

KEY INSIGHTS AND STRATEGIES FOR PURSUING NSF CAREER

A WEBINAR FROM HANOVER RESEARCH

APRIL 17, 2024



WEBINAR LOGISTICS

PRESENTATION LENGTH

45-minute presentation followed by Q&A

Q&A

Please ask questions using the Q&A function in the Zoom toolbar. Presenters will respond in real time, where possible, and we will respond to as many of the remaining questions as time allows during the Q&A.

RECORDING & SLIDES

All attendees will receive a copy of the recording, including the slides.

PRESENTERS

MICHFIIF FRANK SENIOR GRANTS CONSULTANT

- PhD in Physiology, University of Wisconsin
- Joined Hanover in 2019

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- 8+ years of grants consulting experience
- Started writing grants as graduate student

AGENCY FOCUS AREAS







NIH

TOM KUHN SENIOR GRANTS CONSULTANT



- MA in Philosophy, NYU
- Joined Hanover in 2014
- Focus on science and technology R&D, tech transfer, and commercialization
- Started writing grants as junior faculty member







- 1. Understand what makes NSF CAREER unique among NSF early career programs
- 2. Insights into key CAREER pre-proposal efforts and application timing
- 3. Tips for integrating research and education in CAREER projects
- 4. Guidance for articulating intellectual merit and broader impacts in CAREER proposals



WHAT MAKES NSF CAREER UNIQUE

NSF CAREER IS UNIQUE

CAREER grants are investments in YOU!

- Not only a traditional research grant
 - o Investment in your capabilities as researcher and educator
 - o Integration of innovative research and educational activities to enhance your capabilities
- Help reviewers understand why you are right person
 - o They should not be able to replace your name; CAREER should be uniquely yours
- Make clear the links between your research and your career prep and goals
- How you are well-positioned to lead this transformative work
 - How this five years and \$500k will help you advance your research & education in service of your career goals
- Answer questions important to NSF
 - o Make sure your CAREER research questions are linked to NSF priorities (e.g., Big 10 Ideas)
 - Show how CAREER research will help you answer specific questions in service of that bigger picture

Make clear how these activities enhance your capabilities to integrate research and education to advance your long-term career goals!



NSF EARLY CAREER DEVELOPMENT

Grants and supplemental funding to early-career researchers

- Early career = assistant professor or equivalent position
- Tenure track position (or equivalent)
- Supports wide range of research areas across the NSF portfolio
- Eligible and encouraged to compete for NSF's core grants, special initiatives, and <u>other</u> <u>funding mechanisms</u>
- Highly competitive (~10-15% award rate depending on directorate)

CAREER is one of several NSF mechanisms geared to support early career faculty

- CAREER is most prestigious (and path to PECASE) and highly competitive
- It can be counterintuitive to go for CAREER first (before other grants)
 - Standard NSF grants enable you to collaborate, gain experience, and produce preliminary results
- Other early NSF early career funding mechanisms can help you to initiate and/or accelerate theoretical work



Faculty Early Career Development (CAREER) Program

- Must show potential to serve as academic role models in research and education
 - Meritorious research + integrated educational activities
 - Unique articulation of intellectual merit and broader impacts
- Foundation for a lifetime of leadership in integrating research and education
- Positions you as exemplary PI to lead advances in mission of your department and institution

Investment in YOU

- No co-PIs allowed
- More than investment in specific research, CAREER in an investment in your career
 - o Integration of meritorious research & education activities
 - o Advance your short- (during award) and long-term (beyond award) career goals

Unique aspects

- Thoughtful, evidence-based, and impactful integration of research and education
- Intellectual merit and broader impacts focused on integrated impacts
- Departmental support for you and your career as a future influencer



INTEGRATION OF RESEARCH & EDUCATION

CAREER requires you to articulate plans for integrated research and education activities

- Meritorious research + education = key components of any CAREER project
 - o Mutually enhance each other (e.g., students engaged in research, citizen science, etc.)
- Evidence-based and/or innovative educational activities
- Engage, mentor, and involve students in scientific research
 - o Substantial involvement; near collaborators
 - o Involved in research, adjustments, publications, presentations, and broader dissemination
 - o Undergraduate, grad, and doc (even K-12 activities, mainly outreach)
- Well-argued and specific proposal for activities over a 5-year period in context of your long-term career goals

Reviewers are looking for creative, effective, and integrated research and education plans

- Integrated research and educational activities not ad hoc activities see next slide
- Mutually reinforcing (e.g., citizen science)
- Be innovative, but not too "ambitious"
- Builds firm foundation for lifetime of contributions to research and education



