BIOLOGY

Senior Project Schedule and Guidelines 2019-2020

SPRING SEMESTER JUNIOR YEAR (2019)

Wednesday, March 13	Attend meeting at 12:20 to 12:50 pm in Quigley 101 for introduction to the senior project process and information on research areas of the Biology faculty.
By Tuesday, March 26	Submit electronic preference form for faculty advisor **by noon**.
By Friday, April 19	Register for the appropriate section of the Senior Project (Bio 600) by obtaining the signature of your senior project advisor.

FALL SEMESTER SENIOR YEAR (2019)

By Monday, September 2	Register for and attend the appropriate section of Biology 600.
By Friday, October 4	Submit a 5-12 page project proposal to your committee **by 5:00 pm**. (Failure to meet this deadline will result in a 1 letter grade penalty, plus an additional 2/3 letter grade penalty for each additional week past this date.)
By Friday, October 25	Complete your proposal meeting with your committee.
By Tuesday, December 10	Submit a progress report to your Senior project advisor.

SPRING SEMESTER SENIOR YEAR (2020)

By Spring Semester 'add' deadline	Register for the appropriate section of Biology 610 by obtaining the signature of your senior project advisor.
By Monday, March 30	Submit a final draft of your written thesis to each member of your committee **by 5:00 pm**. (Failure to meet this deadline will result in a 1 letter grade penalty, plus an additional 2/3 letter grade penalty for each additional week past this date.)
By Friday, April 17	Complete your oral defense of your senior project before your committee.
Monday-Wednesday, April 20-22	Orally present your research at the Biology Senior Project Symposium.
By Tuesday, April 28	**Step 1.** Submit an **electronic copy of your abstract** via the Senior Project Abstract Submission Form to the department secretary and by email to your advisor. **Step 2.** Submit an **electronic copy of your thesis** to Pelletier Library. **Step 3.** Submit one copy of your **corrected and bound thesis** to your advisor. (Your grade cannot be submitted—and therefore you will not graduate—until Steps 1 through 3 have been completed to the satisfaction of your advisor.)

MEMORANDUM – Biology Department Senior Project Guidelines

To: Biology Department Seniors
From: Biology Faculty
Re: Senior Projects

This memo is meant to clarify what the Biology faculty expects from a Biology Senior Project. The key to our expectations is that it is an independent project; you are expected to initiate the necessary procedures discussed below. The senior project is designed to help you begin to operate on your own as a biologist. You will be able to use this training in any career you pursue, academic or otherwise.

Finally, and quite sincerely, we want you to enjoy your senior project. It is your chance to become deeply involved with some aspect of biology that particularly interests you.

Senior projects in the Biology Department are year-long projects that break down into two one-semester courses carrying a total of 6 credits. During both semesters, you will meet once per week with your research advisor and the other students working with your advisor. In these meetings (the “Senior Seminar”) you will discuss pertinent literature in your general area of research in order to identify proper experimental approaches, designs, techniques, and methods of data analysis. You will also, as your work progresses, discuss any problems you might be having with your research projects, as well as data analysis and interpretation, and modes of presentation of research findings.

The first (fall) semester’s work is worth 2 credits and involves writing a research proposal, discussing the proposed research with your senior project committee, learning experimental techniques, and beginning the actual process of data collection and analysis. The grade for the first semester of work is based on the senior project committee’s evaluation of your research proposal, submitted no later than October 4, 2019, your progress report due December 10, 2019, and participation in the Senior Seminar.

The second (spring) semester’s work is worth 4 credits and continues the experiments and data analyses begun in the first semester. You must submit a final written report on the research project by Monday, March 30, 2020. Shortly after the written report has been submitted the department schedules an oral defense of the report, to be held no later than April 17, 2020. In this oral defense, you will be expected to answer questions from the senior project committee about your project. Finally, you must make a formal presentation of your senior project at the annual Biology Department Senior Project Symposium, which is held during the last full week of classes (April 20-22, 2020).

