Guidelines for the Fourth Year Independent Research Proposal
University of Maryland, College Park

All biochemistry students who advanced to candidacy will be required to submit and defend an independent research proposal. The purposes of this exercise are to have you become familiar with current research outside of your advisor’s laboratory, give you some initial experience 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.

For this exercise, you have chosen or been assigned a proposal advisor. This person should be a member of the Biochemistry Division and a member of your Ph.D. Advisory Committee. You should work together with your proposal advisor and with your Ph.D. advisor to select a topic and read over initial drafts of your proposal. The main role of your Ph.D. advisor is to guide you in choosing a topic that is a reasonable choice given your expertise and training. The proposal advisor’s roles are to guide you in choosing a topic that is clearly independent from your current research project and advise you through the writing process. You will receive a separate memo from the Biochemistry Division chair with proposal advisor assignments and specific deadlines.

To give some 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 with any lab in the world. The only requirements are:

1. Your research should have some connection to biochemistry.
2. You must carry out the research at an institution where you have not previously studied.
3. The research should provide you with experience and knowledge that is different from what you did as a graduate student. In other words, it should not be a simple extension of your Ph.D. work.
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 proposing 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 outline provided below. At this time you should also arrange the dates for your Independent Proposal Seminar and the meeting with your Advising Committee.

The **Independent Proposal Seminar** is a presentation focused on the background of your proposed project (what is the problem and why is important, what do we know so far, etc…). This seminar is not just a review article. You are expected to choose from the literature a set of experiments that you deem crucial for the development of your research proposal. The presentation should start by providing some background on your topic and the rationale for the experiments, and continue with a detailed description of the experiments, 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 Independent Proposal Seminar should be given no later than December of your fourth year.

The meeting with your Advising Committee should be scheduled for about three weeks after your Independent Proposal 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 Advising Committee. Your advisor will recommend final revisions. To facilitate implementing these revisions it is strongly encouraged that you submit your final draft even before the date for your Independent Proposal Seminar. Once the final revisions are complete, you can distribute the proposal to your Advising Committee. The proposal should be distributed to your Committee at least four days in advance of your meeting.

Your Advising Committee will read your proposal and will individually evaluate it with regard to the first two categories on the evaluation form below, “Manuscript: Mechanics and Clarity:” and “Manuscript: Logic and Organization”

For the oral presentation prepare a short (5 min) introduction (a very brief summary of your Independent Proposal Seminar), and an overview of your proposed project. The presentation should be organized to take no more than 30 min. You may use overheads and/or a computer projector. 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 fully understand 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) to 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.

Following your oral presentation, the members of the committee will then provide feedback in the remaining categories: “Literature and Background”, “Originality and Significance”, “Feasibility of Proposed Research” and “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.

Please observe the following guidelines:

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. THE PROPOSED RESEARCH MAY NOT BE AN EXTENSION OF YOUR DISSERTATION RESEARCH. If you are going to use similar techniques (e.g, biomolecular NMR, mechanistic enzymology, immunology, etc) then the problems you tackle should be clearly distinct from your own research topic or what is underway in your advisor’s lab. Likewise, if you are addressing similar issues, than the experimental approach you adopt should be different from what is being done in your own laboratory.

3. If successfully completed 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 so 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. Unless you are told otherwise, the proposal should be written using standard Biochemistry formats for references, etc. Please use standard typefaces and font sizes (10 pt or greater). Line spacing should be set to 1.5. Organize your proposal using the outline below.
Part I: Cover Sheet. (An example is provided below):

A. Name of Student

B. Student's Ph.D. Advisor

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 experimental techniques or methods that will appear in your proposal. In situations where your proposed mentor has only recently entered a new area of research, you should include references from competing laboratories that describe similar or alternative approaches to the research problem. Submit legible copies of these papers with your proposal. You will be expected to demonstrate a thorough and critical understanding of these 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 pages).

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 clearly identify 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 stated as goals rather than methods. 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. 3 pages).

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 5000 words of text.** This corresponds to a little under 5 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 PROCITE, now is a good time. You can cite as many references as you want.

**Part V: Appendices.**

A. **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 main body of your proposal should be written assuming that the reviewers have not read these papers.

B. **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.

(V. Muñoz 2004, revised J. Kahn 2007)
Independent Proposal Evaluation Sheet.

Student Name: ________________________________

Proposal Title: ________________________________

Committee Members: ________________________________

Each category will be assigned a consensus score from 0-4.
0=unacceptable; 1= marginally acceptable; 2= acceptable; 3= above average; 4 = outstanding

Manuscript: Logic and Organization: Score _____
Comments:

Manuscript: Mechanics and Clarity: Score _____
Comments:

Literature and Background: Score _____
Comments:

Originality and Significance: Score _____
Comments:

Feasibility of Proposed Research: Score _____
Comments:

Overall recommendation and comments:
(for example, Pass/Rewrite proposal/Repeat oral defense/Repeat entire exercise)