



## Course coordinators:

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**CSU Student Honor Code:** This course will adhere to the Academic Integrity Policy of the Colorado State University [General Catalog](#) {Page 7} and the [Student Conduct Code](#).

## Student Learning Objectives:

- Develop transferable skills (ask smart questions; investigative answers; navigate libraries, publications, databases, and other research venues; develop the flexibility to redirect your research if your first plan flops; master the art of time management; hone your argumentation skills; organize a lengthy piece of writing; polish your oral communication skills by presenting and defending your thesis to faculty and peers)
- Work closely with faculty mentors
- Satisfy your intellectual curiosity (this is your chance to follow your passions, explore further, and contribute some original ideas and research in your field of interest)

## Guidelines

### 1. BC 499B, C, D (3 credits)

You may only register for Senior Thesis, BC499 B, C, or D, (3 credit one semester course) in your senior year. The course is similar to an independent study, in that you are working directly with your mentor to create the learning experience. For an idea of the hours involved, three credits are equivalent to nine hours of work per week, or 12 hours per week until the due date of the final draft of the thesis. These numbers should be approximately doubled for Summer Session. This is the same amount of time any 300- or 400-level class typically requires. As you can see, it will take a serious commitment of time and effort to complete your thesis! BC499 is graded on a traditional grading scale (A, B, etc.). Your BC499 mentor decides your final grade based on the quality of your work and your oral presentation.

### 2. Definition of the Thesis

The BC499 thesis is designed to provide a culminating experience that allows students to explore areas of Biochemistry & Molecular Biology about which they are most passionate, engage in the process of discovery, and make a creative contribution in their areas of interest and expertise. The Thesis is to be an **original** work by the student based upon a combination of review and primary literature articles from the recent scientific publications. **Plagiarism at any stage will automatically result in a failing grade for the course.** Limited quotations may be incorporated into the thesis, where appropriate, with proper quotation marks and references, but **the majority of the thesis is to be written by you as the author, expressing your views, thoughts, and words. At least four primary literature references must have been published in the 2-year period before the formal proposal due date.**

### 3. Your Thesis Mentor

A BMB faculty member serves as the mentor for the senior thesis experience. The duty of the mentor is to assist you throughout the thesis writing process. In one of your early meetings with your thesis mentor, your meeting agenda should include developing a work plan with short-term and long-term goals. It should also include a timeframe for reaching your goals. If you need to modify your

work plan later, inform your mentor and agree upon a new timeframe. Find out how long it typically takes your mentor to return papers or drafts. Ask how far in advance they must receive a draft to read and comment upon it before a deadline for the assignment in canvas. Discuss how often you and your mentor will meet face-to-face and whether email is acceptable for certain issues or questions. Take responsibility for running meetings with your mentor. Arrive with an agenda of issues and questions you want to raise and find discuss solutions. Prioritize them so that you are asking the most important questions first. When you turn in a draft for your mentor to read, consider submitting a list of your questions or concerns along with it.

#### 4. Thesis structure overview

The thesis has writing, reviewing, editing and presentation components. The written thesis will be 4000 words minimum (text only excluding figures, figure legends, and references), 6000 words maximum, double-spaced (1" margins, 12-point type, Times or similar Serif font). The BC499 thesis style will be based on that of a "Trends in X" article (also see section 4 for specifications). The presentation component consists of an oral presentation by the student and responses by the student to questions from the instructor and fellow students. The oral presentation is open and may be attended by your friends and family if you desire.

