

The Honors Program

Department of Chemistry and Biochemistry at the University of Minnesota Duluth

Goals and Overview: The goal of the Honors Program is to provide Chemistry and Biochemistry majors a framework to become well-rounded students, who enhance their educational experience by engaging in supervised scientific research. Successful students will also maintain high academic standing in their coursework while being active members in the department via outreach activities. Under the supervision of a research advisor, honor students will be trained in the scientific methods of hypothesis testing, experimental design, best practices in lab notebooks, data analysis, and will disseminate their research findings both in writing and in oral presentations. In addition, the students will enhance their people and communication skills. The students will be encouraged to participate in community building via outreach activities, which in return will help them develop people skills. At the end of their successful completion of the Honors program's requirements, the students will be asked to provide feedback as a group in an informal discussion as a means to keep the program dynamics through continuous improvements.

Admission Guidelines: Chemistry or Biochemistry majors will be encouraged to apply to the Honors Program by email and by their academic advisors. The Honors Committee will help the applicants to identify a research area and a research advisor that are in line with their interests and career plans. The students will be encouraged to interview a couple of potential research advisor before making the final decision. With the support of their adviser, students will formulate a broad research proposal encompassing at least three semesters of research. The plan will be evaluated by the Committee, who may accept it or suggest modifications to render it suitable for both the student's career plan and the program.

Research Adviser: By supporting a student's application, a faculty member will become the research adviser of that student. Although the Honors program is focused on scientific research and academic achievements, applicants may choose to focus on the development of teaching laboratories, pedagogical research, or curriculum development, especially if these activities are aligned with their career plan and interests. The role of the faculty adviser is to provide the research infrastructure, technical mentorship, and to support the student's applications for funding opportunities. In addition, the adviser (with the help of the Honors Committee as needed) will facilitate and track the student's progress towards completing the checkpoints delineated in the research plan, and

provide timely feedback as the student begins writing the thesis or practices oral presentations.

Program Requirements: Specific requirements of the Honors Program are provided below.

1. Honors students will be Chemistry or Biochemistry majors at the time of application and throughout the program.
2. Honors students will perform at minimum the equivalent of 3 semesters of research, which are meant to involve a constant engagement throughout the semester. Examples of 1 semester of research include successfully completing a UROP, 3 credits of CHEM 3194, or a Summer Undergraduate Research Program (SURP). The contribution of other less structured forms of research will be evaluated by the Committee on an ad-hoc basis. At the end of every semester, honors students will submit a written report tracking the progress they made toward the milestones highlighted in their proposal. The research adviser and the Honors committee will work together to monitor the progress each student is making as a means to maintain a quality control concerning the student experience in the program, and will propose ways for improvement if needed.
3. Honors students will demonstrate proficiency in oral and written communication by presenting their research at local, regional, or national conferences or research exhibits. UROP and SURP offer convenient avenues to fulfill this requirement. In addition, students will present the research at the Casimir Ilenda symposium on their graduating year.
4. Honors students will demonstrate their engagement with the program by participating in activities designed to enhance their people and communication skills. Examples of such activities are the departmental luncheons, poster presentations, and other events to which students are invited to act as ambassadors of science and of the department.
5. Honors student will demonstrate both in-depth and global understanding of the chemical and biochemical sciences. This will be demonstrated by both their research achievements and by holding a minimum of a 3.0 GPA in the CHEM denomination courses at the time of submission of their thesis.
6. After receiving approval and written feedback from the research adviser, Honors students will demonstrate their writing skills and critical thinking by submitting to the Committee a thesis summarizing their research accomplishments over their entire program. The thesis must be submitted at least 90 days before the expected graduation

date. Upon review, the Committee may accept the thesis, suggest modifications to make it suitable for the program, or reject it.

7. Upon graduation, the students as a group will share their experience in the program with the Committee group in an informal discussion, where they will be encouraged not only to discuss their research experience, but to also provide feedback as how to further improve the program.

UMD Chemistry & Biochemistry Honors Thesis Guidelines: Specific guidelines for the Honors thesis are provided below.

1. The Honors thesis should not exceed 15 pages and should be no less than 10 pages, including a title page, figures, tables, and references.
2. The thesis in general should include the following sections: Title; Abstract; Introduction; Material and Methods; Results; Discussion; Conclusions; References. Deviations from these sections may be accepted if meaningful within the context of the research performed. The thesis should also include figures and tables with appropriate labels and captions.
3. The thesis should be written in Times New Roman 12 point font, single-spaced, superscripts and subscripts used appropriately, pages numbered consecutively, page numbers centered on the bottom of each page, no spelling or punctuation errors, abbreviations appropriately defined.
4. The references should be formatted following the guideline of peer-reviewed scientific journals in the field of research, such as the *Journal of the American Chemical Society*. The reference style must be consistent throughout the thesis.
5. The research advisor must approve the research proposal and each component of the Honors thesis prior to submission to the Honors Committee.

UMD Chemistry & Biochemistry Honors Thesis Timetable: Specific benchmarks for a successful progression of the Honors Thesis are listed below.

1. Before Beginning the First Semester of Research.

- a. Meet with a member of the Honors Committee for orientation.
- b. Meet with three potential research advisors.
- c. Select a faculty research advisor.
- d. Submit the research proposal as part of the Honors Tracking Form.

2. At the End of the First Semester of Research. Within two weeks after the end of the first semester, submit the Honors Progress Report Form with attached your thesis draft including the following content:

- a. A "Title" page.
- b. An "Introduction" with relevant references, clearly stating the hypothesis tested and the expected results.
- c. A "Materials and Methods" section.
- d. A "References" section.

Deviations from these sections may be accepted if meaningful within the context of the research performed.

3. At the End of the Second Semester of Research. Within two weeks after the end of the second semester, submit the Honors Tracking Form with attached an updated thesis draft including the following content:

- a. A "Results" section. At this stage, this portion of the thesis must include preliminary figures and tables showing progress in the research. The data should be presented in a clear, logical, and organized manner, making proper use of values, units, and errors. Figures and tables should be cited in the text, and have appropriate labels and captions. Appropriate literature references should be cited.
- b. A "Discussion" section. In this section, the data presented in the Results is discussed, related to existing literature, and linked together by the common thread that is the research hypothesis, overall building momentum towards the Conclusions. Potential pitfalls and limitations of the current research should be highlighted.

Deviations from these sections may be accepted if meaningful within the context of the research performed.

4. At the End of the Third Semester of Research. Within two weeks after the end of the third semester (and for every optional following semester), submit the Honors Tracking Form with attached an updated thesis draft including the content below. Notice that if your third semester of research is your last semester at UMD, you'll need to submit this not at the end of the semester, but at least 90 days prior to graduation together with the Honors Progress (see point 5 below).

- a. A "Conclusions" section. Based on the results presented and on the discussion, you draw the conclusions in regards to the research hypothesis, relate them to the bigger picture, and provide an outlook for possible future investigations.
- b. An "Abstract". In less than 300 words summarize the scientific gap that your research is filling, your working hypothesis, the methods you used to test the hypothesis, and your main conclusions.

5. At Least 90 Days Prior to Graduation. At least 90 days prior to graduation submit your complete thesis as an attachment to the Honors Tracking Form.