DETAILED OUTLINE OF THE SENIOR PROJECT PROCEDURE

After receiving information on the research interests of the Biology faculty (at a meeting on Wednesday, **March 13, 2019**), you should submit your first three choices for (1) a faculty senior project advisor and (2) your second reader, in order of preference, by no later than noon on Tuesday, **March 26, 2019**. The department will then match you with an advisor and second reader, attempting to assign your first choices as much as is possible. Once you have been advised of your match, you should begin consulting with your senior project advisor immediately and attempt to narrow your research plans to a specific problem. If this research project is acceptable to both you and the faculty member involved, register for the appropriate section of the Biology Senior Project by no later than the all-college change period in spring 2019. Each faculty member has a particular section of the Senior Project (Biology 600 for the first semester, Biology 610 for the second semester). Keep in mind that once a senior project advisor and the associated fall and spring semester sections of the Senior Project are chosen, no changing of advisors (or sections) will be permitted. You will not be allowed to register for one of the Senior Project sections without an advisor's approval.

All senior project proposals should be initiated in the context of a discussion with a potential senior project advisor and will normally be closely related to the advisor's research area. Students who will be conducting projects that were proposed during the junior seminar should consult with the appropriate faculty member about that project when requesting a signature for Biology 600 during the spring of the junior year. Students who are proposing new projects will consult with one or more potential advisors to agree on an acceptable topic before being permitted to register for a section of Biology 600. Registration for Biology 600 is contingent upon proposing a project that is acceptable to the senior project advisor.

The research proposal is based on a current review of the primary literature relevant to your proposed research. This review should place the proposed research in context, and demonstrate that you understand that context. We expect the proposal to be well organized, with good syntax and grammar. The proposal

should contain 1) an introduction to the topic that includes a literature review of background information, 2) a statement of the objectives and/or hypothesis(es) to be tested, 3) methods, including a detailed experimental design, 4) a budget, and 5) a timetable for completing the project. Your experimental design is expected to be complete, with appropriate controls and replications (if necessary), and statistical analyses (if appropriate) to be used. Methods should be explained in the detail appropriate for subdiscipline. An exhaustive treatment of methods will not compensate for a poor review and vice versa. The timetable should include a list of expectations for the work that you complete during the first semester.

Provide each committee member with a copy of your proposal by Friday, **October 4, 2019**. Failure to meet this deadline will result in a penalty of 1/3 letter grade on the proposal, plus an additional 1/3 letter grade penalty for each additional week past this date. Using information that you provide to your advisor via a standardized scheduling form, you will be assigned a time for a committee meeting, to be held by **Friday, October 25, 2019**. Your committee will formally evaluate and approve your proposal at this meeting, and agree upon a list of expectations for progress during the first semester. After your proposal meeting, your committee will assign a grade to the written proposal (based on the average of each committee member's evaluation). You should not order materials until the committee has approved your project. If your proposal is NOT approved, you cannot continue with your comp, and will have to register for Biology 600 again in a subsequent semester.

All seniors must complete safety training with the Allegheny College Safety Officer before beginning experimental work on their senior project. Your advisor will announce times of training sessions during Senior Seminar. All seniors also are required to complete training in research ethics before embarking on experiments. You will receive an announcement about specific ethics training requirements at the beginning of fall term. If you plan to use vertebrate animals in any part of your research project, you must prepare and submit an approval form to the Animal Research Committee (ARC). If you plan to use humans in any part of your project, you must submit a proposal to the Institutional Review Board (IRB). Similarly, if you plan to use radioisotopes in any part of your research project, you must prepare and submit your protocols to the Allegheny College Safety Committee. Contact the Safety Officer about the information required by this committee. **No work on your project can proceed until approval(s) by the appropriate committee(s) have been received.** As this approval process often takes a few

weeks, it is important that you submit your proposal for approval as soon as possible.

Once you have completed the above steps **START WORKING!** April 1 will come much sooner than you think. Anyone who has done an extensive research project knows that there is significant inertia to be overcome in just getting started.

You will submit a progress report to your senior project advisor by Tuesday, **December 10, 2019**. The progress report should contain a description of the work done on the project during the first semester, including a summary of any relevant data collected, a discussion of problems and/or modifications of the proposed experimental design suggested by the preliminary experiments, and revised timetables, expectations, and “plan of action” for the spring semester.

This document, along with your proposal grade and informal observations of your progress, will be used to assign a grade for the first semester of your senior project. The progress report will be graded by your senior project advisor against the list of expectations agreed to at the proposal meeting. Extenuating circumstances will be considered and lack of progress on some expectations might be traded for progress beyond expectations in other areas.

