

NSF CAREER Proposal: My Advice and Experience

Paul R. Chiarot

**Department of Mechanical Engineering
State University of New York at Binghamton**

NSF/CMMI CAREER Proposal Writing Workshop
St. Louis, Missouri
March 21-22, 2016



Objective

To share my advice and experience in preparing, writing, and submitting an NSF CAREER Proposal.

- Details on intellectual merit and broader impacts
- Writing and presentation style
- Getting advice
- Tips for avoiding pitfalls



My Background

- PhD Mechanical Engineering, University of Toronto, 2008
- Post-doc, University of Rochester
- Assistant Professor, SUNY Binghamton, September 2011



My CAREER Timeline

- Submitted many, many (mostly declined) proposals from 2011-2015
- Submitted my **first** Career Proposal in July 2014 (end of 3rd year as Asst. Prof.), **declined**
- Attended NSF Career Proposal Writing Workshop in April 2015
- Submitted my **second** Career Proposal in July 2015, **awarded** January 2016, “Additive Manufacturing using Electrospray Printing of Nanoparticle Inks”

Selection of Issues from my First CAREER Proposal

The proposed research was described as “interesting” and “well-conceived”, but:

- Connection between **hypotheses** and proposed research not well articulated
- Impact on **long-term career plans (my vision)** not well discussed; proposal read like a regular proposal

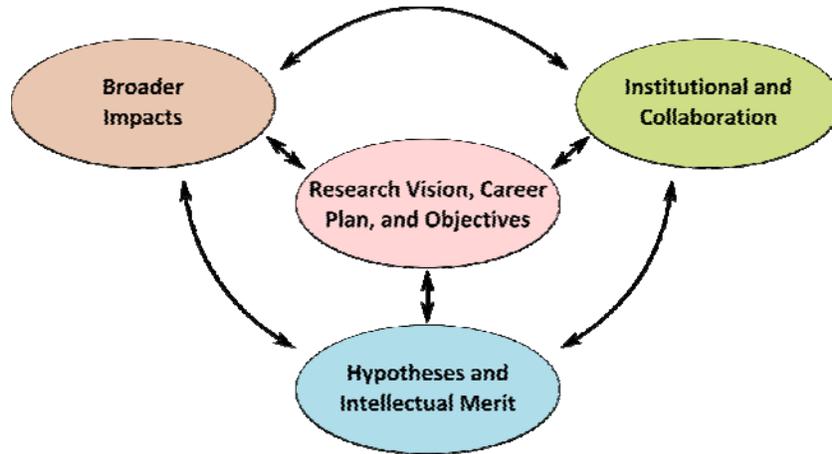
** These were only two **significant** issues selected from a list of several; I am leaving technical aspects aside*

Where to Start Before Writing

- Attend CAREER Workshop
- Discuss your ideas with colleagues – well before you start writing (you may already be doing this multi-year effort)
- Discuss topic with NSF Program Manager; good strategy is to email ahead of time a ~1 page (or 1 paragraph) white paper on your idea
- Ask your colleagues for a copy of their successful CAREER proposal – if for no other reason than to see their “style”
- Volunteer to attend review panels



Structure of My Proposal

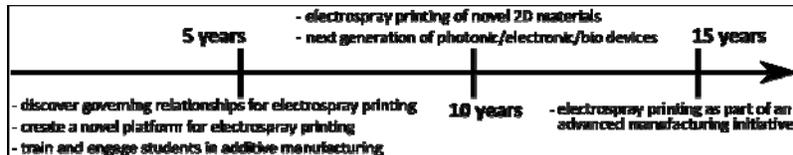


“Big Picture” Items

- Focus your proposal on fundamental research and the creation of new knowledge – not a development project
- Hypothesis driven research is key: both to focus your plan and to help the reviewers understand (see Dr. Hazelrigg’s presentation)
- Broader Impacts should focus on education/outreach **and** implications for industry, scientific discovery, etc., etc.

“Big Picture” Items

The CAREER Proposal is not a “research” proposal;
it should reflect your *vision and career plan*...



...but it should have a set of hypotheses that
can be reasonably tested over 5 years.

The question is: how does this proposal set
you up for the next 5, 10, 20, 35 years?

My Strategy for Writing the Proposal

Technical Content

- Difficult to provide general advice; this has likely be refined over years
- Consult with your colleagues, collaborators, etc.
- Is your proposal a good fit to selected NSF program?

