WRITING A STEM RESEARCH PROPOSAL

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Facebook.com/OURSUCBerkeley

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Personal Background

• Graduated from University of Nevada, Reno in 2013
• Degrees in general biology, and biochemistry/molecular biology.
  • Minors in organic chemistry, mathematics, Spanish, American Sign Language.
• Ph.D. first year in UC Berkeley-UCSF Joint Program in Bioengineering
• My Research Interests:
  • Linking mechanotransduction to cellular immune response
  • Molecular basis of cell migration
Introductions!
Motivation

- Research proposal/grant writing is a learnable skill!!
- Critical for scientific researchers to fund their projects.
- Persuasive writing is useful in many professional fields.
  - Convincing people to give you money!
Motivation

“Over the past decade, UC Berkeley has had more NSF fellowship winners than any other university in the nation.”

Robert Sanders, UC Berkeley News Center
University of California, Berkeley
February 3, 2010
Technical Style

**Good Writing**
- Terse
- Objective
- Refutable
- Tangible
- Immediately evident

**Bad Writing**
- Unspecific
- Presumptuous
- “Sales-y”

SHOW, DON’T TELL! Coherence, clarity, completeness
There is plenty of fascinating research being done on the African blue-pokey bug because it might be able to help prevent Alzheimer’s disease.

“Plenty of fascinating research…” Like what? Show examples of fascinating research – don’t just tell me it’s fascinating.

“might be able to help prevent Alzheimer’s disease” How? Why might it do this?

Instead:

The African blue-pokey bug has recently undergone extensive study due to a discovery that oral consumption of its shell surface assists in the production of neurotransmitters conducive to preventing Alzheimer's disease.
SURF Style

SURF L&S, Rose Hills Independent:
  • Use “I” instead of “We”.

  • Write about your ideas and motivations, not your PI’s/lab group’s.
SURF Proposal Structure

A. Research Statement
B. Background/Justification
C. Research Plan
D. Qualifications
E. Bibliography
F. Appendix [OPTIONAL]
G. Additional Support [OPTIONAL]
A. Research Statement

What it is:
• Context of the research you are proposing.
• The potential impact of the research.
• The research question you will be answering (aka your hypothesis).

What you need to show:
• Your research is “plugged in” to your field, addresses a gap of knowledge in the field.
• Your question is thought-out and specific.
• Your research is resulting in something tangible.
• Your research has broad impacts.

Structure:
• Broadest → Broader → More specific
Statement of Purpose Exercise
Questions that should be answered in Intro Statement:

1. What will be the final product of this work? (thesis, publication, a new apparatus, etc.)

2. What do you want to find out? What don’t we know? (We know a, b, c… d is suspected to play a role. What is the cause or effect of d?)

3. Why are you doing this research? Why should we care? (Often this is an intriguing recent result that raises a new issue/controversy.)

4. What are the broader impacts of this research to the field, to society, etc.?
A. Research Statement

Go from broadest to more specific!

e.g., Commercial space flight has recently become a topic of interest due to breakthroughs in controlled flight [1], materials technology [2,3], and market forces [4]. Despite these advances, the weight of current fuel storage units in spacefaring vehicles remains a deterrent to the commercial viability of space flight [5]. Electromagnetically contained fuel cells have been proposed as a light weight alternative to conventional units, but the feasibility of these cells has yet to be investigated in liftoff conditions. I propose to model the failure modes of these units in these conditions by (x, y, z)…
B. Background/Justif.

What it is:
• Overview of previous related work – What’s the big picture?
• Explanation of how your work is new/different – How does it address the limits or gap in the field?
• Enough technical details for the reader to understand your research plan - Don’t assume the reader knows the ins and outs of your field!
• Detailed explanation of importance/impact of your work.

What you need to show:
• You understand what’s going on in your field.
• You have the authority to say that your work is novel/impactful.

• (Hypothesis/Experimental Overview) – Keep it brief if you include it – just to orient the reader.
Background/Justification

• Convention:
  • Moving from macro → micro, citing from oldest references to most recent.
  • Last reference cited is usually the most relevant (e.g., something from your lab group)

• How do I find good references?!
  • Talk to PI/advisors!
  • Look at recent publications from your lab.
  • Look at review articles.
  • Once you have a good article, look at what they cite.
C. Research Plan

What it is:
- Describes your hypothesis in detail.
- Outlines the steps you will take to dis/prove your hypothesis.
  - Aim 1, 2, (3)
- Establishes the benchmarks and metrics you will be using.
- Outlines how your time will be allocated.
  - What are various milestones in your plan, and when do you expect to reach them?
- Addresses scheduling risks and contingencies you may need.
  - What if things don’t work? Will we still learn something – do you have a backup plan?

What you need to show:
- You have a thorough and thought-out plan that will actually show whether your hypothesis is correct or not.
- You have clearly defined and established metrics for evaluating your results.
- You have a reasonable perspective on how long tasks will take and have thought through potential delays or obstacles.
- What are your specific aims? When will you carry these out? (Aim 1: I will do x in the first 3 weeks of the fellowship tenure... Aim 2... )
Research plan

Level of Detail:
Someone else in your lab should be able to do this, just from looking at your plan.

(Include methodology, equipment, troubleshooting ideas, timeline.)
(Don’t include concentrations of reagents, lines of code, etc.)
D. Qualifications

What it is:
• Describes experience, coursework, training that is pertinent for completing the research plan.
• Describes access, contacts, support, resources you have that give you an advantage doing research in this field.

What you need to show:
• You have the skills, resources, and support necessary to complete the work.
• You will have access to all the places, equipment, etc that you will need to complete the work.
E. Bibliography

What it is:
• References to related and pertinent work.

What you need to show:
• That you didn’t make all this up.

Don’t include a reference you haven’t read!
Cite scholarly sources (i.e. journal articles, reviews)
Getting Started

1. Write down what you can (editing is a lot easier after it’s all out there).
2. Come in to office hours! www.wejoinin.com/justinlopez
3. Get feedback from as many people as possible.
4. Read and follow instructions carefully!
What will the selection committee be looking for…?

• NSF selection committees look for intellectual merit and broader impact. Keep these two in mind for SURF as well!
  
  • Merit:
    • How important is the proposed activity to advancing knowledge/understanding within the field or across different fields?
    • How well qualified is the proposer to conduct the project?
    • What extent does the proposed activity suggest/explore creative, original, or potentially transformative concepts?
    • How well conceived/organized is the proposed activity?
    • Is there sufficient access to resources?
What will the selection committee be looking for…?

• Broader Impacts
  • What are the benefits of the proposed activity to the field or to society? (i.e. What’s the big picture here? Why is this important to fund? Orient the reader!)
  • How exactly will your project make an impact?
  • e.g., “Increased understanding of the role of Protein X in the slow wave activity of the gastrointestinal tract could potentially result in novel approaches to treating Disease Y, which burdens ## people each year.”

http://www.nsfgrfp.org/how_to_apply/review_criteria
Resources

- surf@berkeley.edu - Include Justin or STEM in the subject or To line.

- Office Hours: www.wejoinin.com/justinlopez