Second semester reminders:

Remember to register for the second semester of your senior project during the pre-registration period for spring semester. The second semester continuations of the senior projects are numbered similarly to first semester, except the course number is Biology 610 (a signature course).

During the spring semester your advisor will indicate the particular deadline schedule she/he will use for the completion of rough drafts of parts of or all of the written senior thesis. The final draft of the written thesis must be turned in to **each** committee member by Monday, **March 30, 2020**. **This is the copy that will be graded. Failure to meet this deadline will result in one letter grade penalty, plus an additional 2/3 letter grade penalty for each additional week past this**

date. The copies submitted on March 30 should not be bound because your committee might require revisions after your oral examination.

Using information that you provide to your advisor via a standardized scheduling form, you will be assigned a time for your final oral examination, to be held by Friday, **April 17, 2020**. At your oral examination, the committee may ask you to make changes in the written thesis. Those changes must be made in order for you to receive your grade.

Submit an electronic copy of your abstract via the Biology Senior Project Abstract Submission Form to the department coordinator and by email to your advisor no later than Tuesday, **April 28, 2020**. Upload an electronic copy of your thesis to Pelletier Library no later than Tuesday, **April 28, 2020**. Submit a copy of your corrected and bound thesis to your advisor no later than Tuesday, **April 28, 2020**. Failure to meet this deadline will result in 1/3 letter grade penalty, and failure to submit the bound thesis by **4 pm May 8, 2020** will result in an incomplete (and no graduation).

In order to insure that students properly clean up the cultures, organisms, equipment, etc., which they have used in their senior project, we require that all clean-up be completed and that all keys have been returned **before** the final grade will be submitted to the registrar.

Evaluation

Grading of the Senior Project will be determined as follows:

Fall Semester (2 credits)

30% of the grade is based on the quality of the research proposal.

70% of the grade is based on the extent and quality of the progress made on the project as shown primarily in the written progress report, as well as attendance and quality of participation in Senior Seminar.

Spring Semester (4 credits)

33% of the grade is based on the quality of the written project.

33% of the grade is based on the level of scientific scholarship that you display during the research. (The Department considers intellectual curiosity, persistence, flexibility, and participation in Senior Seminar, as evidence for scientific scholarship.)

17% of the grade is based on the quality of the oral defense of your project.

17% of the grade is based on the quality of your oral symposium presentation.

The grading procedure at the end of spring semester for the senior project is as follows:

Immediately following your senior project oral defense, your committee will tell you whether or not any revisions are required in the written manuscript. When these corrections have been made to the satisfaction of the committee, you can submit a bound copy to your advisor and to the department secretary. You will receive in writing from the senior project committee the earned grade on the project and a written critique of your efforts after you have 1) submitted the corrected and bound thesis, 2) given your symposium presentation, and 3) cleaned your work space and returned all materials used during the project.

GRADING CRITERIA

1. Quality of the written thesis.

a) Style. Style refers to the appropriate format of the written thesis. Considerations include: a clear statement of the objectives and/or hypotheses, self explanatory tables and figures, all references correctly cited, topic adequately introduced in the Introduction and Discussion related to other work of importance.

b) Content. Content refers to the intellectual merit of the project. Considerations include: relevant introduction and background material from the primary literature, appropriateness of experimental design, application of appropriate statistical tests, presentation of the data, and interpretation and discussion of your data relative to other work in your field.

2. Oral defense.

The oral defense is intended to test the depth and breadth of knowledge relevant to the topic. You should be able to demonstrate a solid understanding of a) the subject area and be aware of problems and/or limitations of the particular study, b) the methods used and their relevance to the overall project, c) the limits to your ability to interpret and extrapolate from your results, and d) the most important literature references related to your project. In general, what we are looking for in the final oral exam is that you have a solid understanding of your material. You should be aware of the problems and limitations of your study (all studies have some), the ramifications of the study, and other research which could be undertaken to deal with the problems or ramifications. In other words, you must be intellectually involved with your work. Simple reporting of your data, or reorganization of some published information is considered a serious weakness. You should be ready to discuss and make your own interpretation of the ideas in your study based upon fundamental concepts and ideas of biology.

3. Presentation at the Senior Project Symposium.

Your oral presentation should be interpretable and understandable to an audience of biologists who have not read the written thesis. Your presentation will be evaluated by attending faculty members, at least some of whom will not have been part of your thesis committee. Grading of oral presentations will be determined by the following criteria:

1. Was the oral presentation clear, well organized, and delivered with an engaging style?

2. Did the presentation include sufficient background for persons unfamiliar with the specific area of research?

3. Did you place the research in its proper disciplinary context?

4. Did you adhere to the established time limits?

5. Did you respond effectively to questions?

6. Did you illustrate your talk with effective visual aids?

4. Independence of thought and action.

The initial design of an experiment often involves collaborative thinking between you, your advisor, and the other members of your Senior Seminar. However, once an appropriate topic has been chosen you will be expected to work independently. Although you will certainly have questions, you should not rely heavily on your advisor or other faculty members for guidance at every turn of events. We expect you to show initiative in getting started and completing the project and written thesis, to attend and contribute to Senior Seminar, to meet deadlines, and to clean up after your work is complete.

Guidelines for Written Thesis

General:

1. Your report should be well written in proper English and of a style consistent with the literature in your specific field.

2. The report must be typed, double spaced, with 1 inch margins, except 1.25 inch on left side.

3. Avoid quotes. Their content can generally be incorporated without direct quotes.

4. Properly reference outside sources using the published literature in your field as an example. Check with your senior project advisor to be sure of the proper format.

5. Assume that the reader has a basic understanding of the area of your subject matter.

1. Abstract.

A brief (< 200 words) paragraph that highlights the salient points of your research.

2. Introduction.

a) An introduction to the topic addressed in your project.

b) A clear statement of your objectives and/or hypothesis(es) being tested.

c) A summary of background information that demonstrates knowledge of what is already known in this field and how your project will add to that knowledge.

3. Materials and Methods.

a) This section should be detailed enough for someone else to reproduce your study. Do not include extraneous and unnecessary details.

b) Your experimental design should be appropriate to the questions being asked – i.e., adequate replication and controls.

c) Your techniques should be appropriate for the problem studied.

d) Use metric units.

e) Lengthy tables of raw data should be placed in appendices.

4. Results.

a) Keep your explanations of the results separate from your interpretations of your findings in the discussion.

b) This section should be a clear exposition of your actual findings with some assistance to the reader to show which results and relationships you want to specifically consider.

c) When appropriate, statistical analyses should be used to aid you in evaluating your data.

d) Set up tables and figures according to accepted styles in your discipline.

– Table captions should go above tables and figure captions below figures.

– Be sure that they are well labeled. Tables and figures must be clear enough so that the reader can understand the data in them without referring to the text.

– Lengthy tables of raw data should be placed in appendices.

5. Discussion.

a) You should discuss your results with regard to the objectives or hypotheses posed in the Introduction. The discussion should not include a reiteration of the

results, but rather should be an interpretation of the findings and their relationship to previously published information on the topic.

b) Use appropriate supporting or contradictory literature to put your results in perspective. However, this is not a review of everything you know about the subject.

c) Weaknesses or limitations in your study should be discussed.

d) You should suggest further research to clarify some of the unanswered issues related to your project.

6. References.

All references cited in the text of your thesis are to be listed in an order consistent with the published literature in your field.

BIOLOGY DEPARTMENT POLICY ON SENIOR PROJECTS DONE OFF-CAMPUS

Under normal circumstances, research projects designed, directed, and conducted away from Allegheny College will not be permitted to be used as a senior project in the Biology Department. The senior project is a capstone to the work done at Allegheny, as well as a valuable learning and growing experience. As such, biology faculty should be directly involved in those projects from beginning to end, in order to properly assist our students and to properly assess the intellectual and time investments of our students in those projects.

This policy specifically does not preclude students working off-campus to collect data. For instance, an ecology student may still collect data at sites away from campus. However, under these circumstances, the project would still be designed in consultation with, and under the ongoing direction of, an Allegheny faculty member.

We recognize, however, that off-campus research is a valuable experience for our students, and would like to encourage students to seek and obtain this kind of experience whenever possible. This work could, in most cases, be awarded college credit at Allegheny as an internship, but not as a senior project.