

INFORMATION FOR GRADUATE STUDENTS IN BIOCHEMISTRY

Department of Chemistry and Biochemistry
Utah State University, Logan, Utah

The Department of Chemistry and Biochemistry offers advanced study and research leading to the M.S. and Ph.D. degrees in Biochemistry. The Ph.D. is awarded primarily for independent research. The M.S. is awarded for successful completion of specific courses and research less comprehensive than a doctoral problem. The section on qualifying examinations does not apply to M.S. candidates.

Entering Students: During orientation week, new students who have not selected an advisor will be advised by the biochemistry faculty. New students are required to participate in a Workshop on Responsible Conduct in Research that is organized by the Graduate School during their first semester of residence. New students are required to develop and submit an initial curriculum vitae (CV) according to a provided template. This CV will be updated each year and kept in the student's file. All biochemistry graduate students will be invited to attend the Chem 5700 and Chem 5710 lectures to reinforce foundational biochemistry concepts and all biochemistry Ph.D. students will take the exams associated with the Chem5700/5710 courses and need to pass seven of the eight exams with a score of 80% or higher prior to taking the qualifying exam for promotion to Ph.D. candidacy. Additional details concerning this process are included in the "qualifying exam" section below.

Also during orientation week, the Department Head will provide students with a list of faculty who participate in the biochemistry graduate training program. Entering students will meet with each faculty member on the list to learn about their research programs. The students who have not already selected their faculty advisor will then select three laboratories in which to do laboratory rotation projects during the fall Semester (3 laboratory rotations beginning the 1st, 6th, & 11th weeks of the semester).

Major Advisor and Supervisory Committee: Students who have not selected a major advisor at the time of matriculation, will do so after the first semester has been completed. After the rotations have been completed, the students will submit a list of 1st, 2nd, & 3rd choices for major advisor to the Department Head no later than December 14. After some deliberation with the people involved, the Department Head will assign a major advisor to the student, normally within two weeks of the submission deadline.

In consultation with the major advisor, the student will then select a supervisory committee for approval by the Department Head. For a Ph.D. student, a minimum of 5 faculty are required, with at least 4 members coming from the Department of Chemistry and Biochemistry, and one from another Department; a minimum of 2 members must be chosen from the Division of Biochemistry.

For M.S. Students, 3 faculty from the Department are required, including 2 USU Biochemistry faculty. Selection of the committee should be accomplished by April 1.

Annual meetings with the supervisory committee must be held each academic year in the spring. The purpose of these meetings is to monitor and assess progress of the student in

coursework and research. For the first meeting, students must submit a one-page research statement and an updated CV to the supervisory committee one week prior to the committee meeting. The one page report should include a paragraph detailing methods learned to date and any other research progress. A second paragraph should outline expected research directions for the coming year. In all subsequent years, the student will provide a progress report and an updated CV to the supervisory committee no later than 10 days prior to the committee meeting. This report should be 2-5 pages in length and should provide a progress report of results to date and a clear outline of future directions. Within two weeks following the meeting, the committee will forward a letter to the student, summarizing the conclusions from the meeting, which the student will sign acknowledging understanding of its contents. The signed letter will be sent to the student's file. The letter will detail the progress of the student, perceived deficiencies, steps to be taken to remedy them, and expectations for successful completion of the degree. The letter will also include a recommendation as to whether or not the student should be allowed to continue in the program.

Curriculum: Students should discuss course schedules with the biochemistry faculty during the first year and with the major advisor and supervisory committee in subsequent years. The Masters degree requires 30 credit hours. Ph.D. students entering with a BA/BS need 60 credits; students entering with a Master's degree need 30 credits. Students should check the graduate catalog for resident and other requirements. Students must meet with the Department graduate staff assistant prior to registering for classes each semester.

Every graduate student in biochemistry must complete 1) the six credit graduate biochemistry core curriculum, 2) one additional graduate class having a CHEM prefix, 3) at least one additional graduate class having any prefix (with committee approval), and 4) must register for seminar as described below. M.S. and Ph.D. candidates must complete a total of at least 10 credits in advanced courses as approved by the supervisory committee, exclusive of seminar and research.