#### 5. Deadlines

To ensure adequate progress of writing a thesis, BC499 has several mandatory due dates to turn in written forms and thesis drafts. The grades associated with each assignment and the deadline dates are listed in canvas. ***Failure to meet any deadline will result in zero points for that assignment, and if you miss the peer review deadline you will get an automatic F in the course, meaning you will have to retake it in order to graduate.***

**All the written materials should be received in Canvas by 4:00 pm on the specified due date unless otherwise indicated.**

### Thesis Writing Timetable

#### Form 1 - Topic and Thesis Questions (Preliminary Proposal)

You may have identified a topic in BC493 last year. The preliminary proposal is intended to help focus your ideas and generate a thesis topic. Use the *BC499 Form 1* available on Canvas, to briefly describe your topic and then submit it to Canvas by the due date. I will try to match students up with appropriate mentor based on their thesis topic, and faculty availability. **If you need help identifying a topic please contact Dr. Stargell.**

#### Form 2 - Detailed Thesis Description (Formal Proposal)

The BC499 Thesis Formal Proposal is a comprehensive statement about your thesis topic and plans. Your thesis mentor must approve your proposal, so you must schedule an appointment to meet with them to discuss. If you wish to change your topic after submitting the formal proposal, your assigned thesis mentor must approve the new proposal. The *BC499 Form 2* available on Canvas, and is to be submitted to Canvas. We also strongly encourage you to make an appointment at the CSU Writing Center and speak face-to-face with one of their consultants about your thesis prior to the deadline for this assignment. Again, this will greatly enhance the quality of your formal proposal and will be taken into consideration of your grade for this part of the assignment. Schedule an appointment at <http://writingcenter.colostate.edu>. This form also asks for you to report on the schedule that you have arranged with your thesis mentor.

#### Preliminary thesis draft for thesis mentor review

The preliminary draft version of the BC 499 Thesis is your first real written draft. You should have determined the organization of your entire thesis and this draft should contain **at least the first two pages of the Introduction close to its final form (this will be graded)** and all the sections in some preliminary form with references. Also include the date and time of a second visit to the Writing Center. We strongly encourage you to have a face-to-face (may be virtual) appointment with one of BC499B, C, D Guidelines (8/1/2022)

their consultants about your thesis prior to the deadline for this assignment as well. This will greatly enhance the quality of your preliminary draft and will be taken into consideration of your grade for this part of the assignment. Schedule an appointment at <http://writingcenter.colostate.edu>. **The preliminary draft of the thesis must be submitted to Canvas.**

### **Complete thesis draft for peer review**

This draft should be close to the final version of your thesis, **including all references**, and is due **in electronic format** to Canvas. Copies of draft manuscripts will be distributed to other students in the course for peer review. The peer reviewers will have about 10 days to read the proposals and make specific recommendations to the authors, as per the Peer Review Guidelines page of this Guide. A significant portion of the course grade will be based on the quality and thoroughness of the peer reviews and we expect you to make constructive comments.

The completed peer reviews, consisting of two documents per thesis (#1 - a marked up version of the thesis and #2 - answers to the Peer Review questions) **will be submitted electronically to Canvas**. The thesis mentor will grade your reviews and return the manuscript with the reviews to the authors for their consideration. Authors should revise the manuscript in accordance with the reviewer's comments, or otherwise alter the manuscript appropriately to improve the final version of the thesis.

### **Final Thesis**

Students submit the final electronic version of their thesis to Canvas. The student should have responded appropriately to the peer reviewers in this version of the thesis. We expect the thesis to be in excellent form by this stage of the process, clearly written and informative with no spelling or grammatical errors, and figures integrated into the text. *The quality of the thesis itself comprises approximately half of your overall grade.*

### **Thesis Presentation**

The presentation is an opportunity to present your thesis to your peers and mentor. You must give an oral presentation about your thesis during the final weeks of class. The BC 499 thesis presentation differs from a graduate thesis defense in that it is less formal and more of an opportunity to share your learning experience with your peers.

The senior thesis oral presentation is open to the public and will be publicized to students, faculty, and staff of the Department of Biochemistry and Molecular Biology by posting on the department's website and printed announcements. Faculty, staff, students, family members, and other interested individuals are welcome to attend and to ask the student questions about the thesis presentation.

