and manuscripts in preparation should be cited in the text. The citation should include the source's name and affiliation in the following form: (Henry J. Smurd, university or other affiliation, city, state, personal communication). Letters should be available from authors of personal communications giving permission to cite the unpublished data.

Journal article: (do not capitalize titles of journal articles)


Book: (book titles are in capitals)
Chapter in book

Technical report

Meeting paper

Dissertations and Theses: (note distinction between dissertation & master’s thesis)


Online article

Appendix C

Honors Thesis: Content and Form

THESIS CONTENT

Scientific research is a group activity. Individual scientists perform experiments to test hypotheses about biological phenomena. After their experiments are completed and duplicated, these researchers attempt to persuade others to accept or reject their hypotheses. The scientific paper is the vehicle of persuasion and an archival record for future generations. When it is published, it is available to other scientists for review. If the results stand up to criticism, they become part of the accepted body of scientific knowledge unless later disproved.

A scientific report usually consists of the following:
- Title
- Abstract
- Introduction
- Materials and Methods
- Results
- Discussion
- Acknowledgments
- End References or Literature Cited

There is general agreement among scientists that each section of the report should contain specific types of information.

Title
The title should reflect the factual content of the paper. Scientific titles are not designed to catch the reader's fancy. A good title is straightforward and uses key words from the paper.

Abstract
The purpose of an abstract is to allow the reader to judge whether it would serve his or her purposes to read the entire report. A good abstract is a concise (100 to 250 words) summary of the purpose of the report, the data presented, and the author's major results and conclusions. Write the abstract after completing the rest of the report, even though the abstract comes just after the title. The abstract should not contain images or reference citations.

Introduction
The introduction defines the subject of the report. It must outline the scientific purpose(s) or objective(s) for the research performed and give the reader sufficient background to understand the rest of the report and what has been done previously. Care should be taken to limit the background to whatever is pertinent to the experiment. A good introduction will answer several questions, including the following:
- Why was this study performed? Answers to this question may be derived from observations of nature or from the literature.
- What knowledge already exists about this subject? The answer to this question must review the literature, showing the historical development of an idea and including the confirmations, conflicts, and gaps in existing knowledge.
- What is the specific purpose of the study?
- How is this study different from past studies?
- The specific hypotheses should be described.

**Materials and Methods**
As the name implies, the materials and methods used in the experiments should be reported in this section. The difficulty in writing this section is to provide enough detail for the reader to understand the experiment without overwhelming him or her. When procedures from a lab book or another report are followed exactly, simply cite the work, noting that details can be found in that particular source. Materials used in the study should be described in the text of this section and not presented in a list. However, it is still necessary to describe special pieces of equipment and the general theory of the assays used. This can usually be done in a short paragraph, possibly along with a drawing of the experimental apparatus. Generally, this section attempts to answer the following questions:
- What materials were used?
- How were they used?
- Where and when was the work done? (This question is most important in field studies.)

**Results**
The results section should summarize the data from the experiments without discussing their implications. The data should be organized into tables, figures, graphs, photographs, and so on. But data included in a table should not be duplicated in a figure.

This section of your report should enable the reader to develop an appreciation of the general trends in your data and the degree of variability in your results. Concentrate on general trends and differences and not on trivial details. Many authors organize and write the results section before the rest of the report.

**Discussion**
In the discussion section, the data collected are interpreted in relation to the hypotheses or purposes proposed in the introduction. Your findings should be related to existing knowledge on the topic. You should also be able to suggest future experiments that might clarify areas of doubt in your results.

This section should not just be a restatement of the results, but should stress interpretation of the data, relating it to existing theory and knowledge. Speculation is appropriate if it is so identified. Suggestions for the improvement of techniques or experimental design may also be included here. In writing this section, you should explain the logic that allows you to accept or reject your original hypotheses.
Acknowledgments
In this section, the writer gives credit for special assistance received from other sources. Stating specifically what assistance was provided (e.g. someone who ran statistical analysis, someone who injected animals, etc.).

End References or Literature Cited
All references must be properly cited in the paper. When information belongs to others, they must be given proper credit. Failure to do so is plagiarism.

The literature cited is a list of all books, publications, and communications from which significant materials were cited in the paper.

- The listing is alphabetical by the last name of the first author of a citation.
- In general web site sources as literature citations are unacceptable. Computer sources should be archived (files, databases, books, etc. which are available for inspection but are put on-line for easy access and convenience) or refereed on-line journals.

THESIS FORM
The following presents a style guide for the preparation of the Honors Thesis. These guidelines are to be strictly followed.

Typing

- Use double-spacing throughout all text. Single spacing may be used in tables, figure captions and each reference citation (double space between individual citations). Print on one side only of 81/2 x 11-inch white paper.
- There shall be no more than twelve characters per inch for monospaced fonts. If a word processor is used, choose 12 point font size using one of the following print fonts - Helvetica, Times New Roman, Courier, or Geneva.
- Do not use a font larger than 14 point for the title, text or text sections.
- Do not change font size. A change of typeface is acceptable for some cases of emphasis.
- Margins shall be not less than 1 inch (2.5 cm) on top, right, and bottom sides and 1.25 inches on the left side of all pages INCLUDING appendices.
- Dot matrix printers are acceptable if letter quality type is used. Do not use draft mode. All copies must be dark enough to photocopy.

