

Guidelines for the **Independent Research Proposal,** **Fourth Year Seminar, and Research Progress meeting.**

June, 2016

All biochemistry Ph.D. students are required to present a seminar, submit and defend an independent research proposal, and meet with their advisory committee to review their research progress, after they have advanced to candidacy. These exercises enable you to become familiar with current research outside of your advisor's laboratory, to give you experience in presenting a formal seminar and in writing research proposals, and to allow those interested in an academic career to develop research ideas that could be expanded for future fellowship and job applications. Even if you are not planning an academic career, proposal writing experience is valuable. Almost every Ph.D. scientist in the private sector has to write proposals or research plans for review by supervisors within his/her company. In fact, virtually every industrial scientist we hear from tells us they wish that they had obtained more writing experience in graduate school.

I. Independent Research Proposal

Students should choose a **proposal advisor** who is a member of the Biochemistry faculty and of your Ph.D. Advisory Committee but not your Ph.D. advisor. You will work together with your proposal advisor and with your Ph.D. advisor to select a topic for your seminar and proposal. The role of your Ph.D. advisor is to guide you in choosing a topic or area that is clearly independent from your current research project and that is a reasonable choice given your expertise and training. The proposal advisor's roles are to guide you in choosing a specific topic, to read over initial drafts of your proposal and your literature seminar, and to advise you throughout the writing and conceptualization process. It is the **student's responsibility to initiate and maintain contact with the independent proposal advisor and to provide all documents for review in a timely manner.** Do not expect the proposal advisor to read anything and give you feedback in 24 hours!

To give focus to this exercise, base your proposal on the following scenario. You are a finalist for a prestigious 2-year postdoctoral fellowship. This fellowship will provide sufficient funds that you can do whatever research you want in any lab in the world. The application requires a **written research proposal and an oral defense of its contents.** The requirements are:

- (1) Your proposal should be **substantially comprised of biochemistry** as opposed to cell biology, computer science, or any other discipline.
- (2) You must carry out the research at an institution where you have not previously studied.
- (3) **The proposed research must not be closely related to your dissertation research.** If you are going to use similar techniques (e.g. biomolecular NMR, mechanistic enzymology, immunology) then the problems you tackle should be clearly distinct from your own research topic or what is underway in your advisor's lab. On the other hand, if you are addressing similar issues to your advisor, then your experimental approaches should be different from what is being done in your own laboratory. The research should provide you with experience and knowledge that is different from what you have already done as a graduate student. It should be work that could not be done in your current advisor's laboratory.

- (4) You must be able to carry out the proposed research **by yourself in 2 years**.
- (5) Your research proposal must be approved by a review panel (your Advisory Committee).
The review panel will judge the quality of your written proposal and your ability to explain and defend your project in an oral presentation.

Identify a possible postdoctoral advisor. This person should be someone who is NOT at the University of Maryland, who has an active research program, and who has recently published a body of interesting work. Keep in mind that you do not have to actually DO a postdoc with this person, just read up on his/her research. Based on your readings, come up with a plan for further developing current research in your hypothetical mentor's laboratory OR consider interesting new directions you could take based on his/her earlier work.

If you want to work on a novel research idea that is not obviously part of anyone's existing research program, then pick a postdoctoral advisor who has the necessary expertise or equipment to help you succeed. For example, if your project involves some specialized single molecule techniques, it would be wise to carry out your research in the lab of a scientist with a track record on those techniques. Likewise, if you were to propose working in a specific model system (e.g. *C. elegans*), then you would pick a lab with experience in that model system.

Once you have a topic and postdoctoral advisor in mind, consult with your proposal advisor. Provide him/her with a short outline of your idea (1 page max) and copies of four papers that are most relevant to your work. Your proposal advisor will either encourage you to continue developing your idea, or suggest more productive directions that you could take. Once your topic is approved, then you can begin to prepare the written proposal. Use the specific guidelines provided below (see pp. 3 - 6).

II. Seminar

The seminar is a presentation focused on the background of your independent proposal project (what is the problem and why is it important? what do we know so far? etc...). This seminar is not just a broad review of your topic, nor is it a presentation of your actual proposal. You are expected to explain the critical experiments and the evolution of thought in the field that have set the stage for your proposal. The presentation should start by providing some background and significance on your topic and then move on to the rationale for key experiments, the interpretation of results, and the conclusions that can be extracted from them. The seminar will be given in the Marker Seminar Room, usually as part of the weekly biochemistry seminar series, and will be open to the public.

