



SENIOR PROJECT GUIDELINES

INTRODUCTION

General philosophy

As stated in the Catalogue, the Senior Project "is not a mere report or semester paper, but a significant piece of independent study, research, or creative work." Indeed, a mandatory comprehensive senior research project is unusual among liberal arts colleges, and this experience distinguishes Allegheny graduates as they embark on professional careers.

More importantly, the successful completion of an independent research project is a milestone in personal development, with merit transcending the context of vocational utility. As with all crucibles of personal growth, the Senior Project evokes a spectrum of feelings over its course, from frustration and disappointment to excitement and acute curiosity. Letting one's efforts be driven by the latter—and not hindered by the former—is a large part of success.

The Senior Project is assessed with respect to: a) the work that is carried out, and b) how that work and its implications are communicated to others. Students are invested with full responsibility for the successful completion of the project, including literature research; documentation and interpretation of results; procurement, proper maintenance, and (in some cases) construction of equipment; troubleshooting; and the deft redirection of approaches not yielding desired results. This is a never-ending cycle requiring constant initiative.

Of course, the research advisor is an integral part of this cycle, but the student should not expect to wait upon the advisor to issue directives. Rather, the advisor should be viewed as an expert resource from whom guidance about specific research issues may be obtained. The advising relationship is a complex dynamic, however, and chemistry faculty have differing styles, which reflect the diversity of approaches in the discipline. Students are therefore encouraged to be mindful of this when choosing their Senior Project advisor.

Goals and Behaviors

The Chemistry Department has defined specific goals for the Senior Project, which include:

- exposing the student to cutting-edge laboratory research in chemistry
- beginning the development of the student's ability to ask interesting and well-defined scientific questions
- furthering the development of the student's ability to work independently
- engaging the student intellectually in a multi-dimensional chemical investigation

Students who undertake such an endeavor should therefore exhibit the following observable behaviors:

- engaging productively and safely in independent research
- communicating scientific ideas in written and oral fashion, both formally and informally
- properly applying the relevant tools (literature, equipment, techniques, computers) to the problem at hand.

LOGISTICS

Academic Credit

Chemistry has a two-semester Senior Project. Students usually sign up for 4 hours in the fall as credit/no credit (CHEM 601), followed by 4 hours graded in the spring (CHEM 611). While no formal grade is received in the fall, 25% of the spring grade will reflect efforts in the fall semester.

Scope of Project

The Senior Project must: a) exhibit scientific merit, b) contain a body of work appropriate for a senior-level research experience, and c) fall within the realm of at least one faculty member's area of expertise. The exact scope of the project is defined collaboratively through discussion between the student and the research advisor.

Choice of Research Advisor

During the Junior Seminar, faculty members present research overviews of current projects. Near the conclusion of Junior Seminar students submit advisor preferences to the course instructor. The first choice is usually given, except in cases where this places an undue burden on one or more faculty members. Once assignments are made, students are encouraged to be in contact with their advisors as soon as possible.

The Senior Project Committee

Each Senior Project is evaluated by a three-member committee. The first reader is the student's research advisor; two additional readers are assigned to the student by the department. The written and oral presentations of the project should conform to the format and expectations of the first reader's subdiscipline; however, care must be taken so that the project is presented to an audience of non-specialists. The committee has the final authority in evaluating the project.

Biochemistry Majors & Joint Senior Projects

The goals, behaviors, appropriate topics, and meeting schedules of biochemistry majors, self-designed majors, and joint senior projects must conform to the

department in which the primary research advisor is a member. Furthermore, the student is expected to abide by the guidelines of the specific group in which they are working.

Biochemistry majors wishing to complete a Senior Project in the Chemistry department must have completed the Chemistry Junior Seminar. Students provide the Junior Seminar instructor with their preferences for research advisor and for the second reader, who must be a Biochemistry faculty member outside the Chemistry department. The research advisor will be assigned by the Chemistry department, taking into account the preferences of the student. Likewise, the second reader will be assigned by the Biochemistry program director.

Joint senior projects Students pursuing a joint senior project typically choose a major advisor by approaching the faculty member they are interested in working with. Once an agreement is reached, the student approaches a faculty member from the second department to be second reader. If a third reader is needed (based on the procedures of the major department) the student is responsible for contacting a third person who can be from either department. Chemistry has always followed the procedures of the major department with regard to assignments, final product, oral exams and grades.

EXECUTION OF THE PROJECT

Meetings

Research advisors' styles vary from more directive to more "hands-off", reflecting the diversity of environments within the discipline. Students are encouraged to consider this aspect in their choice of advisor. In all cases, however, responsibility for successful completion of the Senior Project lies with the student.

Some advisors have required weekly group meetings. The format of these meetings vary, but can include opportunities for students to engage the rest of the group in their project and/or to review literature that is relevant to the entire group. These meetings might also provide an opportunity for students to speak both formally and informally and to show adequate intellectual engagement with their chosen field of study. In contrast, some advisors have no formal meetings with students. Some advisors schedule weekly meetings with students one-on-one and some schedule one-on-one meetings only as the need arises. There are no formal meetings with second and third readers.