Presentation

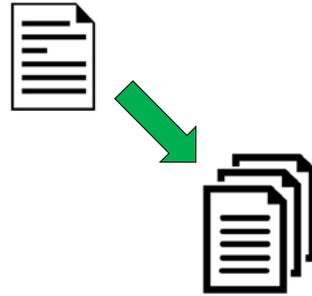
- Research vision and objective clearly stated (early on)?
- Hypotheses clearly stated?
- Logically presented plan? Not a meandering discussion
- Clearly stated contributions
- Relevant preliminary results
- Figures speak a 1000 words

Quality of Proposal = Technical Content x Presentation

Quality of Proposal ≠ Technical Content + Presentation

My Strategy for Writing the Proposal

- Start with the Project Summary – build off the “white paper” you may have submitted to the PM. **Why?** This provides you with a roadmap for the proposal (don’t wait until the end!)
- This will mean that early in the process, you will have defined your **research objective** (Dr. Hazelrigg’s presentation)



My Strategy for Writing the Proposal

Next, concisely write your hypotheses. **Why?** This also assists in focusing your mind on what you are proposing to do.

Hypothesis #1: Nanoparticles printed by electrospray onto a dielectric substrate maintain their excess charge for a finite time. Hence, they influence the deposition of subsequent particles.

Build out from here!

Why is this important (problem statement)?

How will you test this hypothesis?

What will be the contributions?

Notes on Broader Impacts

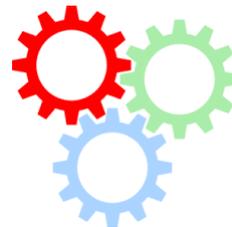
A particular focus should be on your education and outreach programming.

- You have the opportunity to be ambitious – and have some fun; but make sure you can reasonably achieve your goals!
- In my case, focused on programming I am very excited about (and past experience)
- **How will you measure success?**
- Opportunities for undergrads and grads

Notes on Broader Impacts

But you should also think beyond education.

- Will there be an impact on industry, society?
- An impact on your institution (e.g. grad recruitment, new capability)?
- Scientific impact – focus here on interconnectedness (e.g. research on optics impacting astronomy)



**Chair's tip: there is a required section, but BIs should appear throughout.*

Example: Outline of My Approach

1. Describe career plan, vision, and research objectives; qualifications; institutional resources; importance of the topic, etc. = **long-term vision and impact (BIG)**
2. Test three related hypotheses to discover P-S-P relationship, role of electric charge, etc. = **new knowledge that aligns with vision (FOCUSED)**

Example: Outline of My Approach

3. Create a novel ES printing platform to provide unique mech/elec/optical properties for thin film devices (i.e. create a new capability) = **use new knowledge (MED)**
4. Integrate research and education to engage, motivate, and train students at all levels; in particular in AM = **apply research program to education and outreach initiatives; impact of research; leverage university resources; collaborate (BIG)**

Getting Advice

You should get advice before the proposal is written to focus ideas. You should provide the draft proposal to colleagues for feedback many weeks before the deadline. Select the following:

1. Someone with significant background in the area
2. Someone with a general background in the area (Mechanical Engineering, Physics, etc.)
3. Someone with limited technical background (a friend, parent, etc.)

**Chair's tip: even provide the proposal for feedback after it is submitted.*

Getting Advice from Program Managers

- Program Managers at the NSF are helpful and supportive; this Career workshop is a great opportunity to speak with them (including people outside your “typical” area)
- In my experience, you can receive great advice before submission and after you hear the results of the review (both accepted and declined)



Getting Advice from Program Managers

Before Submission:

- Is the program a good fit for your proposal?
- Items to focus on (i.e. hypothesis-driven or knowledge-driven research, etc.)

After Receiving Review:

- More comprehensive feedback on panel discussion
- Recommendations on where to pay particular attention to improve the proposal
- For funded proposals, key notes from the panel that will help things get started on the right foot

Final Thoughts

- Start formulating your ideas early
- Focus on content and presentation
- Start writing using a roadmap (vision, objectives, and hypotheses = summary)
- Broader impacts can be exciting and fun
- Get advice and feedback
- Listen to advice and feedback

Thank you!
Questions?



Contact Information

Paul Chiarot

Mechanical Engineering, SUNY Binghamton

pchiarot@binghamton.edu