Expected/"Meh"	"Meh" for other reasons	Innovative
 Mentoring students 	 Summer camps (too much work, not great ROI) 	 Citizen science: (e.g., involving citizens in collecting project data)
 Involving students in research 	 K-12 Outreach without clear learning outcomes 	 Hackathons (e.g., crowd-sourcing data analysis/problem solving)
 Curriculum Development 	 Lab tours without interactivity or hands-on experiences 	 Leveraging existing events to engage with the public (e.g., community science days, museum outreach events)
 Standard seminar series/journal club 	 Basic website/blog that doesn't meaningfully engage with audience 	 Flipped classroom-style modules



NSF uses three principles for merit review



• NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified. = broader impacts

 Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project. = assessment/evaluation



Provide the basis for the merit review criteria as well as a context within which the users of the criteria can better understand the NSF's merit review criteria.

INTELLECTUAL MERIT CRITERIA

Intellectual Merit criterion encompasses the potential to advance knowledge

- Advance knowledge and understanding within its own field or across different fields
- Proposed activities suggest and explore creative, original, or potentially transformative concepts
- Plan for carrying out the proposed activities wellreasoned, well-organized, and based on a sound rationale
- Includes a plan and mechanism to assess success
- Individual/team/organization is qualified to conduct the proposed activities

Why people in your field would care about your work

- Write to the people who can recognize the value of your work
- Who can use your findings (i.e., results of research and education)
- How your findings, results, and/or conclusions enrich or add to...
 - o Your discipline
 - o Educational science/understanding
- Value to interdisciplinary nexus



Intellectual merits for CAREER encompasses both the research and educational components!

Encompasses potential to contribute to achievement of specific, desired societal outcomes

- Benefit society or advance desired societal outcomes
 - o NSF Big 10 Ideas (<u>https://www.nsf.gov/news/special_reports/big_ideas</u>)
 - o NSF Strategic Plan (<u>https://www.nsf.gov/news/special_reports/strategic_plan</u>)
- May be accomplished through the research itself, activities that are directly related to specific research projects, or activities that are supported by, but are complementary to, the project

Describe how you will disseminate to broader stakeholders

- The knowledge/results are valuable only when they get into the right hands
 - o Describe how you will make the impacts accessible
 - o Know your stakeholders and be able to identify and target them
 - o Science ambassador (not just researcher/educator about STEM)
- Evolution of dissemination (museums
 public broadcasting
 www
 social media)

Use categories of impact to emphasize

- Impacts to society progress towards desired social outcomes
- Impacts to capacity benefits to research capabilities, commerce, and industry
- Impacts to education enhanced STEM education, increased diversity



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BALANCING INTELLECTUAL MERIT & BROADER IMPACTS IN CAREER

PROPOSAL SECTION	INTELLECTUAL MERIT	BROADER IMPACTS
INTRODUCTION	Compelling problem statementImportant/innovative research questionsSummary of innovative approach	 Concise summary of how the problem affects industry, economy, society Summary of impactful education/outreach activities that are integrated with the research
PROJECT GOALS AND OBJECTIVES	 Research objectives 	 Education Objectives
CAREER GOALS AND STRENGTHS OF THE PI	 Career trajectory: next 10 years of research program Publications/prior research that supports research objectives 	 Career trajectory: next 10 years of education and outreach program Prior track record of mentoring and conducting education and outreach activities
SIGNIFICANCE OF THE PROPOSED PROJECT	 Literature review and preliminary data showing rigorous base of foundational research Compelling problem/knowledge gap Exciting, potentially transformative solution/approach to the knowledge gap 	 Current impacts on industry, economy, society, etc. of the problem/knowledge gap Potential benefits that would result from project findings
RESEARCH PLAN	 Rationale based on rigorous prior research Research questions/hypotheses Rigorous, feasible methods & data analysis Quantifiable outcomes tied to research questions/hypotheses Anticipation of potential problems with well-reasoned strategy for mitigation 	 Involvement of students in specific research tasks Specific results that will feed into course modules, outreach activities, etc. Specific data that would be analyzed in student laboratory exercises
EDUCATION AND OUTREACH PLAN	 Underlying conceptual framework; educational/pedagogical theory Measurable outcomes for education and outreach activities Evaluation 	 Participation of students in specific tasks of the research plan, with specific skills/instrumentation/software learned Involving underserved/underrepresented target populations in education and outreach activities



INSTITUTIONAL SUPPORT

NSF encourages organizations to value and reward the integration of research and education

- Requires close collaboration between you and your department/institution
- Part of the merit review process
 - o "Quality of integration of research and education" as review criteria
 - o Need to document support in Departmental Letter

Departmental Letter

- Confirms your eligibility
- Demonstrates understanding, commitment, and effective integration as primary objective
- Confirms department is committed to your professional development
 - Relationship between the CAREER project, your career goals and job responsibilities, and the mission of your department/organization
 - How department head (or equivalent) will ensure the appropriate mentoring of you in the context of your career development and efforts to integrate research and education throughout the period of the award and beyond

Confirms that your proposed CAREER research and education activities are supported by and advance educational and research goals of your department and organization.



WHEN TO APPLY TO CAREER

KEY CONSIDERATIONS

Most important consideration is your readiness

- Innovative research idea with potentially transformative results
- Long-term career plan (how this 5-year project advances your career)
- Integrated educational plan (beyond what is normally required in your faculty role)
- Aligned with your department and/or institutional mission

Not a traditional/core research grant

- Investment in YOU and your career potential/goals
- Integrated path to successful career as an outstanding researcher and educator
 - o Project in context of your long-term career goals
- Integration of research & education
 - Must go beyond what is expected for all assistant professors
 - Reciprocal relationship between the proposed research and education activities
 - How it will advance your capabilities
 - How you translate that into departmental/institutional leadership

Build the groundwork for integrating meritorious rese arch and evidence-based approaches to education to achieve broader impacts

STEPS TO GET READY

Focus on your productivity

- Research generate preliminary results and productivity to distinguish yourself
- o Teaching/mentoring gain experience and capabilities you can showcase

Leverage your expertise and work to develop longer-term goals

- Research = importance for science and the NSF
- o Education = importance for students, department, institution, and you

Orient to your institution

- o Gain insights into student needs (and relations with feeder schools)
- Build a track record for the outreach and education activities that you will be proposing
- Learn how you can leverage recruiting/equity work being done in your department (e.g., engagement officer, department)
- Attend NSF conferences to learn more about priorities and opportunities
- Review and learn from previously funded abstracts (e.g., NSF Award Search)
- Take time to synthesize this into your CAREER application!

(IDEALLY) AFTER FIRST YEAR IN TENURE TRACK

Settling in at your institution will give you time to...

Get your research lab underway and students engaged

- Enhance knowledge of your student body, capabilities, and needs
- Greater understanding/working relationships to coordinate institutional resources
 - o Identify strengths and weaknesses in your current environment/institution
 - o Identify where and how you can enhance research and education through your work
- Leverage institutional resources to help you attract and enroll students

Develop your longer-term research goals in relation to your career goals

- Gain working knowledge about research and education environments
- Contextualize and show where your work can enhance
- Discern activity and need in your research lab to help drive research and education innovations

Produce preliminary data to inform project rationale

- While not required for CAREER, has advantages with reviewers
- Leverage early-stage funding to show productivity/capability and bolster rationale



(IDEALLY) AFTER YOU HAVE RESULTS

Results from research inform project rationale

- Research experience and credibility
- Indicative of productivity and contributions
- While not required, they are always recommended
 - o Crucial to establishing project rationale
 - Crucial to convincing reviewers of the potential merits
- Differentiate from competition (e.g., research, education, and dissemination)
 - o Gaps in field that you can address
 - o Experience with subject, instruments, etc.
 - Understanding of institutional research resources

Results from educational activities inform project

- Teaching experience and credibility
- Educational productivity and results as part of rationale
 - Grounded in the literature and/or best practices
 - Grounded in unique challenges and needs of your students
 - o Refined through training or practice

(IDEALLY) AFTER YOU DEMONSTRATE PRODUCIVITY

Not required but...can be valuable as you build your track record

Collaborate Secure & complete Serve as PI or co-PI early-stage work Collaborate with seasoned Gain experience as principal investigators (learn the Exemplify capabilities as solo or co-investigator process, scope, admin) PI Achieve preliminary Achieve preliminary Achieve preliminary results/publications results/publications results/publications Gain insights into Gain insights into directorate Gain insights into directorate or specific or specific program(s) directorate or specific program(s) program(s)



Gives you something substantial to point to in Results from Prior NSF Support section!

(IDEALLY) AFTER YOU SERVE AS REVIEWER

Unparalleled experience and insights

- Gain first-hand knowledge of NSF's peer review process
- Learn about common problems with proposals
- Discern strategies to write strong proposals
- Meet colleagues and NSF program officers managing programs related to your interests
- Service to funder and scientific community

How to become an NSF reviewer

- Send an e-mail to the NSF program officer(s) of the program(s) that fits your expertise
 https://www.nsf.gov/staff
- Introduce yourself and identify your areas of expertise and let them know that you are interested in becoming a peer reviewer
- Attach a 2-page CV with your current contact information



(IDEALLY) AFTER YOU DEVELOP PROJECT SUMMARY

Project Summary is the Essential Asset!

- Used to refine the project with colleagues and SMEs
- Communicate with program officer during pre-proposal phase
- Most read document in your proposal package
 - o Reviewers use to triage proposals for review and prepare for panel discussion
 - o Elevator pitch get them excited and enthused to read whole proposal

Write to the program officer and reviewers

- Start with compelling context and potential to advance on significant goal
- Cite literature, motivating theory, and preliminary results as evidence base
- Succinctly describe what, who, and how you will implement
- Describe the expected outcomes and impacts
- Link outcomes/impacts to the merit review criteria



(IDEALLY) AFTER YOU TALK WITH A PROGRAM OFFICER

Program officers are key staff

- Peers in your field; often have more "global" knowledge about work in your field
- Write RFPs, manage review panels, make funding decisions/recommendations
 - NSF POs tend to be advisory focused on objective review of science
- Critical and/or required step in the application process

Can help improve chances of funding

- Discuss agency interest and alignment
- Guidance and recommendations about your proposed topic *vis-à-vis* their priorities
- Strategic referrals to other people/programs
- Timely insights not otherwise available = definitive resource



3 X SUBMISSION OPPORTUNITIES

Rare NSF mechanism with resubmissions

- Very competitive mechanism (~10-20% success rate)
- Provides three opportunities to submit (prior to tenure)
- Opportunity to be strategic
 - o Incorporate peer reviewer feedback
 - Gain additional perspectives about your research and education plans
 - Include information about how you responded to reviewer feedback to enhance project design and proposal quality

Reconnect with your program officer prior to resubmission(s)

- Review panel summary/reviewer comments
- Ask them about priority for addressing changes in the resubmission(s)



Plan for three, aim for two, shoot for one!

TIPS FOR APPLYING TO NSF CAREER

ARTICULATE YOUR CAREER TRAJECTORY

Contextualize your five-year project within your 10-year career goals

- Convince the review panel how the work will help to advance a stellar career and have substantial positive impacts
 - o For your field(s) = intellectual merit
 - o For society and array of stakeholders = broader impacts
- Articulate how what you will do over the five-year project positions you for success over the next 7-10+ years



Consider alignment with NSF's Big 10 Ideas

- Pioneering research and pilot activities
 - o https://www.nsf.gov/news/special_reports/big_ideas

Align with NSF Strategic Plan

- Mission, vision, core values, goals, and strategic objectives
 - o https://www.nsf.gov/news/special_reports/strategic_plan/



CAREER proposals must have an integrated research & education plan

INTEGRATION OF RESEARCH & EDUCATION

- Propose creative research and educational plans
 - o Describe how they will be integrated and assessed
- Envision how the research program will impact educational goals & vice versa
 - o This feedback loop is critical to your career development
 - o Ensure that there is bi-directional relationship between the research and education
- Balance both research and education, but avoid overextending
 - o Focus on quality over quantity

Research	Education	
Five-year research plan to advance career	Activities related to how students are integrated into the research program	
Creative, original, evidence-based	Creative, original, evidence-based	
Well-conceived, organized, and integrated with education	Well-conceived, organized, and integrated with research	
Measurable outcomes, risks and contingency plans	Measurable learning outcomes and assessment plan	
Intellectual merit & broader impacts	Broader impacts & intellectual merits	



Communicating intellectual merit is key

INTELLECTUAL MERIT

- Make clear the expected IM contributions in the Project Summary
- Re-introduce and describe the expected outcomes and IM in the introduction to the Project Description
 - o Rigorous foundation of prior research
 - o Important knowledge gap
 - o Innovative approach
 - o Potential for transformative results
- Articulate and highlight the IM throughout the work plan
 - o Not a separate section since 2020
 - o Highlighting the merits when describing the research
- Articulate and highlight the IM throughout the education plan

Provide a strong summary of the ways the project outcomes will advance both research and education fields!

BROADER IMPACTS

Articulating broader impacts can be nuanced

- Results-focused outcomes!
 - o Derived from the research and education activities
 - o Integrated into the research and education activities but described in the BI summary
- Impacts on broad array of stakeholders
 - o Public (policy, labs, science, government)
 - o Private (tech transfer, commercialization, economic development, etc.)
 - o Your institution (department, students, others)
 - o Your students (serving target students e.g., groups underrepresented in STEM)
 - o Society more broadly (e.g., NSF Big 10 and NSF Strategic Plan)
- Ensure you describe how you will assess/evaluate the proposed broader impacts

Think broadly, be creative

- Impactful broader impacts are the results of innovative research and education
 - Not the activities themselves, but the results of those activities i.e., "impacts"



NSF expects meaningful assessment and evaluation of its funded projects

EVALUATION

- PIs accountable for carrying out the activities described in proposal
- Proposals should include:
 - o Clearly stated goals
 - o Specific descriptions of the activities that the PI intends to do
 - o Plan in place to document outputs of those activities
- Should be based on appropriate metrics
 - o Clear and measurable
 - Likely correlation between the effect of broader impacts and the resources provided to implement projects
- If the size of activity is limited, evaluation of that activity in isolation is not likely meaningful
 - o Assessing effectiveness of activities may best be done at aggregate level

Think about how your assessment plan advances on NSF's merit review principles and helps to measure and validate success!

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Broad and creative dissemination is crucial for CAREER





Describe who will be interested in your research outcomes (field and stakeholders)

- Identify journals and conferences in which you plan to publish and present
- Describe networking plans to increase awareness and citation of your work

Describe plans to get information into hands of array of stakeholders

- Public sector (e.g., universities and colleges, publicly-funded labs, etc.)
- Private sector (e.g., companies, industry thought leaders, etc.)
- Specialty/interest groups (e.g., policy, non-profits, etc.)
- Students and teachers (e.g., post doc, grad, undergrad, K-12, etc.)

Think beyond publications and conferences

- Tools that reach target audiences (websites, listservs, associations, events, etc.)
- Tools that reach broader audiences (e.g., websites, podcasts, public media, etc.)

Use metanarrative strategy to help drive home key points and tell your story

META-NARRATIVE

- Avoid random highlighting, which can be confusing
 - o Detracts from the logical organization
 - o Can confuse reviewers re key points they are seeking
- Provide a "meta-narrative" of the proposal useful to reviewers working at fast pace (e.g., skim reviewers)
 - Use bold italics for 7-10 complete phrases or sentences
 - Drive home key points vis-à-vis the funder mission and merit criteria
 - When strung together comprise a meta-narrative of the whole proposal
 - Useful during read, discussion, and scoring
 - Particularly useful to "skim" reviewers

When read separately, the meta narrative should be clear and persuasive vis-àvis the merits and potentially transformative impacts for your field(s), education science and capabilities, and your long-term career goals!



Be persuasive and write to excite!

GENERAL TIPS

- Be sure reviewers understand project on page 1
- Write to the reviewers SMEs, statisticians, and generalists
- Innovative activities are not sufficient
 - o Make clear how they help you achieve IM and BI
 - o Make clear how they will help you advance your career
- Help the reviewers understand
 - Use clear language (balance technical and non-technical descriptions)
 - o Make it easy to find the info they need to assess
 - o Think about secondary and "skim" reviewers
 - o Make strong links between research, activities, and outcomes that help reviewers "see" the merits

Finish with a strong summary of your broader impacts in that required section!

FINAL THOUGHTS

KEY QUESTIONS

- How does the CAREER proposer's past, present, or future work "fit into" the existing research landscape at that institution?
- How does the CAREER proposer's initial work lead toward later work?
- How does the CAREER proposer's past and present research activities point that person toward a line of investigation that can advance the person's research and education goals within the next five years or so?
- What kind of faculty member (both researcher and educator) does the soon-to-be CAREER proposer want to be? What is the personal brand that they want to establish? What former teacher do they want to emulate? What former research mentor do they want to be like? Why? How can they become the best possible version of themselves as an integrated researcher and educator?

HANOVER RESOURCES

GRANTS LEARNING CENTER



 Build your own grantseeking capacity with
 flexible training for faculty Hanover's **Grants Learning Center** offers on-demand grants training designed specifically for higher education professionals. Online training, resources, and tools can be accessed at any time from anywhere.

KEY FEATURES



Essential sessions covering foundational grant writing skills and strategies



Agency-specific modules to enhance approach to specific funders and programs (such as **NSF CAREER** & NIH R Series)



Self-paced modules with step-by-step guidance to develop compelling proposals



Interactive exercises, videos, and resources to navigate the process

visit hanoverresearch.com/grants-learning-center/ to learn more



QUESTIONS?