Seminar. Students must register for the biochemistry seminar, CHEM 7800, each fall and spring semester during the first two years of the program. Annual participation in the Departmental section CHEM 7800-001 of the seminar program is mandatory regardless of the student's registration status. Seminars will expose new students to current graduate biochemistry research programs in the Department and will give advanced students the opportunity to describe progress in their research projects and to get experience in giving scientific presentations. First year graduate students will provide a seminar presentation on a research paper of their choosing. The paper must be unrelated to their graduate research project and must be approved by their graduate advisor and/or the faculty member in charge of Chem 7800. No more than 2 unexcused absences from biochemistry seminars per semester will be allowed. Students' attendance and a satisfactory annual seminar presentation are a requirement for continuation in the program, and will be evaluated at the annual meeting with the supervisory committee. Occasionally outside speakers will be invited to present technical lectures. These lectures will be open to the entire Department. Seminars will be announced to the Department one week in advance.

Research Proposal Workshop: At some point during their first two years in the program, each biochemistry graduate student will participate in the proposal-writing workshop, "Getting Started as a Successful Proposal Writer and Academician," organized by the Office of Research and Graduate Studies. This will help prepare the student to write their research proposal that

accompanies the oral exam, described below.

Academic Status: Students who make satisfactory progress are considered candidates for a degree, even though they may not have been formally advanced to candidacy by the Graduate School. Students must maintain a 3.0 average in all courses taken at Utah State University as part of their graduate program, exclusive of seminar and research, and must not receive more than one C in any graduate course work (excluding seminars) taken throughout the program. A student's progress will be evaluated at the yearly supervisory committee meeting. The supervisory committee will advise the Department Head of students who have failed to meet any of the requirements and recommend that the student either be dropped from the program or be given a probationary semester to make up the deficiency. If the deficiency has not been satisfied by the end of the probationary semester, further reinstatement will be a decision of the entire biochemistry faculty. Every student must meet with the supervisory committee at least once each year to present a written and oral research progress report.

Qualifying Examination: In addition to passing the six (6) credits of graduate biochemistry core, Ph.D. students must pass a qualifying examination. This examination must be taken by the end of the seventh semester after entrance, including summer semesters. In order to schedule the examination, a student must pass 7 of the 8 Chem 5700 and Chem 5710 exams, including final exams, as a graduate student with an 80% or better. Each student will be encouraged to attend the Chem 5700/5710 lectures and will be given access to all Canvas materials for the course, including examples of past exams. Students who do not pass an exam or multiple exams in their first year will have an opportunity to take the equivalent exam when it is administered the following year. Students who do not achieve an 80% or higher on 7 of the 8 exams (by the end of their second year in the program) will be advised on degree alternatives. In the event that a student changes from the M.S. program to the Ph.D. program or changes major advisors within the Biochemistry Program, the student will be given four semesters after the change to pass the required Chem 5700/5710 exams and complete the qualifying examination unless the Supervisory Committee recommends otherwise to the Graduate Studies Committee. If a student transfers from any other degree program to the Biochemistry Program, that student will be considered a new student in the program and will also have seven semesters from the semester of transfer in which to pass the required Chem 5700/5710 exams and complete the qualifying exam.

The qualifying examination will include a formal, written research proposal patterned after those submitted to national funding agencies, including specific aims, progress report, and experimental lines to be pursued. Specific formatting instructions can be found in "Guidelines for the Qualifying Examination in the Biochemistry Program" document. The proposal must contain original ideas, but it will be based on the student's own research project. Consequently, direct assistance from the major advisor will not be permitted in either the writing or the formulation of original avenues of investigation. A student is permitted to solicit information from others, including faculty. However, this must be done on a strictly limited basis and good judgment must be exercised on both sides. It is expected that originality and the bulk of the preparation of the proposal represent the student's own work. If a student is in doubt about the propriety of requesting information in a specific case, the examination committee should be consulted. Any information in the written proposal obtained from others should be acknowledged. The proposal will be presented at a formal, open seminar. The student will meet with the examination committee within 5 working days following the seminar to defend the proposal orally. A detailed description of the

expectations for this examination is contained in the document, "Guidelines for the Qualifying Examination in the Biochemistry Program". Immediately following the examination, the examination committee will decide if the student has passed or failed each of the three components of the exam. In the case of no more than a single negative vote, a recommendation of pass will be forwarded to the student. In the event of failure, the student will be provided with a written statement that clearly details what the student must do to pass the examination in the event that he or she petitions to retake it.

