

**Life Sciences Concentration Capstone Policy**

1. **The Life Sciences Capstone Experience**

The SUA capstone experience gives students the opportunity “to acquire in-depth knowledge about a topic within their field of concentration by drawing upon the skills and knowledge acquired from the liberal arts education they have received at SUA.”

The Learning Objectives for the Life Sciences capstone mirror those of SUA capstones:

* To further develop habits of independent inquiry and study.
* To acquire close, focused knowledge of a topic.
* To further develop and refine research, writing, and analytical skills congruent with the educational mission of Soka University of America.
* To enhance students’ ability to formulate and research a question or set of questions and from this to produce a coherent and substantial treatment of the chosen topic.

A Life Sciences capstone should be a student-initiated project related to one or more of these fields of study: astronomy, biochemistry, biology, biophysics, chemistry, health, biomedical sciences, or physics. A successful Life Sciences capstone should achieve both of these Life Sciences learning objectives:

1. Acquire and synthesize scientific knowledge
2. Communicate science effectively

A Life Sciences capstone with Life Sciences faculty should take one of these three forms:

a. Novel independent data collection and analysis, in the field or in the laboratory with the purpose of answering a question related to the sciences.

b. Novel independent data analysis, where data that is already available in databases or in the literature are analyzed in a novel way with the purpose of answering a question related to the sciences.

c. A literature review, data are neither collected nor analyzed, but existing scientific literature is synthesized with the purpose of answering a question related to the sciences.

Options A and B could be in collaboration with an external research organization (e.g. a biotechnology company). Please see guidelines at the end of this document.

Students may work with a capstone mentor who is not in Life Sciences, as long as the capstone aligns with the Learning Objectives above and the Life Sciences concentration director approves the capstone topic.

1. **Life Sciences Capstone Deadlines**

Please Check the SUA Capstone Calendar for all due dates.

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|  | **CAPSTONE 390** | **CAPSTONE 400** | **CAPSTONE 450** |
| **Requirements** | Student submits completed Capstone Mentor Identification Form to LS Director by the first Friday after Labor Day their senior year.[[1]](#footnote-1)  Student submits first draft of Capstone Proposal (see below) due to mentor by 1st Friday in November.  Student submits Final Draft with completed and signed Capstone Project Approval Form, to LS Director by the first Friday of December. | Submit evidence of progress to mentor by the first Friday in February. The mentor will then submit a Capstone 400 Progress Form to LS director and the student by the fourth Friday in February. | Student submits final Capstone Project with official Cover Page to mentor and Brightspace Dropbox by the last Friday in April. |
| **Grade notices** | If the student is not progressing sufficiently on the project, the mentor will send a low-grade notice mid-semester to the student and the Concentration Director. | If the student is not progressing sufficiently on the project, the mentor may send a low-grade notice in mid-January to the student, the registrar, and LS Director. | If the student is not progressing sufficiently on the project, the mentor may send a low-grade notice mid-semester to the student, the registrar, and LS Director. |

1. **Life Sciences Capstone Guide**

**Capstone 390**

The purpose of CAPSTONE 390 is the identification of a suitable project with appropriate research questions, methodology, and data sources in close collaboration with the mentor. This semester-long thought process is then summarized in the proposal. Thus, CAPSTONE 390 is not just about submitting a proposal but actively vetting ideas with the capstone mentor. The following are recommended best practices:

1. Introduction/Background

Describe the relevant background of your research topic or question citing relevant literature. State your research question(s) based on the background you provided in the Introduction. Explain why these question(s) are important and relevant to the field of scientific study that aligns most closely with your research question.

1. Research Design/Methods

Describe which of the categories your capstone fits in (field or lab work, data analysis, literature review, or collaborative project with a biotechnology company). Describe the research design and methods you plan to use in this project. Explain how these methods will help you answer your research question(s). If you are planning a data analysis capstone (Option a or b above), explain where you will obtain your data and what type of analyses you will perform. If you are performing a literature review (Option c above), briefly state how each piece of literature will contribute to answering your question(s).

1. Timeline

Develop a detailed timeline for completion of major steps or sections of your final project.

1. Budget

You have $250 available to use towards your project. What consumable supplies, software, books, etc. do you need, and what is the cost for each item?

1. Ethics Approval

If you will be working with human subjects (e.g. conducting interviews or distributing surveys), you will need IRB approval. If you require IRB approval, submit your request to the IRB by the last Friday in December deadline; the review process will take 2 weeks and you may not begin this portion of your project until you receive approval or exemption for your study. Your Methods section should describe how you plan to meet IRB requirements.

1. References

Include a list of references following the CSE citation style. A literature review capstone proposal should include a minimum of 10 references, proposals from all other capstone categories should include a minimum of 5 references.