General style

- Even though some journals accept first person writing, we prefer that you do not. Avoid using the first person, I or we, in writing. Keep your writing impersonal, in the third person. Instead of saying, "we weighed the frogs and put them in a glass jar," write, "the frogs were weighed and put in a glass jar."
- All scientific names (Genus and species) must be italicized (e.g., *Aeschynomene virginica*).
Use the metric system of measurements.

Be aware that the word *data* is plural while *datum* is singular. This affects the choice of a correct verb. The word "species" is used both as a singular and as a plural.

Numbers should be written as numerals when they are greater than ten or when they are associated with measurements; for example, 6 mm or 2 g, but *two* explanations or *six* factors. When a list includes numbers over and under ten, all numbers in the list may be expressed as numerals; for example, 17 sunfish, 13 bass, and 2 trout. Never start a sentence with numerals. Spell out all numbers that beginning sentences.

Be sure to divide paragraphs correctly and to use starting or ending sentences that indicate the purpose of the paragraph. A report or a section of a report should not be one long paragraph.

Every sentence must have a subject and a verb.

Avoid the use of slang and the overuse of contractions.

Be consistent in the use of tense throughout a paragraph—do not switch between past and present.

Be sure that pronouns refer to antecedents. For example, in the statement "Sometimes *Cecropia* caterpillars are in cherry trees but they are hard to find," does "they" refer to caterpillars or trees?

After writing a report, read it over, watching especially for lack of precision, in your results and ambiguity, in general. Each sentence should present a clear message. The following examples illustrate lack of precision:

- “There may have been an error in our temperature measurements.”
- “The sample was incubated in mixture A minus B plus C.” Does the mixture lack both B and C or lack B and contain C?
- The title "Protection against Carcinogenesis by Antioxidants" leaves the reader wondering whether antioxidants protect from or cause cancer.
- “The vole population was relatively large in the field near the preserve.” "Relative" statements must always include a clear comparison. For example, “the vole population in the field near the preserve was large relative to the average population size of all fields.”

The only way to prevent such errors is to read and think about what you write. Learn to reread and edit your work.

**Symbols, acronyms, spelling and measurement**

Define all symbols and spell out all acronyms the first time they are used.

All weights and measures must be in the metric system, SI units. Abbreviations may be used for units of weight or measurement that describe data.

Consult *The CBE Manual for Authors, Editors, and Publishers*. Chicago (IL): Council of Biology Editors (1994 or more recent), for conventions and examples of table style, abbreviations, symbols, etc. For spelling, consult *The American Heritage Dictionary of the English Language* (Soukhanov 1992 or more recent).

**Figures**

“Figures” refers to graphs, maps, illustrations, original art, drawings, or pictorial models.
All figures **should be able to stand alone**, i.e., figures have a descriptive title, caption, and legend explaining any symbols, abbreviations, or special methods used. The title and caption belong below the figure.

Figures should be numbered separately and should be referred to in the text by number. The numbers should be in order as they appear in the text. For example, do not refer to Figure 2 before you refer to Figure 1. Note that when referring to a figure the word or “Figure” is capitalized.

If tables or figures are printed in Landscape mode the bottom of the table (figure) should be to the right side of the page (binding is on the left side).

Black-and-white figures, photographs, maps, line drawings, and graphs must be high quality, camera-ready, black-and-white prints, photostats, or original art. If submitted as a file, the resolution must be 300 dpi or greater. When labeling figures, make sure to use large enough letters so that they will be no smaller than 12 points. In drawings and graphs, capitalize only the first letter of the first word of each label; use a typeface without bold or italics (unless genus, species, or gene names).

All figures and images must be within the typing area of the paper. They may be any size, but under no circumstances may they extend into the margin.

Generally a graph is superior to a table when you are more concerned about the “shape” of the data, for example, how concentration of glucose in the bloodstream changes over time.

By convention the independent variable belongs on the X-axis.

Remember the data you graph may be subject to more than one interpretation. You can bring out, hide, exaggerate, or misrepresent the message carried by a given set of data by the way you choose to draw the graph.

**Tables**

- Do not use a table for a small amount of data that can be easily listed in the text.
- The table title and caption should allow the table to stand by itself without additional explanation. The title and caption belongs at the top of the table.
- Each column must have a descriptive heading. Lower case letters should be used to indicate table footnotes.
- Tables generally do not include vertical lines or horizontal lines other than the lines setting off the column headings from the body of the table and the line at the end of the table (note example below).
- Numbers in columns are properly aligned (note last two columns below).
Table 3. Growth rate of cell cultures and activity of ornithine decarboxylase (ODC) and succinate dehydrogenase (SDH) in *Pseudomonas aeruginosa* in response to various carbon sources.