The supervisory committee will serve as the examination committee except that the major advisor will not participate as a voting member of the committee. A biochemist member of the supervisory committee will serve as chair of the examination committee and the student will select the chair from among the biochemistry members. The major advisor will attend the exam, but should remain quiet until the end of the exam. The PI can then provide clarifying comments to the Committee after the student is excused, if needed. Upon petition, a student who fails the examination may be allowed to retake it once upon approval of the examination committee in consultation with the major advisor. Consequently, the written document given to the student following the examination must be agreed upon by the committee in detail before being transmitted to the student. The conditions for retaking the examination must be explicit enough so that someone who was not present at the meeting can judge exactly what is expected of the student. The time period within which the examination must be re-taken must be clearly stated (a date would be most appropriate). The conditions for the second examination, if approved, will be set by the examination committee.

Students who do not pass the examination may transfer to the Masters degree program. If, after completing the Masters degree, a student failing the oral exam wishes to reapply to the PhD program, the student must petition the Graduate Studies committee to that effect. This petition should explain why the student believes they can succeed in this program, and any extenuating circumstances concerning their previous failure. In addition, this petition must be supported by at least one faculty member in the Department who would be willing to accept the student into their research group if they are readmitted to the Ph.D. program.

Final Requirements: After passing the qualifying examination, Ph.D. students will submit the approved candidacy form to the School of Graduate Studies. With the Graduate School's approval, students will then be advanced to candidacy for the Ph.D. degree. The candidacy form must be submitted to the Graduate School Office at least one semester (three months) prior to the final defense.

When the research project nears completion, students should check on final requirements and scheduling with the School of Graduate Studies. Prior to scheduling the defense seminar, students should meet with the supervisory committee that will provide the student with guidelines and expectations concerning the written thesis/dissertation and its defense. When the research is complete, the results must be reported in a thesis/dissertation that conforms to Graduate School guidelines and that must be presented in a formal departmental seminar. It is the student's responsibility to ensure that the seminar is announced at least one week in advance. The purpose of this seminar is to demonstrate the ability to present material to chemists and biochemists outside

of a specific research area. The seminar is an important degree requirement and must be presented to the satisfaction of the faculty at large. The thesis/dissertation must be given to each member of the supervisory committee at least four weeks before the final seminar. After the seminar, the supervisory committee will conduct a final oral examination.

Biochemistry Graduate Student Timeline

Summary of important dates and deadlines

First Year

Orientation week: Submit an initial CV

Beginning of 14th week: Deadline to submit choice for major professor

April 1: Deadline to select supervisory committee

Biochemistry Core Curriculum

CHEM 7800 registration in fall and spring semesters

The first supervisory committee meeting must be held during spring semester.

Program of Study must be approved by the end of second semester

Second Year

10 days prior to committee meeting: Deadline to submit research statement to committee

Committee meeting must be held during spring semester

CHEM 7800 registration in fall and spring semesters

Subsequent Years: Committee Meetings

10 days prior to committee meeting: Deadline to submit progress report to committee

Committee meetings must be held each year during spring semester

Third Year: Qualifying Examination

5 weeks prior to exam: schedule must be approved by committee

4 weeks prior to exam: deadline to submit written proposal

1 week prior to exam: seminar announcement

Qualifying exam must be taken by the end of the seventh semester

Committee meeting must be held during spring semester

Final Defense

4 weeks prior to seminar: Deadline to submit thesis/dissertation to committee

1 week prior to seminar: seminar announcement

Guidelines for the Qualifying Examination in the Biochemistry Program

The qualifying examination in Biochemistry will be composed of three parts, (1) a written proposal based on the student's own research project and patterned after a major research proposal to an outside granting agency, (2) a seminar (open to general attendance) and (3) an oral examination, administered by a committee composed primarily of the student's advisory committee. In preparation for the qualifying examination, students should initially consult the current version of the Information for Graduate Students in Biochemistry.