**Capstone 390 Project Approval Form**

Directions to the student: Fill out the **Capstone 390 Project Approval Form,** which is an *Adobe Acrobat Sign document*(web form). After you submit this form, it will automatically go to your capstone mentor for their approval and signature and then it will go to the LS Concentration Director for their signature. The completed approval form, along with the actual proposal, should be submitted to the LS Concentration Director by the **first Friday of December**.

Students planning to work with SUA mentors outside the Life Sciences concentration should also submit a 1-2 paragraph description of how their planned project aligns with the LS Capstone learning objectives by the first Friday after Labor Day.

Students working with a scientific mentor outside of SUA must also submit a contract outlining their agreement with the external mentor.

**Capstone 400**

Directions to the student: Submit evidence of progress on your capstone to your capstone mentor by the **first** **Friday in February**. The capstone mentor will then submit a Capstone 400 Progress Report to the LS Concentration Director and the student by the fourth Friday in February.Evidence of Capstone 400 progress may consist of any of the following in accordance with the timeline submitted in the proposal:

* A draft of the Capstone showing progress since the Capstone Proposal.
* Field or Laboratory Notebook
* Data tables, figures, or other evidence of data collection.
* Other written evidence as determined in consultation with your mentor.

The mentor will then complete the following progress report and email it to the Concentration Director and the student.

Progress Report

I have reviewed [name of mentee]’s evidence of Capstone progress and affirm that

* I **am** satisfied with the mentee’s progress during Capstone 400.
* I **am** NOT satisfied with the mentee’s progress during Capstone 400.

Comments:

**Capstone 450**

Capstone 450 is the final written product, due by the last Friday in April.

Capstone 450 will also include an oral presentation and/or poster session for students and faculty of the Life Sciences Concentration in early May.

The guidelines for Capstone 450 will vary slightly, based on the category of the capstone.

Suggested Guidelines for Field or Laboratory Capstone (Option a)

Please see the Life Sciences Writing Handbook regarding data-based laboratory papers.

Suggested Guidelines for Data Analysis Capstone (Option b)

Please see the Life Sciences Writing Handbook regarding data-based laboratory papers.

Suggested Guidelines for Options a and b if students are working with external research organizations:

Some possibilities exist for students to conduct capstone projects with mentorship from SUA faculty in collaboration with external scientists. For example, these scientists may include faculty from nearby universities such as UC Irvine, biotechnology scientists from University Lab Partners or other academic year internships. In cases where students are conducting these projects, they will need to identify two mentors: an external research mentor and an SUA faculty mentor. The external research mentor supervises the research project and execution, while the SUA research mentor supervises the ways in which the research experience meets the curricular goals of the capstone, including critiquing the capstone writing, assessing the student’s progress, working with the student to meet the deadlines, and submitting grades for the capstone. In cases where the group effort results in proprietary publications or are protected by IP agreements, the student will need to acquire permission from the SUA capstone mentor and collaborators to proceed with the project. The student, the external mentor, and the SUA mentor should sign a contract to clearly define the responsibilities and commitment of the external mentor and student; see the modifiable example below. Approval of external capstones is dependent on a clear contract submitted no later than the deadline for the Capstone 390 proposal.

**Example External Mentor Capstone Form**

For the completion of a Soka University of America capstone, we agree to the following.

* The student will have access to the laboratory to work on their project for at least 6 hours a week during the fall and spring semesters and up to 40 hours a week during the January winter block.
* The student will have access to an on-site mentor who will supervise experimental design and data collection and analysis.
* The student will be compliant with all safety and on-site policies while working in the laboratory and other non-SUA facilities.
* The student will be permitted to write a complete capstone thesis paper about their project that can be submitted to the Soka University of America Ikeda library and embargoed to the public for up to 3 years.
* The student will be permitted to publicly present their data either orally or as a poster on SUA campus as a part of capstone thesis presentations.
* A student will be eligible for $250 for supplies from the concentration budget, but funding for the remainder of the project will be provided by the external sponsor.

Student name, signature, and date:

External Mentor name, signature, and date:

SUA Mentor name, signature, and date:

Suggested Guidelines for Literature Review Capstone (Option c)

Under this option, you will pursue an independent project that will culminate in an extensive literature review paper.This capstone will be written based on a synthesis of information gleaned from *primary literature that attempts to answer a specific scientific question(s)*. Primary literature refers to the presentation of original data, typically in peer-reviewed journals in which the material is scrutinized by experts in the discipline. Note that primary literature should contain a methods section.

Step 1: Select a Topic

Your first responsibility is to identify a scientific question(s) to explore. How to begin? Write down three scientific research questions that interest you. Next, investigate those questions by having conversations with faculty who may have inspired those interests and pursuing preliminary research of scientific papers. Based on these conversations and preliminary investigations of the literature, you should be in a position to select a research question(s) for which there is ample material available to address in a thorough manner. As you begin this process, you should employ a citation manager such as Zotero or Mendeley to streamline your cataloging of resources, citations, and bibliography.