## **4. Specifications for the final copy of the senior thesis**

1. The thesis must follow a writing style appropriate for the type of research in the thesis. The style and standards are determined by your mentor but will generally follow that of a "Trends in X" (there are many to choose from) article.
2. The thesis must be 4000-6000 words (min-max), double-spaced (6 lines per inch), single column, 1" margins all around, 12 pt type, Times or Arial font, with numbered pages.
3. The cover page of your final thesis should contain the title of your thesis, your name, the date, followed by "**Submitted to the Department of Biochemistry and Molecular Biology, Colorado State University, in partial fulfillment of the requirements for a B.S. Degree (BC 499[B, C, or D, as appropriate]), Semester Year.**"
4. The thesis should be based on *at least* a dozen primary papers from the scientific literature, in addition to relevant review articles. Four of the primary papers must have been published in the previous 2 years.
5. Primary references are to be to scientific journal publications, not to web sites. Cite your references following the format of the journal "*Cell*" (described at the following url: <http://www.cell.com/authors#sections> ).
6. Plagiarism in any form will be monitored closely and not tolerated. Students guilty of plagiarism will receive a failing grade in the class, and appropriate disciplinary action will be taken.

## 5. Grading

**This course uses conventional grades (i.e. A, B, C, D, and F).** A total of 100 pts are divided as outlined in the deadline summary shown below. Failure to turn in an item on time will result in a grade of zero for that item. The peer review thesis must be submitted on time or a grade of F will be earned for the course. Turning in shoddy or incomplete work will result in a partial grade. **Use the Writing Center to increase the quality of your work. The writing center is available virtually during COVID – 19 diminished face-to-face activities.**

## 6. Deadlines and Grading Summary

Items due by 4 pm unless otherwise stated

August 24 and 26, 2022 Introduction to Senior thesis meetings

4:30 PM – MRB 312

August 31, 2022 Further discussion on Topics and Thesis organization 4:30 – 5:30 PM (MRB 312)

Sept 2, 2022 Form 1 (**Topic and Thesis Questions**) due in Canvas (5 pts)

Mentor Assignments emailed to students ASAP (**by Sept 7**).

Sept 28, 2022 Form 2 (**Detailed Thesis Description**) due in Canvas (5 pts)

Oct 12, 2022 Preliminary thesis draft due in in Canvas (5 pts)

**Thesis reviewed and returned to students by your mentor with comments for revisions.**

Nov 2, 2022 Complete thesis draft for peer review **due in Canvas** (15 pts)

Theses available for peer review via Canvas

Nov 16, 2022 Peer reviews of two other theses due **in Canvas** (15 pts)

This includes addressing the review criteria provided **and** making electronic comments on the theses themselves.

**Thesis reviewed and returned to students by your mentor with comments for final revisions.**

Nov 30, 2022 Final thesis due in electronic form to Canvas (40 pts)

10 pts for organization

10 pts for depth of coverage

10 pts for clarity of writing

10 pts overall quality

Wednesday Dec 6, Thursday Dec 8, Friday, Dec 9, 2022

Oral presentations ~ 2:00-5:00 pm; exact times to be scheduled in consultation with your thesis mentor and the BMB office (15 pts)

## **Thesis Methods and Writing**

### **Selecting a topic**

Completing a thesis is a rigorous and time-consuming endeavor, so you should select a topic that is both intellectually exciting and challenging. If you had previously taken BC493 (Senior seminar), you can use that same topic for your thesis. Otherwise, the following are some helpful hints about finding and choosing a topic:

- > As soon as possible start a “research file” in which you keep track of potential areas of interest. Occasionally review your file to see if there are recurrent themes.
- > Ask yourself the following questions: What Biochemistry and Molecular Biology topics have most engaged me? What am I most curious about? What do I enjoy? What am I most passionate about?
- > Visit with faculty and discuss ideas with them. They have a great deal of experience and knowledge that will help you discover a topic.

We encourage you examine the past theses to get a better feel for the full range of topics and proper formatting (see Canvas).