In order to pass the qualifying examination, the student should be able to:

- 1) identify a significant and original scientific problem
- 2) formulate a testable hypothesis
- 3) formulate an experimental approach to directly test this hypothesis
- 4) express this research problem clearly and concisely in writing
- 5) present his/her ideas orally in an effective manner before a general audience and defend before the examination committee
- 6) demonstrate fundamental knowledge of biochemistry related to his/her research project

The Written Proposal The schedule for the qualifying examination must be approved by all members of the examination committee no later than one week before the distribution of the written proposal. No less than four weeks prior to the student's scheduled seminar, a written proposal will be provided to each member of the student's Examination Committee. The composition of this committee will be designated beforehand by the student's thesis committee. A suggested format for the written proposal is described below. The proposal will be complete, with references, and will be composed according to any style acceptable by the graduate school for the Dissertation. Within one week after receipt of this proposal each member of the examination committee will inform the chairman of the committee if the writing or style of the proposal is unacceptable. If unacceptable in writing or style, the student will resubmit the revised proposal until acceptable to all members. In preparation for this written proposal, students are encouraged to solicit and examine approved proposals from faculty and previous students.

In general, the written proposal serves two functions: (1) to demonstrate the student's independent ability to compose a well-written and thoroughly documented research proposal, distinct but not necessarily completely separate from proposals previously written by the student's major advisor and (2) to provide an experimental foundation on which the examination committee can base critical questions during the oral examination.

The proposal should be formatted according to the following guidelines:

Format requirements:

1. 1 inch margins on all sides, top and bottom
2. Paginated
3. Times Roman or Arial 11 point font on all text. Figure legends, scheme legends, tables, and table legends may be done in 8-11 point.
4. Single space
5. Entire proposal (not including references) must not be longer than 9 pages.
6. All figures should be embedded and have a figure legend.
7. The bibliography will include at least 35 references and all references will be annotated (include a few sentences stating the essential parts of the paper and how the reference relates to the proposed research).

Sections

1. Project summary/abstract - one page limit having the following 3 separate components
 - a. *Intellectual merit*: if the aims are achieved, what will be produced/learned?
 - b. *Intellectual significance*: if the results are obtained/achieved, how will this impact science or society?
 - c. *Career development plan*: how do you envision your proposed studies facilitating your career goals?
2. Specific Aims – one page limit having the following components
 - a. sufficient background and significance to understand why the aims you are going to propose are significant
 - b. list of specific aims-these should be followed by a brief (1-2 lines) description of how (methodology) these aims will be achieved.
3. Literature Review – two to three pages thoroughly reviewing/describing the body of scientific literature related to your proposed research.
3. Approach – This section is limited to 5-6 pages, represents the bulk of your proposal, and will include:
 - a. a short narrative as to why each aim is important, with more specifics added than what you could fit on the specific aims page—you can think of this as your *rationale*
 - b. any preliminary data that either support the rationale, or show the *feasibility* of the aim; if you need particular reagents or proteins, you need to say so and you need to show that getting these things is reasonable
 - c. actual experiments to be conducted-*experimental protocol*
 - d. *outcomes expected/potential problems* that may arise should be addressed
 - e. a summary statement after each aim should be included
4. CV

Each member of the Exam Committee (not including the PI) will prepare a written evaluation of the proposal (in a format similar to NIH or NSF) and provide the evaluation to the student 2 weeks before the exam date. Following the exam, students will likely be asked to carefully consider these evaluations and revise their written proposal accordingly.

The Seminar The Seminar should be announced in writing to the faculty, students and staff of the Department of Chemistry and Biochemistry at least one week beforehand. This seminar will consist of an oral presentation of the research proposal, directed toward a general audience. The seminar should be a clear and concise presentation of the research with sufficient background for the non-specialist. An important aspect of the presentation will be the effective use of visual aids. The presentation should be 40-45 minutes, with sufficient time for questions from the audience. Members of the examination committee may ask general questions, but the examination should be confined to the oral section.