Step 2: Capstone Proposal

Please see Description of the Capstone 390 Proposal above.

Step 3: Writing the Review

Your paper should be a solid piece of scholarship, suitable for publication as a review article. It goes without saying that your paper must be entirely of your own synthesis. As is true of all good writing, your topic must be properly introduced with the basic information that provides the context for studying it: Why is the research question of interest to you? Why is it of interest to the broader scientific community? A thesis statement is typically something that you defend; in other words, having reviewed the literature carefully, you have developed a novel interpretation that you will then argue *throughout* the paper. Having established this context, it is crucial to clearly articulate the specific objectives you will address in the subsequent sections that will constitute the body of your paper. In a final section of your literature review, you must provide a summary of your work and examine its significance relative to your thesis.

The following guidelines might be helpful in writing the literature review.

* Put the research question in a general context. Explain why the subject is interesting and what you will do in the paper; *i.e.*, articulate your thesis and your specific objectives.
* Review what is known about the topic. What are the major questions? Describe the kinds of experimental approaches and observations used to answer these questions.
* Analyze the results of work in the field in a critical way; this is the essence of your thesis topic. This should be the underlying question(s) that you are attempting to address in your research, beyond a simple review of the current literature. Are experiments or observations well designed? Well analyzed? What assumptions do the researchers make? What interesting questions remain unanswered and could they be tested? Spend considerable time developing your thesis question *before* you start writing your paper. Carefully consult the grading rubric before you turn in your draft and final revisions for grading.
* Your paper should demonstrate your ability to integrate information based on a comprehensive examination of the literature. *Your paper must not be a serial report of the articles you examine; in other words, this should not be a book report where each paragraph is a summary of an article.*
* *Writing is an iterative process, requiring much revising and editing.*Spend considerable time developing your thesis question before you start writing your paper.
* According to the Association of American Colleges and Universities, students enrolled in a capstone course should be able to do the following through written communication: 1) demonstrate a thorough understanding of context, audience, and purpose; 2) use appropriate, relevant, and compelling content to illustrate mastery of the subject, conveying the writer's understanding, and shaping the whole work; 3) demonstrate detailed attention to and successful execution of discipline-specific organization, content, presentation, formatting, and stylistic choices; 4) demonstrate skillful use of high-quality, credible, relevant sources; and 5) use graceful language that skillfully communicates meaning to readers with clarity and fluency and *is virtually error-free*.

Step 4: Smooth Draft submitted for Peer-Review (Recommended)

In academia, when a scientist is ready to publish his or her work, a manuscript is submitted to a journal for consideration. Prior to accepting the manuscript for publication, the journal editor asks reviewers who are knowledgeable in the field to examine the manuscript and indicate whether the paper is suitable. Peer-reviewers check both the mechanics of the writing as well as the science of the paper. You are encouraged to ask a fellow capstone student to read and comment on your draft before submitting to your mentor.

Technical Specifications For Your Literature Review

Academic Honesty: In the analysis of the body of information you will have assembled, you will need to synthesize this information into a comprehensive and comprehensible review. You must be scrupulous in providing proper attribution of the sources you have employed by including citations in a standard manner. To further preserve academic honesty, be sure that the phrases, sentences and paragraphs are *yours*. Plagiarism will not be tolerated. In your own words, paraphrase the work of other researchers and cite them appropriately. Do not use direct quotes (this is an acceptable practice in other disciplines, but is *rarely* used in the natural sciences).

Use of Annotations: It may be helpful to annotate the articles you will utilize in your review. By having short summaries of the objectives, methodological approaches, results and conclusions for each paper, you can work from these rather than wading through the many pages of dozens of articles searching for information or attempting to connect information to a source. Make life easier on yourself by employing good organization as you proceed with your reading and investigation. I encourage you to use the freeware Mendeley to highlight, organize, and annotate your articles.

Details of Length, Font Size, *etc:* The text of your completed paper should be at least 30 pages in length – double spaced; 12 pt font; 1” margins, Times New Roman font. *In addition*, your paper should include a cover page with a creative title, a references cited section, and any complementary figures or tables.

Policy on the use of Websites: Public websites are not peer-reviewed and are unsuitable for reference in your research paper. However, the information presented may help you read the more difficult primary literature. As well, there may be graphics that you want to use in your presentation. Under the provisions of the “fair use” doctrine of copyrighted material laws, you can use the material for a course assignment, but you must acknowledge the source of the material (a reference), and you must not publish the material (you can't upload your presentation to a website).

1. Students planning to work with SUA mentors outside the Life Sciences concentration should also submit a 1-2 paragraph description of how their planned project aligns with the LS Capstone learning objectives by the first Friday after Labor Day. [↑](#footnote-ref-1)