### **Thesis Methods and Approaches**

Research and scholarship methods and approaches vary. Therefore, it is important to meet with your primary thesis mentor to discuss accepted guidelines for your thesis area. An excellent resource for research by discipline can be found on the Writing Center webpage <http://writing.colostate.edu/>. This site discusses many aspects of writing such as research techniques, using print and electronic sources, and citing sources. A “top 10 list” description of how to start your research can be found in a US News & World Report blog: [http://www.usnews.com/blogs/professors-guide/2011/08/04/top-10-tips-for-doing-e-research-at-college.html#read\\_more](http://www.usnews.com/blogs/professors-guide/2011/08/04/top-10-tips-for-doing-e-research-at-college.html#read_more). Your faculty advisor can provide additional insight into other electronic database resources for primary literature, including the PubMed and the Web of Science (see below).

### **Research and note-taking**

In conducting your research, you will need to find both primary sources (“firsthand” sources that come directly from the original literature) and secondary sources (“secondhand” sources that are filtered through the interpretations of experts in the field – reviews, interviews)

Develop a research system. There are lots of ways to organize notes (cards, computer files, or notebooks), but be sure to follow two rules:

- Make distinctions between direct quotations and paraphrasing. This is critical if you want to be sure to avoid accidentally plagiarizing someone else’s work.
- Record full citations for each source (journal, website, database). It will be far more difficult to find the proper citation later than to write it down now.

### **Writing Styles**

Specific writing styles vary by discipline, so you should consult with your BC 499B instructor for guidance about the writing style appropriate for your topic. In general, the thesis style should be based on that of a “Trends in” article. For each style, there are manuals to help you understand and stay within the boundaries of your discipline. In addition, the Writing Center has writing guides available online.

The written component of the thesis experience must incorporate the fundamentals of writing that you have learned in your composition courses. You need to pay particular attention to:

- > organizing your writing for your audience;

- > engaging in writing as a process which includes formal and informal writing, and writing multiple drafts that are reviewed and subsequently revised;
- > utilizing the writing expertise you have learned while writing summaries, syntheses, evaluations, and arguments in your Freshman Seminar and composition courses;
- > cohesion of ideas and document formatting
- > editing and proofreading
- > utilizing appropriate citation styles – it is worth the effort to learn to use a citation program such as EndNote early on in your writing.

Finally, a thesaurus and dictionary are essential tools to good writing, but comic and sometimes tragic results come from relying solely on your computer for spell checking. Although it is invaluable, it is not foolproof.

## Peer Review Criteria

Remember to both *describe* and *advise* in your responses to all the questions below. Rather unhelpful “yes/no” responses are not acceptable.

Reviewers are to edit each thesis for grammar and spelling using the “Track Changes” tool under the “Toolbox” menu. In addition, reviews are to address each of the following questions:

### Overall Responses:

1. What is your overall response, your gut reaction, to the thesis? Why?
2. Generally, what did you like best about the thesis? Why?
3. Generally, what did you like least about the thesis? Why?

### Focus:

1. Is the thesis clearly written? Why or why not?
2. Does the thesis offer new insight and address a complex and compelling issue(s)? Why or why not?

### Development for Audience:

1. Who is the audience for this thesis? Try to put yourself into the position of the intended audience of this piece. Is this a topic that you are interested in?
2. Identify one section of the thesis that is well developed with solid evidence and examples. Why is this a well-developed section?
3. Identify at least one section of the thesis that needs further development and support. Offer concrete suggestions for the author to develop that section

### Organization:

1. Are paragraphs well-developed and clearly linked to the author’s focus?
2. Comment on at least two transitions. Does the author provide clear transitions between paragraphs? Does the thesis “flow” from idea to idea? Why or why not?

### Style:

1. In a word, how would you describe the tone or voice of the thesis?
2. Is the tone appropriate for the audience? Why or why not?
3. Comment on the author’s sentence structure. Is it varied and engaging? Choose one paragraph as an example for your analysis.

### Conventions:

1. Does the author have any patterns of sentence-level errors that impede your reading? If so, comment on them.
2. Are the references appropriate in style and substance?