The seminar topic will be broadly the same as that of your research proposal, and you may get assistance from both your research advisor and your proposal advisor in choosing your topic and preparing the seminar. You will register for BCHM 698 "Literature Seminar in Biochemistry" during the semester in which you give your seminar. This course includes instruction on how to give a good seminar and practice seminars by each participant. Most students give several additional practice seminars before their research advisor, proposal advisor, fellow students, etc.

III. Independent proposal defense

The meeting with your Advisory Committee at which you explain and defend your independent proposal must take place **within 4 – 6 weeks after your seminar**. Thus, you must contact your Advisory Committee once the seminar date is set, in order to set the date for the committee meeting. The Biochemistry Graduate Program Director must be notified when the meeting date is set, or if any problems arise in scheduling the meeting. The relatively short time between the seminar and the Independent Proposal defense means that you must think about the aims and methods for the proposal as you prepare the seminar.

You must submit a complete draft of your proposal to your proposal advisor at least two weeks before the date of the meeting with your Advisory Committee. Your proposal advisor will recommend final revisions. To facilitate implementing these revisions it is strongly encouraged that you submit a substantially complete draft even before the date for your seminar. Once the final revisions are complete, you can distribute the proposal to your Advisory Committee. **You must distribute a printed copy of the proposal to your Committee at least four days in advance of your meeting.**

You will not receive a final grade for BCHM 698 until you have completed both your seminar and your independent proposal defense.

IV. Research progress meeting

The Independent Proposal defense is combined with the **Fourth Year Meeting with your Ph.D. Advisory Committee**. You should prepare a *ca.* 3-5 page review of your current progress toward your dissertation as well as a *ca.* 10 minute PowerPoint presentation. The purpose of this part of the meeting is to make sure that you are making continued progress in your research and that you and the committee believe that there is a clear path to a dissertation within about 18 months after the meeting (the end of your 5th year).

V. Details of the Independent Proposal and its evaluation

For the oral defense of the independent research proposal, prepare a Powerpoint presentation consisting of a short (*ca.* 5 min) introduction (a very brief summary of your seminar), and an overview of your proposed project. The presentation should be organized to take no more than 30 min. During and following the presentation, the members of your committee will ask you questions on the proposal and on the readings that you did in connection with the proposal. You are expected to understand fully the experimental methods that you are proposing to employ, including their physical basis, applicability, and technical limitations. You are expected to demonstrate a clear and critical understanding of the four papers that you have identified as most relevant to your proposal. You are also expected to have a good general knowledge of related and competing research efforts. You may be asked to explain how the proposed research will serve to educate you beyond what you will have learned at Maryland.

The purpose of the oral presentation is to (1) provide you with feedback on your research ideas; and (2) give you additional practice in giving short talks and fielding questions on a scientific

topic. Everyone has to interview for a job at some point in his/her life. Even after you get a job, you will be asked to make this sort of presentation. Industrial scientists are constantly pitching project ideas to various division directors, vice presidents, etc. Academic scientists obviously do this sort of thing in the classroom and when they give seminars. Those who are comfortable with this presentation format are more likely to have successful careers.

Please observe the following guidelines for the written proposal:

1. The proposal should be focused enough that a single, competent biochemist (you) could complete the work within 24 months. This is not meant to be a broad prospectus of an entire 40–year research career, or even a 5-year effort for an assistant professor with several graduate students and postdocs. This is just meant to be a starting point, providing you with some practice at writing short proposals. If your ideas receive favorable feedback, you might consider expanding the proposal for job and fellowship applications.

2. As discussed above, **THE PROPOSED RESEARCH MAY NOT BE CLOSELY RELATED TO YOUR DISSERTATION RESEARCH.** Fundamentally, the work you present should be work that would never be done in your advisor’s laboratory. Your Ph.D. advisor and proposal advisor will have helped make sure that your proposal and your dissertation research are sufficiently different.