<table>
<thead>
<tr>
<th>Carbon source</th>
<th>Growth rate (generations/h)</th>
<th>Enzyme activity</th>
<th>SDH (mmol fumarate/h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose</td>
<td>0.93</td>
<td>ODC (μmol CO$_2$/h)</td>
<td>12.6</td>
</tr>
<tr>
<td>Sucrose</td>
<td>0.21</td>
<td></td>
<td>6.9</td>
</tr>
<tr>
<td>Mannitol</td>
<td>0.47</td>
<td></td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>50.9</td>
</tr>
</tbody>
</table>

**In-text citations**
- In-text citations must take the form: (Author date). For example:
  - Fox (1978) investigated the effects of hormones on the nest-building behavior of catbirds.
  - Hormones are known to influence the nest-building behavior of catbirds (Fox 1978).
- Multiple citations should be listed by year of publication, earliest first: (Author date; Author date).
- Use the first author's name and "et al." for in-text citation of works with more than two authors or editors (Author et al. date); list every author or editor in the "End References" list unless there are more than 10 authors.
- All works cited in the text must be listed alphabetically by the last name of the first author in End References; works not cited must not be listed.
- Provide the full names of all journals, do not abbreviate.

**Some Examples for End References or Literature Cited:**
**Personal communications, unpublished data, and manuscripts in preparation** should be cited in the text. The citation should include the source's name and affiliation in the following form: (Henry J. Smurd, university or other affiliation, city, state, personal communication). Letters should be available from authors of personal communications giving permission to cite the unpublished data.

**Journal article:** (use sentence capitalization for journal article titles; journal titles require standard title capitalization)

**Book:** (book titles use standard title capitalization)

**Chapter in book**

**Technical report**

**Meeting paper**

**Dissertations and Theses** (note distinction between dissertation & master’s thesis)


**Online article**


**Appendix / Appendices**
This section contains raw data too lengthy to include in the results section of the text but important for an understanding of the entire paper.

The appendix could include data tables, graphs, charts, illustrations, and pictures.
All materials in this section must meet the same style requirements as the text of the paper.
SAMPLE OF THESIS TITLE PAGE:

TITLE

by

name in full

Thesis

Submitted in partial fulfillment of the requirements for Honors in Biology at the University of Mary Washington

Fredericksburg, Virginia

Date
SAMPLE OF SECOND PAGE - SIGNATURE PAGE:

This Thesis by (type name in full) is accepted in its present form as satisfying the thesis requirement for Honors in Biology.

Date: ___________________________ Approved: ___________________________

Signature

(type advisor name)
(Chairman of Honors Committee)

Signature

(type committee member name)
(Title)

Signature

(type committee member name)
(Title)
Sequence of manuscript and page numbering:

Title Page – See sample. In the thesis, this page is not numbered.

Second Page - See sample. This page is for approval signatures of the Honors Committee members. It should be numbered "ii".

Third Page - For the curriculum vitae, this page should include biography of the student (date and place of birth, institutions attended, degree and Honors received). It should be numbered "iii".

Fourth Page - Acknowledgement(s). This page should be numbered "iv".

Fifth Page - The Abstract. This page should be numbered "v".

Sixth Page - Table of Contents. It should be numbered "vi".

Thesis Proper - Arabic numbers are to be given to all pages including illustrations.

Literature Cited - The pagination should follow that of the thesis proper.

Appendices – The pagination should follow that of the literature cited.
## Checklist for Departmental Honors

**University of Mary Washington**
**Department of Biological Sciences**

<table>
<thead>
<tr>
<th>Date Completed</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>__________</td>
<td>Satisfactory completion of Biol 481</td>
</tr>
</tbody>
</table>
| __________     | Submit application for Honors no later than the following dates.  
|                | • Fall semester – July 15<sup>th</sup>  
|                | • Spring semester – November 30<sup>th</sup>  
|                | • Summer semester – April 5<sup>th</sup> |
| __________     | 2 semesters of Biol491 (independent research); 1 semester of Honors research colloquium. |
| __________     | Committee members determined two weeks into the first semester of the student's senior year. |
| __________     | Check point 1, First semester progress review with research committee at the end of the first semester of student’s senior year. |
| __________     | Check point 2, Second semester progress review with research committee in the middle of the last semester of the student’s senior year. |
| __________     | Submit first draft of thesis to advisor at least 18 business days prior to defense. |
| __________     | Submit revised draft of thesis to committee members at least 10 business days prior to defense. |
| __________     | Submit final draft copy of thesis to committee members at least 24 hours prior to defense. |
| __________     | Submit final copy of thesis to committee members for signatures 24 hours prior to the last day of exams. |
| __________     | Thesis defense no later than 24 hours prior to the end of the last day of exams. |
| __________     | 4 copies of final thesis to department by last day of examinations. |