## Suggest References & Sources of Topic Ideas

Search resources:

PubMed (Search by author, subject, year, journal):

<http://www.ncbi.nlm.nih.gov/sites/entrez?db=PubMed>

Web of Science (Search more recent papers that reference one you already have):

1. Go to CSU "Library" link: <http://lib.colostate.edu/>
2. Go to the "Articles & Databases" tab
3. Select "Web of Science – scholarly articles"
4. Or follow this url:

[http://apps.isiknowledge.com/WOS\\_GeneralSearch\\_input.do?product=WOS&search\\_mode=GeneralSearch&SID=1BOchf9dMDLh3NdOeJC&preferencesSaved=&highlighted\\_tab=WOS](http://apps.isiknowledge.com/WOS_GeneralSearch_input.do?product=WOS&search_mode=GeneralSearch&SID=1BOchf9dMDLh3NdOeJC&preferencesSaved=&highlighted_tab=WOS)

Primary Literature (Peer reviewed)

General areas in science:

*Science*

*Nature*

*Proceedings of the National Academy of Sciences, USA*

Biochemistry & Molecular Biology

*Cell*

*Nature Structure & Molecular Biology*

*Nature Medicine*

*Nature ...*(other sister journals)

*Biochemistry*

*Molecular and Cellular Biology*

*Journal of Biological Chemistry*

*Journal of Molecular Biology*

*Nucleic Acids Research*

*Proteins*

*Protein Science*

Review Journals

*Trends in Biology*

*Trends in Biochemical Sciences*

*Trends in Cell Biology*

*Trends in ...*(see library for full listing)

*Current Opinion in Cell Biology*

*Current Opinion in Structural Biology*

*Current Opinion in ...*(see library for full listing)

*Journal of Biological Chemistry Minireviews*

*Annual Review of Biochemistry*

*Annual Review of Biophysics and Structural Biology*

*Annual Review of Genetics*

*Annual Review of Cell and Developmental Biology*

*Annual Review of ...*(see library for full listing)



## **Titles of Some Recent Theses**

Mechanisms and Mutations of HER2 and its Subsequent Role in Cancer Growth

Genetically Engineered Lymphocytes as a Possible Treatment of Cancer

Improvements in Acetylcholinesterase Inhibitors in the Treatment of Alzheimer's Disease

The Role of p53 and Associated Proteins in Lung Cancer

Regulation of the KiSS-1 Gene in the Metastasis of Breast Cancer

HIV Induced Neuropathogenesis

Viability of Viruses as Vectors for Cancer Therapy

The Significance of the BCR-ABL Tyrosine Kinase on Chronic Myeloid Leukemia

RNA Polymerase Inhibitors: Antibacterial Drug Targets

DNA as molecular computers

CRISPR-CAS to modify Hemp species

**SECTION III Oral Presentation and Speech Communication (15 pts) \_\_\_\_\_**

Students name: \_\_\_\_\_

Please assess the student's speech communication skills according to the criteria listed below.

<b>Key:</b> ++ Excellent + Satisfactory - Needs Improvement 0 Failed to Complete
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*Introduction*

- \_\_\_ Captured audience attention/interest
- \_\_\_ Previewed main points

*Body*

- \_\_\_ Main points clear
- \_\_\_ Main points supported
- \_\_\_ Organization logical
- \_\_\_ Sources cited
- \_\_\_ Clarity of visual aides
- \_\_\_ Management of visual aides

*Conclusion*

- \_\_\_ Summarized main points
- \_\_\_ Addressed audience questions

*Delivery*

- \_\_\_ Volume
- \_\_\_ Rate
- \_\_\_ Articulation
- \_\_\_ Eye Contact
- \_\_\_ Enthusiasm

*Overall Impression & Comments on Oral Presentation.*

**SECTION IV**

Confirms that both as written and electronic copy of the final thesis has been approved by the primary instructor and received by the Biochemistry Office.

Thesis mentor signature: \_\_\_\_\_