How to Describe a Research Program

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A guide to help you discover your research program and describe it

As a STEM faculty member, you will be expected to set your own research direction, obtain your own funding, manage your own research group, and develop national and international scientific recognition for yourself and your institution. Your research statement should be a specific, forward-looking document that demonstrates your potential to succeed in all of these areas. **The most common mistakes are**
(a) describing general areas of interest without proposing specific work,
(b) describing specific projects only, without putting them into a context of their significance in a larger research program, and
(c) describing mainly prior work with the assumption that it alone will indicate future success.

This guide seeks to help you in the process to discover for yourself an appropriate research program and write about it. The process involves reading and talking to established investigators ("search"), thinking about your own background and abilities ("self-assess"), devising a plan ("plan"), and casting your plan in words such that others can appreciate your proposed plan as fundable ("write"). The writing should establish that the hypothesis is important, that the plan is well thought out and feasible, that you are uniquely qualified to carry it out. Just ***answering the questions posed here*** should help you ***place the essential parts into your written plan in proper structural order.*** Afterwards, you can fill in the necessary details that make the plan (and your ability to do it) easy to understand and compelling. A compelling research plan (for a faculty job application) is an essential first step toward constructing a full-length proposal for a funding agency. The reverse is also highly recommended: Writing a full-length proposal is the best practice for thinking through the necessary elements of a research plan.

1. First establish your *Research theme and motivation*
(Search) There is usually some consensus among the researchers in a subfield about what are the key questions in a subfield; find out what those are. Identify (choose) one or more important "key questions" in your subfield. (Write) Why is it important to know the answers to these questions?

(Self-assess) Discover for yourself how you would position yourself to contribute to the body of science that will have to be done towards answering one or more of these key questions. Find the gaps in current knowledge and what opportunities you can use to advantage. Aim for something original (novel is a word that is over-used), and of course feasible. Try to find a balance between something "sure" and something new, innovative and/or risky. How you map out a plan to you're your own important contributions could depend on (a) your own expertise, (b) methodologies that you are comfortable with, (c) previous background in a model system that could be argued as particularly appropriate one. Define and design specific experiments that will directly test your hypothesis or answer key questions. Think of the following: Choose to address an important problem. If your research is successful how will scientific knowledge or applications (clinical practice, land management policies, industrial applications, etc.) be advanced? What will be the effect of your studies on the concepts, methods, technologies, treatments, services, or preventive measures that drive this field?

(Write) What part do I expect to carry out in this grand scheme? Place your own plan in the context of the key questions in the field. (Write) Establish your research theme. As an independent investigator, what are **your own long-term research objectives**? This section sets up the rationale for your research program. What are you trying to find out and why is this important? Why is this worth doing? How is it innovative? When you write your research statement, the clearly stated research goals, the most compelling motivation, and the general approach you intend to take are in the first ½ page, constituting about 15% of the text.

2. Second, consider your *Previous research accomplishments.* Write this short section (no more than 15% of the text) to establish your expertise and background. The reason for including this is only to convince the reader that you are capable of doing the future work that follows, not as a substitute for

future research plans. What are the methods or approaches you know and can apply? Specify that portion of your expertise and previous accomplishments that make you uniquely capable of doing the work described in your plan. You may have a huge amount of background in something else not related to this work; this is not the place to mention that.

3. Third, describe your *Future plans* (What research will you do as a faculty member?) The description of your future plans include the specific projects which constitute the research program briefly alluded to in Part 1 (Research Theme and Motivation). Design at least 2 well-defined projects that your research group will work on. For each project, your writing should address the following questions: Why is it important? (i.e., what is the motivation for this project within your research theme?) What are the main hypotheses or questions? Not all research work easily lends itself to the hypothesis-testing framework, but all research can be framed by considering important questions which need to be answered. What are the specific aims of the project? The scope of the project is limited to the specific aims. Note: Distinguish these from long-term research objectives. The specific aims are the specific studies and items that will be undertaken in order to fulfill the research objectives of the project. In a hypothesis-driven proposed work, these aims are the steps designed to prove/disprove the hypothesis of the project. If, instead of stating an important hypothesis, you define your research objective by posing an important question, the specific aims will then be those steps you will carry out to answer the question.

Demonstrate your awareness of other work in the field (place this project in the context of the field). Very, very briefly, what has already been done in general, and what have other researchers done in this field? What will this new work add to the field of knowledge?

Briefly describe how each aim will be accomplished. What experiments will you do? What research methodology will you use? What results may be expected? How will this project contribute to scientific understanding? Be sure to place each project in the big picture, and to state longer term goals that the project may lead to (to assure the reader that, if successful, your work will have scientific impact). This is the major part of your research statement (~65% of the text). The future plans are built on your prior experience, but clearly stated as **not merely** direct extensions of previous work. Research plan should be specific, but offers no superfluous details. Use of good graphics relieves tedium, spices up the research statement, makes it clearer and easier to understand the proposed work.

After writing this section, read what you have written and ask yourself: Are the conceptual or experimental framework, design, methods, and analyses adequately developed, well-integrated, well-reasoned, and appropriate to the aims of the project? Are all aims clearly stated, logically related to each other, attainable within your stated time frame (e.g., 3-5 years), and appropriate to the level of your scientific expertise? Revise as needed.

4. Lastly, write a *Short punch line summary* which succinctly restates what you propose, how your previous experience equips you uniquely for doing this, what contributions to scientific understanding will result from it. Here is where you punch it up by stating what is specially compelling about your research plan? Does the project challenge existing paradigms or standard practice? Does it address a critical barrier to progress in the field? Does the project develop or employ novel concepts, approaches, methodologies, tools, or technologies for this area? (You have a strong advantage if you are taking approaches and methodology from your previous area of research and applying them to an entirely new area of research.) (~5% of the text)