3. If completed successfully the proposed work should result in 1-2 high quality journal articles. It is not necessary to cure AIDS or win the Nobel Prize. Nor is it necessary that your proposal encompass the latest research fad. The point of the exercise is to have you become sufficiently familiar with an area of current research outside of your own project that you can suggest additional worthwhile experiments. We would prefer to see well–thought out new ideas in an established area versus a superficial treatment of a recent fad.

4. The proposal should be written using standard Biochemistry formats for references, including full titles and author lists (for ≤ 10 authors). Please use standard typefaces and font sizes (10 pt or greater). Include figures as needed. Legends count toward the word count. Organize your proposal using the following outline. Each part is described in detail below

Part I: Cover Sheet

Part II. Introduction (*ca.* 2-3 single-spaced pages, 2000 words)

Part III: Proposed Research. (*ca.* 5 single-spaced pages, 3000 words)

Part IV: References

Part V: Appendices

Part I: Cover Sheet.

A. Name of Student

B. Student’s Ph.D. Advisor and Proposal Mentor

C. Proposed Postdoctoral Mentor. Provide his/her name and institutional affiliation.

D. Proposal Title Make your title as specific as possible. It should not only indicate goals of the research, but it should also convey the types of experiments (or theoretical methods) that will be used.

E. Four Most Relevant References. These are the four papers that provide the jumping off point for your proposed research. These would typically have been written by your proposed mentor in the last 3 years. They should describe the general area of research and demonstrate the use of the experimental or theoretical techniques or methods that will appear in your proposal. If your proposed mentor has only recently entered the research area, you should include references from competing laboratories that describe similar or alternative approaches. Submit legible copies of these papers with your proposal as an Appendix, and send PDF's to the committee. You will be expected to demonstrate a thorough and critical understanding of the papers.

F. Additional References. List 4-6 additional references that illustrate alternative approaches to your objective or describe the same experimental approach applied to a different problem. This list is meant to be representative, rather than comprehensive (you will also be asked to supply a complete bibliography at the end of the proposal). The idea is to show that you are familiar with competing research efforts.

Part II. Introduction (*ca.* 2-3 single-spaced pages, 2000 words).

- A. General Introduction.** Describe the general area of research that you intend to pursue. Define any unusual or specialized terms. Explain the significance of the problem or general research area.
- B. Statement of General Objectives.** Provide a 1-2 sentence statement explaining the overall goals of your proposed research. What is the best probable outcome of your proposed studies? This statement should be a separate paragraph that is underlined or otherwise distinguished from the other text. Some good ways to formulate the statement would be: "Successful completion of the proposed research will provide a new method for the analysis of complex protein samples." OR "If successful the proposed experiments will result in a more detailed understanding of the mechanism of pyruvate dehydrogenase."
- C. Background.** Give a more focused introduction to the specific experiments in your proposal. Discuss the recent work that leads up to your proposed investigations. Describe any unusual or specialized techniques that you will apply to the problem. It is important to identify clearly the differences between your proposal and what has been done previously or in competing labs. What questions are left unanswered by the earlier studies? What limitations exist in earlier or competing methods that will be addressed by your studies?
- D. Specific Aims.** Give a list of intermediate objectives for your research. These should be stated as goals or questions rather than as methods to be applied. For example "To carry out a series of 2-D NOESY experiments..." does not describe an aim. "To obtain the full chemical shift assignment of protein ..." does describe an aim.

Part III: Proposed Research. (*ca.* 5 single-spaced pages, 3000 words).

In the third part of the proposal you will discuss your planned experiments (or theoretical investigations). Describe your initial experiments in detail. How will you obtain your materials? What measurements will be made? Discuss the possible outcomes of these experiments and what you will conclude given the various possible outcomes. Outline how you will use these results to plan subsequent experiments (e.g. "...if this fails to provide the monoclonal antibody, then the

following alternative strategies will be examined.”) It is often a good idea to provide some sort of timetable or other indication of what experiments are going to be done first and which ones will be done later. Make sure there is a clear connection between your results and your specific aims. Where possible you should justify the feasibility of key steps by citing related work in the literature.

Note the page counts are just guidelines. **The main body of the proposal (Parts II and III) is limited to 6000 words of text.** This corresponds to about 9 pages of single spaced 12 point text. Use the word count utility on your word processor to see how close you are to the limit. There is no limit to the number or size of figures and/or equations in the main body. Also, the cover page, references, and appendices are not counted toward the word limit.