The Oral Examination The oral examination can be taken as soon as immediately following the seminar, but no later than 5 working days following the seminar. The date of the examination is to be scheduled at least four weeks in advance of the examination. At the oral examination, the student will defend the proposal in an effective manner and demonstrate a comprehensive knowledge of Biochemistry. Ahead of the oral examination, the committee will convene for a short period before meeting with the student for the oral examination. The student's major advisor will be present for the examination, but will be a not voting member of the committee and should remain quiet until the end of the exam. The PI can then provide clarifying comments to the Committee after the student is excused, if needed. Immediately following the examination, the committee will decide if the student has passed, failed, or conditionally passed the qualifying examination. In the last case, the conditions that must be fulfilled by the student to pass and the time period within which these conditions must be met will be written by the committee chairman within one week after the conclusion of the meeting and transmitted to the student.

In general, there are three primary purposes of the oral examination, to test the student's abilities for (1) original thought, (2) competency in general biochemistry concepts related to their proposed research, and (3) verbal competence in critical, independent evaluation of experimental protocols and interpretation of data. Publications or preliminary data and/or original lines of proposed experimentation in the proposal (written or oral) are encouraged to the extent that they contribute to these objectives of the oral exam. However, the primary purpose of the oral examination is to examine the student's originality of thought and ability to defend research ideas and to expand upon them. A well-written proposal does not guarantee a successful oral performance, and vice versa; satisfactory performance in the qualifying examination requires a successful completion of all parts.

The student can expect most questions in the oral examination to fall within three general areas:

1. Questions dealing specifically with the hypothesis and the experimental methods and procedures proposed to test the hypothesis. Answers to these questions will reveal whether or not the student is familiar with the experimental procedures needed to test the hypothesis and has envisaged the actual data that might be expected in the proposed experiments.
2. Questions generally dealing with alternative interpretations of existing literature upon which the proposition is based and/or alternative results to be expected from the proposed experiments and/or potential problems in conducting the proposed research. Students can expect to be presented with "hypothetical" data from their proposed experiments and should be prepared to

provide logical and well thought out interpretations and to propose additional experiments based on these results.

3. Questions dealing with general background and preparedness of the student in areas of Biochemistry related to their research proposal.

Guidelines for annual progress report meetings

Annual meetings with the supervisory committee are an important part of the mentorship of graduate students. These provide a venue for feedback about the progress being made on the research project, to clarify expectations for the successful completion of the degree, and for constructive criticism to be given when necessary. Committees will particularly look for progress in the areas below, and comment on these in the letter following each annual meeting that is placed in the student's file.

Committee meeting progress report checklist items.

For the first meeting:

- Is satisfactory progress being made in completing coursework on the Program of Study, and are grades satisfactory?
- Is satisfactory progress being made in the research project; is progress toward research proficiency evident, and does the student show signs of taking intellectual ownership?
- Does the student meet the advisor's expectations with regard to time and effort, lab safety, notebook standards, and citizenship?
- Is there evidence that the student reads and understands the current literature in their research area?

For subsequent meetings:

- Has clear research progress been made since the previous year's meeting?
- Has the student produced work that has been presented at conferences, or in publications? If not, is there clear progress toward this goal; what are the committee's expectations in this area, and are they being met?

Particularly important for fourth year and beyond:

- Does the level of measurable research progress, in terms of meeting abstracts or manuscripts, compare favorably with previous successful PhD students, in a comparable research area, at this point in their studies?
- Has the candidate taken intellectual ownership of their project? Can he/she make choices about the next steps in research, or just doing what they are told?
- If any these areas are not clearly satisfactorily, is there justification for continuation in the PhD program?

Any areas in need of improvement should be clearly identified in the letter, and the student given constructive criticisms during the meeting. Expectations to be met before the following year's

meeting should be specified in the letter.

Format of the meeting: An essential part of the committee meeting is a discussion of the student's research progress. Students should come to the meeting with their notebooks, and any other materials needed to enable them to answer questions and discuss their results. The progress report must be given to committee members no later than 10 days before the meeting, and may include any publications since the previous meeting. An oral PowerPoint presentation may be a part of the annual meeting, but is not mandated. Students should consult with their committee in advance of the meeting to ascertain whether or not such a presentation will be expected, and its length.