Biology 160- Guide to proposal

The full proposal is essentially an expansion of your preproposal, which you have already received feedback on. Please take that feedback into consideration when developing your full proposal. In the full proposal there will be two major sections; (1) the Introduction, and (2) Methods and Materials. For examples, look to some of the papers you have been reading for section.

Introduction - The introduction should be divided as follows

A) Background - Here you should demonstrate that you understand the theoretical and empirical basis of interest in the pattern and goal of the project. You make this demonstration by pointing to the relevant literature. For example, if your pattern was one of vertical zonation and your goal was to understand the generality of the mechanisms promoting the pattern, you should talk about some of the previous work (the most influential) that had been done (note that this does not mean that your species had been worked on, rather we are talking about the question - generality of and mechanisms promoting zonation). If there is a theoretical basis of interest, be sure to note it (e.g., the theoretical basis for the intermediate disturbance principle). By the end of the background section, the reader should have a clear understanding of the ecological theory and questions that the pattern, goal and hypotheses presented in the following sections relate to.

B) Pattern - Describe the pattern clearly and completely. The description should be sufficient to convey the pattern to someone who is not familiar with the system. Only describe components of the pattern that are pertinent to the goals of the project. Use references to previous studies that have described your pattern if they add to the description or understanding of the pattern.

C) Figure - The figure should clearly represent the pattern. Axes must be labeled (with units) and there must be a figure legend that describes the figure. You should be able to understand the pattern from the figure and figure legend. If a reader can't, then the figure is flawed (either lack of detail or poor legend or labeling).

D) Goal - State a general goal for the project. The goal should reflect your understanding of the ecological significance of the questions you will be asking. The goal should directly follow from the observed pattern.

E) Hypotheses - Propose the hypotheses that will allow you to attain your goal in this section. You should restate your goal then link your hypotheses to the goal. A minimum of 6 hypotheses are required. The configuration of working vs. specific hypotheses is flexible, but for every working hypothesis there must be at least one specific hypothesis. Therefore, the minimum number of specific hypotheses is three (in this case there would be three working hypotheses as well). Working hypotheses should be general. Specific hypotheses must be specific. What counts as specific? A specific hypothesis is directly testable. It is essentially, in hypothesis form, the description of a proposed survey or experiment that can be analyzed statistically. Keep the following questions in mind.

1. Are your working hypotheses general (they should be)?
2. Are your specific hypotheses specific and testable?
3. Do your working and specific hypotheses follow logically from the observed patterns?
4. Could the results of your tests of specific hypotheses be used to falsify the specific and working hypotheses? They should be able to. In other words, is there some outcome of your proposed test(s) that would cause rejection of the specific or working hypotheses?
5. Are your hypotheses reasonable?
6. Are there some hypotheses that are at least as reasonable as the ones you proposed that are missing from the proposal (i.e. are there more obvious or logical explanations for the pattern(s) that you have not considered and mentioned)?
7. Will the results of your tests of your proposed hypotheses help you attain the goal of your project?
Material and Methods

A) **Species description** – Describe (1) any particular traits of your system (species or community) that make it particularly valuable for addressing the ecological question your study addresses. For example, lots of previous studies may have been done that provide you with valuable background information (e.g., (1) ecological interactions- are these species known to compete strongly for a particular limited resource, who are their predators, mutualists, what are their physiological tolerances and susceptibility to physiological stresses, (2) patterns in space and time- geographic distribution, habitat associations, are the populations very stable or fluctuate greatly? Is your species really easy to manipulate in order to conduct the experiments you propose? If so, say so. Summarize briefly what is known about the species’ ecology and life history (sessile or mobile, longevity, mode of reproduction and offspring dispersal), particularly those attributes that are important to your project.

B) **Site description** - Describe your study area from the general to the particular. First describe it geographically (e.g., Monterey Bay in central California). Then start adding detail: (1) specific locations, (2) intertidal vs. subtidal (or any other habitat), (3) type of community (e.g., hard rock, sediments, etc.), (4) environmental inputs (tidal range, level of disturbance, type of rock), (5) unusual stresses (temperature, salinity, etc.), (6) any other factor that helps the reader to understand the system and your project.

C) **Methods** –

For each specific hypothesis that you propose (use your hypotheses as subheadings to outline your Methods section!), describe the surveys or experiments you will do to test your hypotheses.

(1) Each test should be described separately (unless you are testing multiple hypotheses with a single survey or experiment). As an example, assume that one working hypothesis was that desiccation stress caused the upper limit of species A. You could start the section describing the methods to be used by saying “**In order to test the hypothesis that desiccation limits the upper distribution of A, I will... (describe the surveys or experiment).**” [This language incorporates the working hypothesis in the introductory sentence]. Not until you have stated your observational or experimental design and how it directly tests your alternative hypotheses, should you describe the details of how you will collect the data. Remember, tell the reader **why** you intend to create a manipulation or collect data before you tell he/she **how** you intend to do these.

(2) Describe the experiment in sufficient detail such that your methods description could be used by someone else to repeat your study almost exactly. Remember, the value of the scientific method is “repeatability” but this can only be achieved if the methods are described clearly and thoroughly.

(3) End each of these sections (i.e. for each hypothesis and your proposed test of its predictions) with a sentence stating how the results of the survey or experiment will be used to test the specific hypothesis. This is a very important section that indicates to the reader how you will interpret the results of your survey or experiment in order to test your hypothesis. For example, “If the average density of species A in plots in which species B was removed is lower than the average density in (1) those plots prior to removal of species B, and (2) control plots in which species B was never removed, we will conclude that species B facilitates the presence of species A.”