Calendar & Deadlines

Fall Semester

Oral presentations. Students present progress to date and summarize their plan for the spring

semester. They also defend their written introduction (see below). Presentations are scheduled for the last full week of classes.

Written introduction. Students submit a well-written introduction providing motivation for the project and placing the project in the context of other work in the field. Due to the committee by 4:00 pm on Tuesday of Thanksgiving week.

Spring Semester

Oral presentations. Students present and interpret the results of their research project and explain the significance of their work. They also defend their final thesis (see below). Presentations are scheduled for the last full week of classes.

Final thesis. Students submit a bound copy of the final thesis, containing all necessary supporting documentation, to each committee member and the department secretary. Unbound or incomplete versions will not be considered for a grade. Late submission may result in grade reduction. Due by 4:00 pm on the Friday three weeks before finals begin.

Rescheduling an oral exam. Times for an oral exam may be changed only under extenuating circumstances. Any change of time must be approved by the entire committee. It is the student's responsibility to arrange the new meeting time and reserve the room.

Assessment

The senior project is graded on the form and content of the written work (ca. 20%), the organization, thoroughness, and response to questions in the oral presentation (ca. 20%), and on the quality of the work carried out and the competency of the student (ca. 60%). Sample grading sheets are attached.

Immediately after the final oral exam, the committee meets in private to determine a recommended grade. The research advisor then meets with the student, at which point the student is told if the project has received a passing or failing grade, but is not told the actual letter grade (this is provided by the Registrar when grades are released).

Grades recommended by the committee are reviewed by the entire department after all oral exams have been completed. At this time final grades are assigned to each Senior Project.

In addition, grades may be withheld until the student properly attends to his/her laboratory space, including properly storing all samples, disposing of waste, and cleaning equipment.

Rewrites and revisions. In extreme cases, students may be asked by the committee to submit a rewritten thesis after the oral presentation in order to receive a passing grade. Without the express instruction of the committee, however, rewritten theses submitted after the deadline may be accepted for archival value, but will not be considered for the purposes of grading. In

other words, an incomplete thesis cannot be 'made up' after the fact.

SPECIFIC GUIDELINES

Scope

Anything presented as "Results" must be from research carried out by the student during the senior academic year. Work from summer research or previous independent study—or work by other students—may be included in the thesis, but must be presented as "Background" or "Previous Work" and must be cited accordingly. These results will not be considered for the purposes of grading in the spring.

Audience

Students are reminded that their Senior Project board is composed of chemists, but not specialists. Information should be communicated in a way that is understandable to a general scientific audience and not heavily laden with discipline-specific jargon.

First Written Document

This document has many functions, and it should address three main topics. An 'Introduction and Background' section should provide a selective but thorough review of previous work in the field and should hint at the student's comprehensive knowledge. In addition, it should show how the student's research fits into this global picture. More importantly, it should naturally substantiate the motivation behind the proposed research (*i.e.*, why is it interesting?).

An 'Experimental Plan' section should outline in detail how the project is to be carried out, and it should include any references that validate the proposed work. This portion should also include any contingency plans—in other words, how might the project be modified if Plan A doesn't provide the desired outcome?

Finally, the student is expected to produce results in the first semester, and these should be included in a 'Preliminary Results' section. All supporting information (data, spectra, etc.) should be included and clearly labeled. The document does not have to be bound, but should be stapled.

First Oral Presentation

The student should prepare a ca. 20-minute presentation using overheads or PowerPoint giving a condensed background of the topic and focusing primarily on preliminary results. The talk should start from the premise that the committee has read the introduction (*i.e.*, not simply rehash the written work),

but it should still be cohesive and understandable on its own merit.

Students may be interrupted during their presentations for points of clarification. Authors of hastily prepared or poorly organized presentations and/or theses may therefore expect more interruptions. At the conclusion of the formal presentation, students should be prepared for in-depth questions about any and all aspects of the project, which may include experimental design issues, interpretation of data, literature background, or basic chemistry concepts related to the project.

Final Written Document

The final written work (thesis) should address three areas with roughly equal attention: a) an introduction which should be relevant to the results presented and may look very different from the introduction of the fall semester, depending upon the course of the research, b) results of the project and explicit experimental details about how they were obtained along with any supporting data, and c) interpretation of the results and discussion of their significance. These are not meant to suggest particular headings in the thesis, but rather areas to be addressed.

As authors of a scientific thesis, students are expected to interpret their data within the context of their field of study and fully document their results according to the accepted criteria of proof for their subdiscipline. Specific format will depend upon the particular subdiscipline.

Final Oral Presentation

The same guidelines apply as for the first oral presentation, except the focus is almost entirely on results and discussion. If addressed at all, only enough introductory material should be included to contextualize the rest of the talk. Where appropriate, results should be supported with spectra or other instrumental data.

The talk should conclude with an indication of what future work might be carried out.