Part IV: References.

Provide a complete reference list using a standard format used in Biochemistry. If you have not yet learned how to use EndNote or a comparable reference manager, now is a good time. You can cite as many references as you want. Full titles and complete author lists (for papers with ≤10 authors) must be given. You should be able to state why each paper is in the reference list.

Part V: Appendices.

A. Required: Copies of Four Most Relevant References. Include full copies of the four most relevant papers listed on the cover page. These are for reference purposes only. The body of your proposal should be written assuming that the reviewers have not read these papers.

B. Optional: Other Supporting Material. You may include miscellaneous reference information in the appendices. This might include complete schemes describing routine synthetic procedures that are not central to your proposal. They might also include full derivations of important mathematical relationships or diagrams of unusual apparatus. **YOU SHOULD NOT ASSUME THAT ALL REVIEWERS WILL HAVE READ THE APPENDICES.** These are provided for readers who might want more detailed information. Therefore the main part of the proposal should be readable on its own to someone who does not have access to the appendices.

Appendices may be distributed to the committee as email attachments.

VI. Evaluation criteria

The essence of the independent research proposal is that you must propose a project that has a good chance of success, you must describe it clearly, you must convince the committee it is worth doing, and you must have a thorough understanding of the general area of science and of any techniques that you propose to use. These are essentially the criteria applied to real research grants.

The committee will evaluate and provide feedback on 1) the organization and clarity of your written document, 2) the feasibility, originality, and significance of your proposed research and your defense of it, and 3) the quality of your oral presentation. If your performance demonstrates good writing and speaking abilities then you will have completed this exercise and you can press on to complete your dissertation. In cases where there is a deficiency, the faculty will

recommend repeating or revising the deficient aspects of the proposal. In extreme cases, you may be asked to repeat the entire exercise.

The evaluation form (“Graduate Outcome Assessment”) used for this meeting is attached at the end of this document (pp. 8 - 9) and is provided on the department web site. The assessment form is intended both to give feedback to the student and to enable faculty to identify general areas of the graduate program that must be improved.

While the proposal is not part of your dissertation, and it should not take over your life for an extended period, it must be taken seriously. If the seminar and/or the proposal is/are found to be unacceptable, the committee may require a range of remedies. These could include repeating the entire exercise, rewriting the proposal, writing a separate document to be described by the committee, repeating the oral defense, or repeating the seminar.

Students usually find the independent proposal to be challenging but rewarding, and in some cases the proposal has been part of the basis of the student’s subsequent career. Exploration of new research areas is part of the continual self-renewal for which active research scientists strive.

Graduate Outcome Assessment
Biochemistry Graduate Program
2. Independent Research Proposal Assessment

Student name: _____ Date: _____
 Faculty advisor: _____
 Committee members: _____

Scoring scale:

0 = unacceptable; 1 = marginally acceptable; 2 = acceptable; 3 = above average; 4 = outstanding

Category	committee consensus score
1. Quality of written document:	
Overall clarity	
Organization	
Clarity and completeness of background summary	
2. Proposed Research:	
Ability to formulate specific research questions	
Ability to design experiments to address those questions	
Ability to anticipate data from proposed experiments	
Understanding of experimental methods to be used	
Significance of proposed research	
Originality of proposed research	
Feasibility of proposed research	
3. Quality of the oral presentation:	
Overall clarity	
Organization	
Ability to defend research proposal	
Knowledge of background material relevant to the proposal	
General biochemistry knowledge	
4. Laboratory performance:	
Effort and time spent on research	
Ability to design experiments independently	
Ability to analyze and interpret data independently	

(see instructions on next page)

At the conclusion of the independent research proposal and research progress meeting, each committee member must enter his or her ratings in one column of the evaluation sheet (previous page). The committee should discuss any deficiencies and give a written consensus explanation in the space below. The committee should also make specific recommendations of steps the student should take to improve on those deficiencies.

A copy of the completed forms must be sent to the Graduate Program Office for inclusion in the student's file. Copies of the completed form should also be given to the student and the student's advisor. The advisor should review the evaluation with the student, to provide constructive feedback to the student on his or her progress and areas that need improvement. The goal is to help the student acquire the skills needed to obtain the PhD degree and for future career success.

Comments: