Applying to NSF

HANOVER RESEARCH

www.hanoverresearch.com

Webinar Logistics

- Feel free to ask questions on the phone or via the chat box.
- There will be time for questions after the presentation as well.

Applying to NSF

- NSF Overview
- The NSF Proposal Process
- The NSF Review Process
- Building Competitiveness with NSF

Applying to NSF

- NSF Overview
- The NSF Proposal Process
- The NSF Review Process
- Building Competitiveness with NSF

National Science Foundation: History and Mission

The National Science Foundation (NSF) is an independent federal agency.

Mission: **"to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…"**

Origin: Created by Congress in 1950.

Annual budget: $7.5 billion (FY 2017)

NSF funds approximately 24% of all federally supported basic research conducted by America's colleges and universities.

National Science Foundation: Goals

NSF's goals: "discovery, learning, research infrastructure and stewardship."

With these goals, NSF seeks to:

- Advance the **frontiers of knowledge**
- Cultivate a world-class, broadly **inclusive science and engineering workforce**
- Expand the **scientific literacy** of all citizens
- Build the nation's research capability through investments in advanced **instrumentation and facilities**
- Support excellence in **science and engineering research and education** through a capable and responsive organization

"NSF is where discoveries begin."

National Science Foundation: Activities

NSF makes grants to advance its goals.

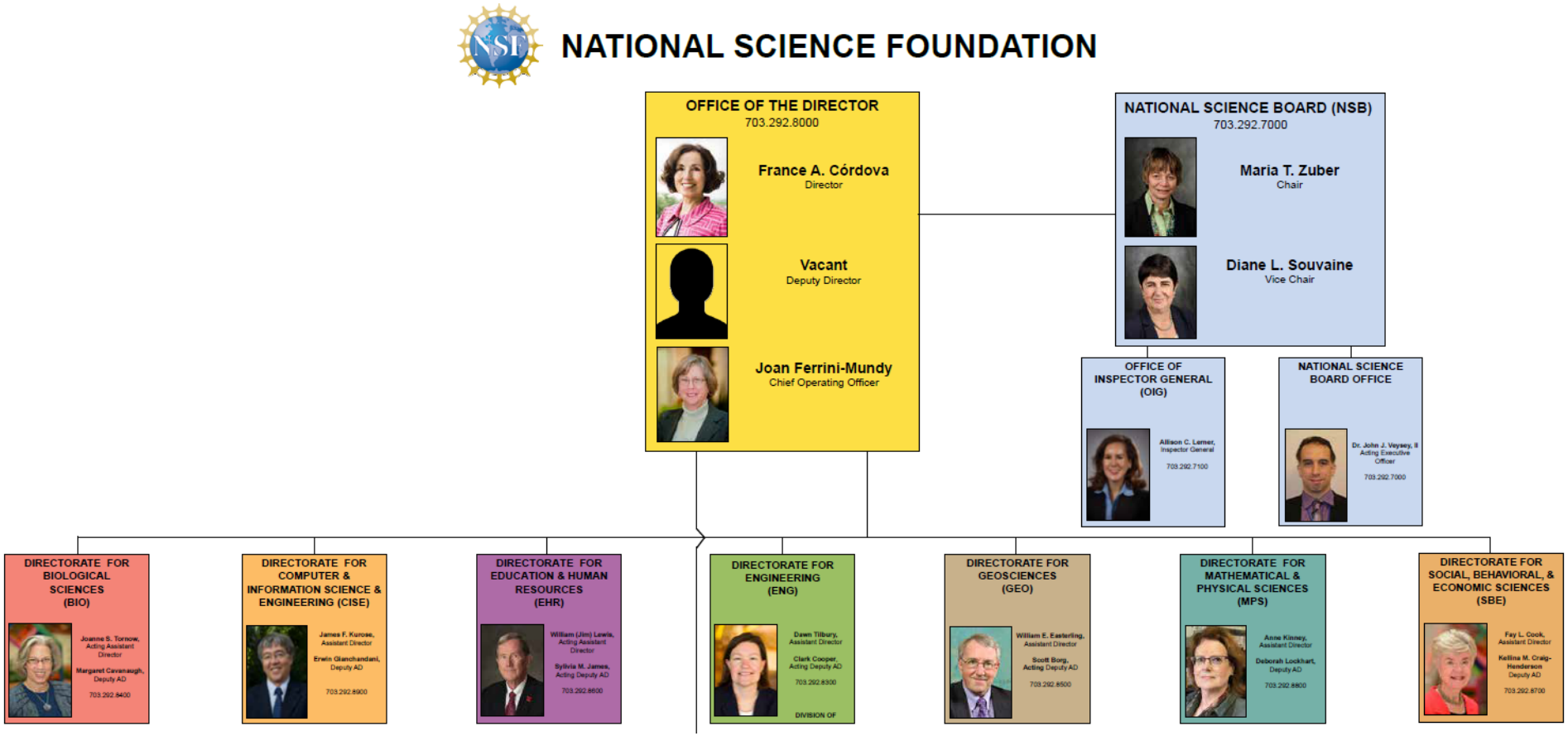
NSF grants fund:

- Basic science research
- Equipment that supports basic science research
- STEM education at all levels
  - PreK-12, undergraduate, graduate, lifelong learning
  - Formal and informal

NSF grants do not fund:

- Health-focused research
- Non-STEM education

NSF Structure



Source: https://www.nsf.gov/staff/organizational_chart.pdf (Administrative offices not included here.)

NSF Grantmaking Directorates and Divisions

Biological Sciences (BIO)

- Molecular & Cellular Biosciences (MCB)
- Biological Infrastructure (DBI)
- Integrative Organismal Systems (IOS)
- Environmental Biology (DEB)
- Emerging Frontiers (EF)

Computer & Information Science & Engineering (CISE)

- Advanced Cyberinfrastructure (ACI)
- Computing and Communication Foundations (CCF)
- Computer and Network Systems (CNS)
- Information and Intelligent Systems (IIS)

Education & Human Resources (EHR)

- Research on Learning in Formal and Informal Settings (DRL)
- Graduate Education (DGE)
- Human Resource Development (HRD)
- Undergraduate Education (DUE)

Engineering (ENG)

- Chem., Bioeng., Env., & Transport Sys. (CBET)
- Civil, Mechanical & Manufacturing Innov. (CMMI)
- Electrical, Comms. & Cyber Sys. (ECCS)
- Engineering Education & Centers (EEC)
- Industrial Innov. & Partnerships (IIP)
- Emerg. Frontiers & Multidisc. Act. (EFMA)

Geosciences (GEO)

- Atmospheric and Geospace Sciences (AGS)
- Earth Sciences (EAR)
- Ocean Sciences (OCE)
- Polar Programs (PLR)

Mathema-tical & Physical Sciences (MPS)

- Astronomical Sciences (AST)
- Chemistry (CHE)
- Materials Research (DMR)
- Mathematical Sciences (DMS)
- Physics (PHY)

Social, Behavioral & Economic Sciences (SBE)

- Social and Economic Sciences (SES)
- Behavioral and Cognitive Sciences (BCS)
- National Center for Science and Engineering Statistics (NCSE)
- Office of Multidisciplinary Activities (SMA)

NSF Directorate and Division Structure

Each NSF Division is divided into sections or clusters, which house grantmaking programs.

Example:

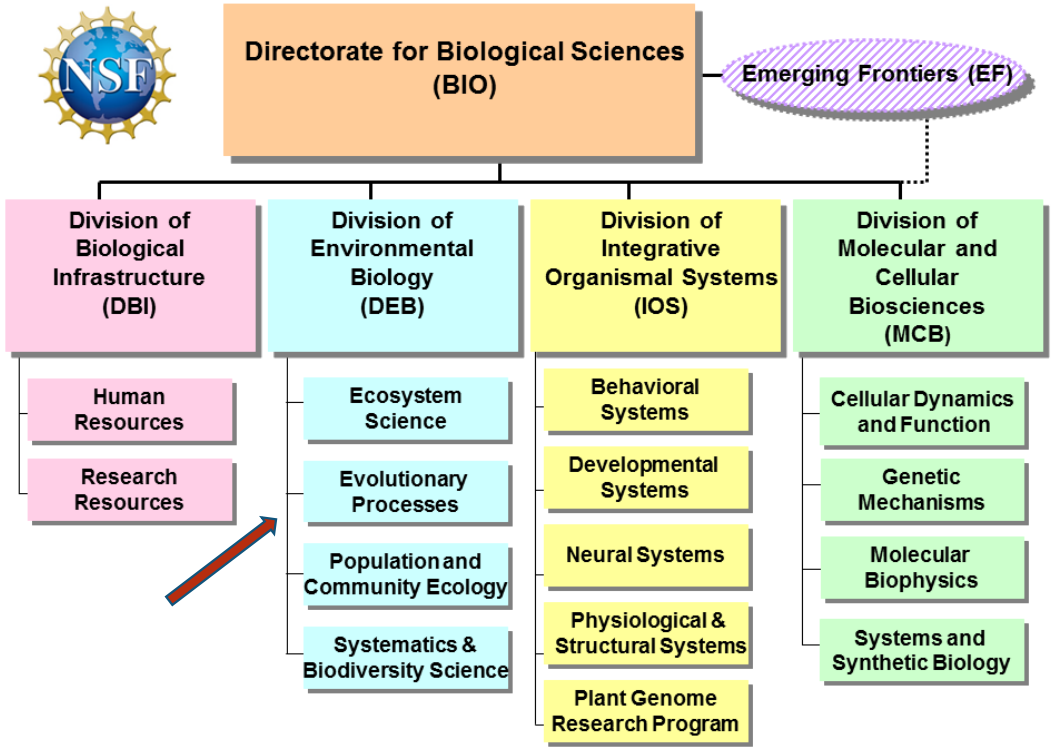
Directorate: BIO

Division: DEB

Cluster: Evolutionary Processes

Program 1: Evolutionary Genetics

Program 2: Evolutionary Ecology



NSF Staff Roles

NSF staff members have clearly defined roles and responsibilities.

NSF Director: Leads the agency, sets the overall agenda.

Assistant Directors: Lead Directorates; set research directions.

Division Directors: Lead Divisions; manage research areas.

Program Directors: Manage individual grantmaking programs.

Program Directors are the primary contacts for grant inquiries.

NSF Grant Mechanisms

Program Description

- Broad descriptions of programs and activities in NSF Directorates and Divisions.
- Encourage submission of proposals in areas of interest to NSF.

Program Announcement

- Formal publication announcing an NSF program.
- More detailed than a Program Description.

Program Solicitation

- Formal publication soliciting proposals in specific program areas of interest to NSF.
- More focused than a program announcement.
- Normally applies for a limited period of time.
- Competition among proposals is more precisely defined.
- Proposals compete directly with each other for NSF funding.

Dear Colleague Letter

- Provides general information to the community, including upcoming programs or changes.

NSF Opportunities: Beyond Individual Programs

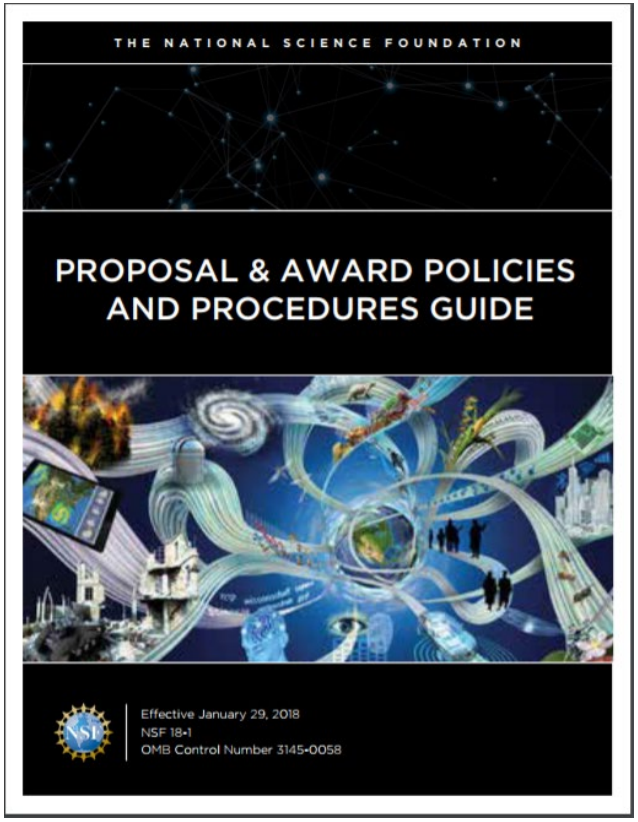
***NSF-wide opportunities* and *crosscutting programs* go beyond the boundaries of one NSF organization or program.**

Examples of NSF-wide opportunities include:

- ADVANCE: Increasing the Participation and Advancement of Women
- Faculty Early Career Development Program (CAREER)
- Experimental Program to Stimulate Competitive Research (EPSCoR)
- Grant Opportunities for Academic Liaison with Industry (GOALI)
- Innovation Corps (I-Corps)
- Major Research Instrumentation Program (MRI)
- National Science Foundation Research Traineeship Program (NRT)
- Grants for Rapid Response Research (RAPID) & Early Concept Grants for Exploratory Research (EAGER)
- Research Advanced by Interdisciplinary Science and Engineering (RAISE)
- Research Experiences for Undergraduates (REU)
- Facilitating Research at Primarily Undergraduate Institutions (RUI)

NSF Publications

NSF's website contains a wealth of information for applicants.



The most important document on the website is the Proposal & Award Policies and Procedures Guide.

The PAPPG is the applicant's best friend (or worst enemy).

The PAPPG contains application guidelines, from font sizes to information requested. It is updated yearly.

Investigators are responsible for knowing the contents of the PAPPG.

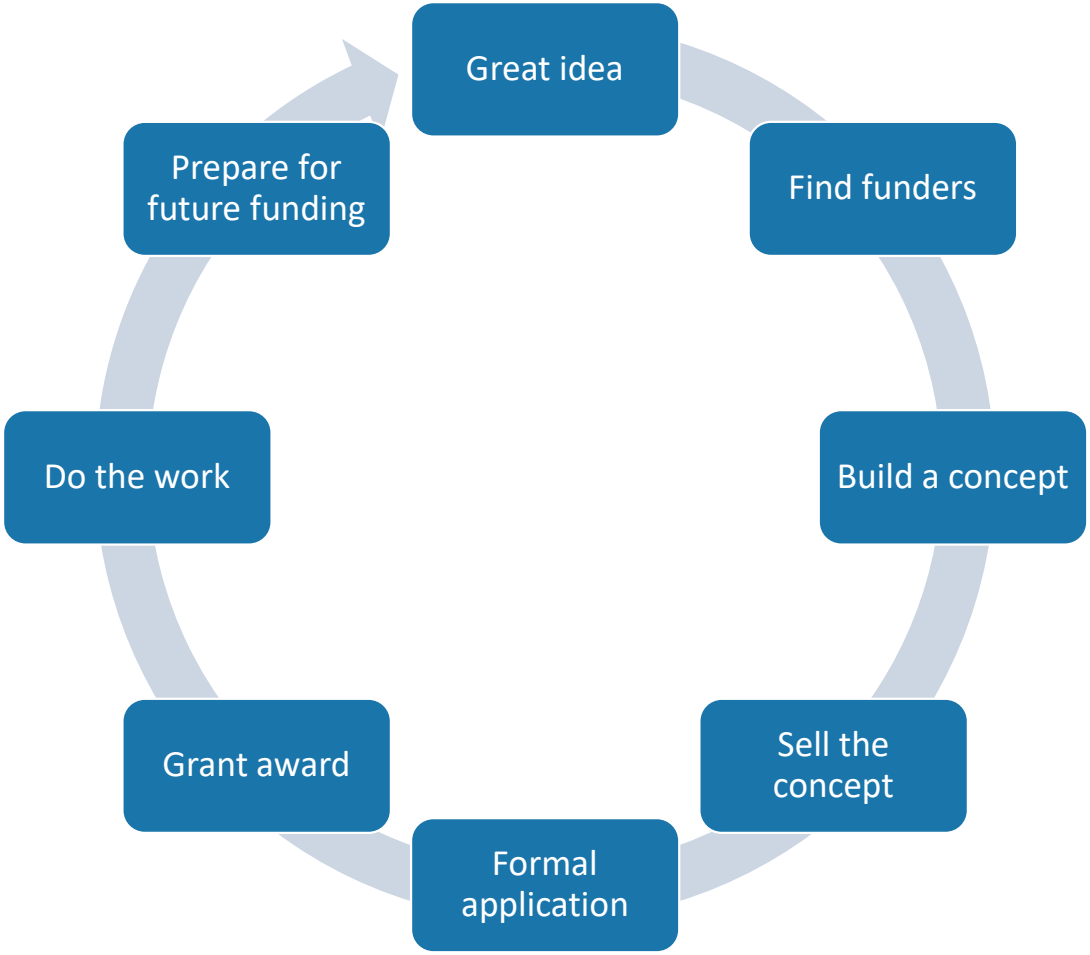
Note that not all important information is contained in NSF Program Solicitations.

When in doubt, consult the PAPPG.

Applying to NSF

- NSF Overview
- The NSF Proposal Process
- The NSF Review Process
- Building Competitiveness with NSF

The Grant Process



The NSF Grant Process

The NSF grant process follows the same pattern as other grant processes.

1. Start with a great idea to advance basic science or STEM education.
2. Identify the appropriate NSF Division(s)/Section(s)/Program(s).
3. Build a solid project concept aligned with Program goals.
4. Reach out to the Program Director to discuss the concept.
5. Complete the formal application process.

and either…

6. Receive a grant award.
7. Do the work.
8. Prepare for future funding.

or

6. Receive a grant decline.
7. Review feedback and discuss with Program Director.
8. Revise and resubmit if advised.

The Great Idea

To be competitive for NSF funding, your idea needs to respond to NSF's review criteria: Intellectual Merit and Broader Impact.

Intellectual Merit encompasses the potential to **advance knowledge**.

Broader Impacts encompass the potential to **benefit society** and contribute to the achievement of **specific, desired societal outcomes**, including:

- Increased **economic competitiveness**
- Development of a **globally competitive work force** in STEM
- Increased participation of **women** and **underrepresented minority groups**
- Improved **education** and teacher development in **elementary and secondary schools**
- Improved **undergraduate education**
- Increased **partnerships** between academe and industry
- Increased public **scientific literacy**
- Increased **national security**

Finding the Right NSF Program

To find the right NSF program for your idea, do your research.

At the NSF website:

- Read available materials regarding divisions of interest.
- Drill down to sections/clusters and programs.
- Remember that your work may be relevant to more than one program.
- Use a variety of keyword searches to find solicitations of interest.

When reviewing program information:

- Identify the program's goals and interests.
- Make a clear match to your own goals and ideas. (Don't force it!)
- Use NSF Award Search to see what has been funded.

Make a list of potential programs and solicitations of interest.

Confirming Program Match: Concept Development

Before you begin the formal NSF proposal process, you need to <u>confirm</u> that your idea is a good match for the targeted NSF Program.

*To prepare for this process, develop your idea into a **project concept**:*

- Articulate what you want to do, why, and how you will do it.
- Draft a short <u>concept paper</u> to share with a Program Officer.
- The concept paper can be in the form of an NSF Project Summary, or it can follow the traditional NSF proposal format. It should be less than 5 pages.

Key tips:

- Clearly communicate your project's intellectual merit and broader impacts.
- Connect your project directly to the program's goals.
- Communicate why you are the right person to do this work.

Confirming Program Match: Connecting with NSF

With your concept paper in hand, you are ready to reach out to NSF to confirm program fit.

To connect with the Program Director at the concept stage:

- Reach out and introduce yourself via email first.
- Ask for a meeting, on the phone or in person.
  - Note that some POs prefer not to meet in person.
  - If the PO prefers to answer questions via email, go with that.
- Share your concept paper with the Program Officer before the meeting.

Keep your communication with the Program Officer professional and respectful: remember, you are building your reputation.

Connect: Emailing a Program Officer

Sample email to a Program Officer:

Subject: Request for call to discuss XXX due on DATE

Dear Dr. X:

I am interested in submitting a proposal for program solicitation #XXX "Program Solicitation Title" and would like to schedule a call with you to discuss whether my research is appropriate for this opportunity. [If your request is urgent, indicate that here and explain why.]

[Briefly describe your proposed work and why you think it is a good fit.] If it would be helpful, I can provide a [brief concept paper / project summary] for you to review prior to our call. [If you have specific questions that you want the PO to consider, include them here.]

[Provide possible days/times *or* indicate that you can be available at the PO's convenience.]

Thank you in advance for your assistance. I look forward to talking with you soon.

Contact Information

Connect: Meeting with a Program Officer

Always prepare questions before your meeting with the Program Officer.

Common questions:

- Is this project a good fit / competitive for this opportunity / your funding priorities?
- Are there other opportunities that would be a better fit?
- What are your recommendations for improving the fit / competitiveness?
- What other recommendations do you have?
- What are the most common causes for proposals being declined for this opportunity?
- What are the usual success rates for this program?
- What is your preferred method for me to contact you if I have additional questions?

Remember to <u>spend as much time listening as talking</u>: POs can provide very valuable feedback and guidance. They know what they're talking about!

Connect: Continued PO Communication

Always follow up after meeting with a PO, and send questions as soon as they arise in the proposal development process.

- Follow up with an email thanking the PO for their time and summarizing the key points you took away from the call.
- In any future communication about this opportunity, reference your call.
- Use the subject line of your email to reflect the purpose and urgency of the request.

Remember that Program Officers are very busy: make things easy for them with clear, specific, actionable communication and a courteous tone.

Taking Stock of Program Officer Feedback

After meeting with the Program Officer, take stock of the feedback and information you've gathered.

Answer these questions:

- How did the PO respond to your concept?
- Did they recommend conceptual changes?
- Did they encourage a proposal?
- Did they recommend that you investigate other opportunities?
- Did they provide specific guidance on developing a competitive proposal for their program?

Always take the PO's advice. They know what they are talking about. If they are lukewarm about a concept, shop it elsewhere or revise the concept.

Developing an NSF Proposal

Once the Program Director is "on board" with your concept, you can begin proposal development.

Key considerations:

- Start early (3-6 months before the deadline or submission window).
- Make a clear grant development plan, including a timeline.
- Make sure the plan includes opportunities for feedback from colleagues and grant professionals.
- Keep careful track of all required proposal elements.

Remember that writing and submitting an NSF proposal is akin to writing and submitting a peer-reviewed publication: it takes a lot of effort and commitment to do it well.

Elements of an NSF Proposal

An NSF grant proposal has many "moving parts."

A typical application package includes, in addition to FastLane forms:

- Project Summary
- Project Description
- Budget and Budget Justification
- Biographical Sketches
- Current and Pending Support
- Facilities, Equipment, and Other Resources
- Data Management Plan
- Post-Doctoral Mentoring Plan

While the Project Description is the heart of the proposal, note that other documents may also require significant time and energy.

The NSF Project Description

Many NSF Program Solicitations will require specific information in a specific order, though some do not specify. Most Project Descriptions are limited to 15 pages.

Sample Project Description outline:

- Introduction/Vision
- Literature Review/Preliminary Work
- Results from Prior NSF Support
- Conceptual Framework
- Hypotheses or Research Questions
- Methodology/Strategy
- Scope of Work
- Management Plan
- Staff and Institutional Qualifications
- Evaluation Plan
- Broader Impacts
- Intellectual Merit

The underlined sections are required by the 2018 PAPPG in every NSF Project Description, unless the solicitation states otherwise.

The PAPPG does not specify where in the Project Description they should occur, so you can adjust them to fit the trajectory of the document (unless the solicitation prescribes a specific order).

Writing a Strong Project Description

A strong Project Description clearly conveys the importance and impact of the work.

Key tips for a strong Project Description:

- Be specific about the project's potential impact on your field (intellectual merit) and society (broader impacts).
- An NSF PO once said "Let no question fester"—this is important! Don't let reviewers be distracted by unanswered questions as they read.
- Make sure all content is relevant to the project at hand.
- Use plain language. Keep it simple and clear. "Show, don't tell." Avoid hyperbole.
- Use the first person ("I/we") and the active voice ("We will do X" rather than "X will be done").
- Use clear, simple formatting, with easy-to-navigate headers.
- Present information in well-crafted tables and figures.
- Use skillful repetition to emphasize key points.
- Edit and proofread!

Always assume that your reviewer is exhausted!

An <u>experienced PO once said</u>, "Think of your proposal as the 40th in a stack."

The Project Summary

NSF uses the Project Summary to sort and screen proposals.

- A Project Summary is not an abstract.
  - NSF will ask for an abstract during the funding process.
- NSF Project Summaries must not exceed one page in FastLane.
  - Note that this could be less than a page as shown in your word processor.
- Three sections are required:
  - Overview
    - Activities, objectives, and methods
  - Intellectual Merit
    - Knowledge to be created, impact on the scientific field
  - Broader Impacts
    - Impact on society and NSF's goals
- The Project Summary is traditionally written in the third person, though this is no longer required.

Budget

The budget shows NSF how you will spend money to accomplish the proposed project.

Tips for Budget Development:

- Gather estimates, quotes, and documentation early in the process.
  - Avoid cost surprises!
- Track all revenue and expenses to make sure you will have to resources to do what you need to do.
- Use an internal spreadsheet to “tinker” with the budget until it is final.
- When the budget is final, “translate” it to the required forms.

Budget Justification

The Budget Justification justifies the listed budget amounts and shows how each budget item will help accomplish the project.

Tips for Budget Justification Development:

- Show a clear method of calculation for each item.
- Link each item back to proposed activities and NSF program goals.
- Use the same terminology that you used in the Project Description.
- Include enough information so that the reviewer knows where the numbers came from and that they are reliable.

The Budget Justification must be consistent with the Project Description.

NSF Biographical Sketches

NSF BioSketches are limited to two pages, with no personal information.

(a) Professional Preparation
- List education and training beginning with undergraduate.

(b) Appointments
- List appointments in reverse order, beginning with current.

(c) Products *(formerly Publications)*

(i) Up to five products most closely related to the proposed project

(ii) Up to five other significant products
- Must be citable and accessible. Examples: publications, data sets, software, patents, and copyrights.

(d) Synergistic Activities
- Up to five examples of work demonstrating broader impact (e.g., service, innovations in teaching/training, development of tools or methodologies)

Make your BioSketch tell a story about why you are the right person for the work.

NSF Current and Pending Support

Current and Pending Support helps NSF determine whether you have adequate time and support to accomplish the project.

For Current and Pending Support:

- List all current project support from any source (e.g., Federal, State, foundation, industry, internal), as well as proposals under consideration in reverse chronological order in the form provided.
- Include the proposed project and all other projects or activities requiring a portion of time of the PI and any other senior personnel, even if they receive no salary support from the project(s).
- Show the total award amount for the entire award period covered (including indirect costs) as well as the number of person-months per year to be devoted to the project, regardless of source of support.

NSF Facilities, Equipment and Other Resources

Facilities, Equipment and Other Resources allows NSF to determine whether you have the necessary resources available to accomplish the project.

For Facilities, Equipment and Other Resources:

- Describe the internal and external resources (both physical and personnel) that the organization and its collaborators will provide to the project, should it be funded, in narrative format.
- Do not include any financial information (e.g., value estimates)! This would count as voluntary committed cost sharing, which NSF wants to avoid unless clearly specified.
- Describe only those resources that are directly applicable to the project.
- Do not use this document to circumvent page limitations! This will only annoy staff and reviewers.

NSF Data Management Plan

The Data Management Plan allows NSF to make sure that data and results are shared with the scientific community to advance research.

For the Data Management Plan, describe in two pages:

1. The types of data, samples, physical collections, software, curriculum materials, and other materials to be produced in the course of the project
2. The standards to be used for data and metadata format and content (Where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies.)
3. Policies for access and sharing including provisions for appropriate protection of privacy, confidentiality, security, intellectual property, or other rights or requirements
4. Policies and provisions for re-use, re-distribution, and the production of derivatives
5. Plans for archiving data, samples, and other research products, and for preservation of access to them

NSF Postdoctoral Researcher Mentoring Plan

The Postdoctoral Researcher Mentoring Plan allows NSF to make sure that post-docs receive adequate support and mentoring.

For the Postdoctoral Researcher Mentoring Plan, in one page:

- Describe the mentoring that will be provided to all postdoctoral researchers supported by the project.
- Include all post-docs, regardless of institution (e.g., applicant, subawardee, collaborative partner).
- Examples of mentoring activities include, but are not limited to: career counseling; training in preparation of grant proposals, publications and presentations; guidance on ways to improve teaching and mentoring skills; guidance on how to effectively collaborate with researchers from diverse backgrounds and disciplinary areas; and training in responsible professional practices.

Applying to NSF

- NSF Overview
- The NSF Proposal Process
- The NSF Review Process
- Building Competitiveness with NSF

NSF Review Process Overview

NSF Review Questions

In evaluating proposals, NSF reviewers consider the following questions:

1. What is the potential for the proposed activity to:

    a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and

    b. Benefit society or advance desired societal outcomes (Broader Impacts)?

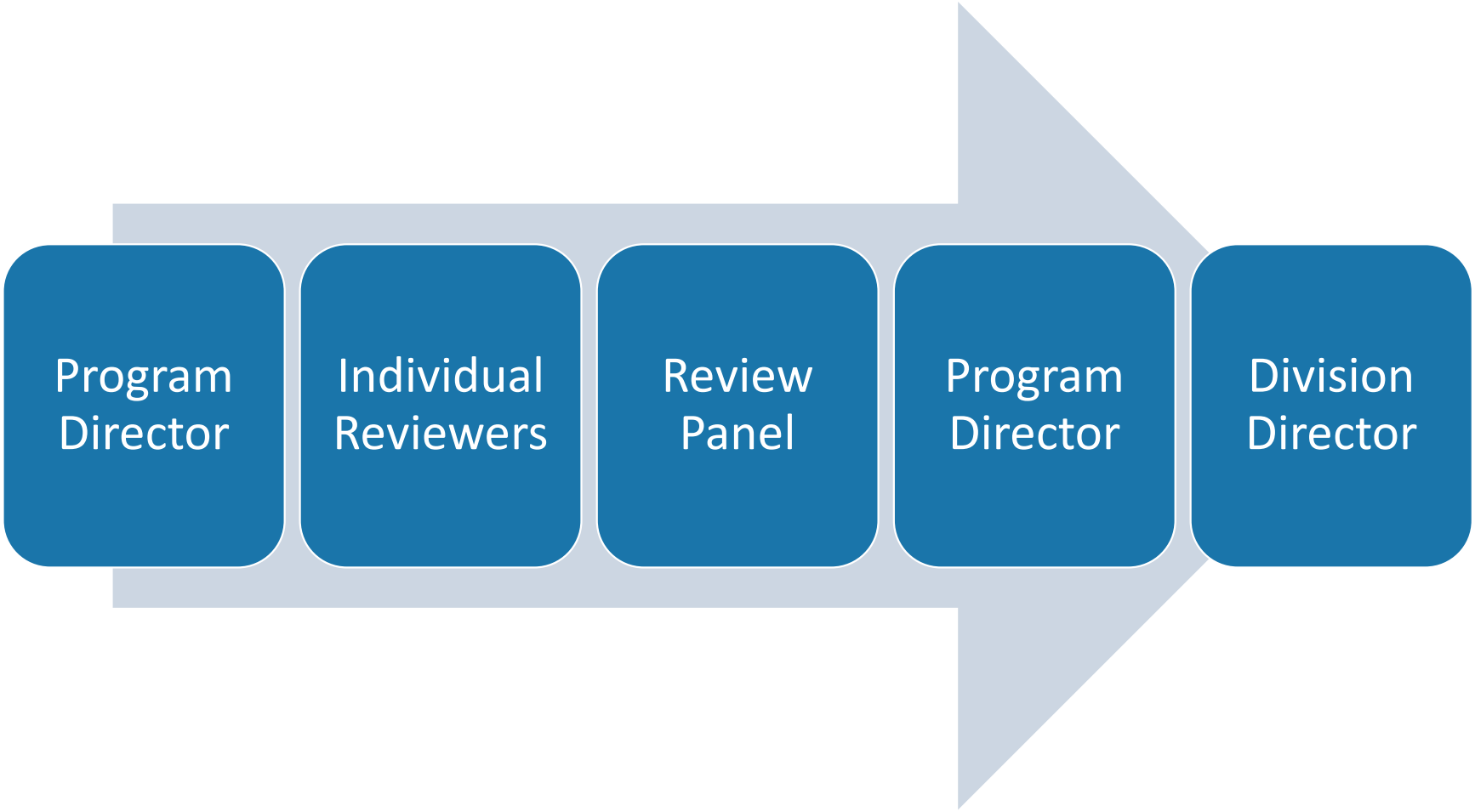
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?

3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?

4. How well qualified is the individual, team, or organization to conduct the proposed activities?

5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

NSF Peer Review Process



NSF Peer Review Process

Depending on the program, an NSF grant may go through multiple layers of peer review.

- Not all proposals are reviewed (e.g., proposals that are not responsive to the solicitation are returned without review).
- Proposals that are reviewed are rated Excellent, Very Good, Good, Fair, or Poor.
- Panel discussions may change reviewers' minds about their original rating of a proposal.
- Program Directors make funding recommendations after receiving panel recommendations.
- Panel dynamics can affect a proposal's chances of funding (e.g., in cases where only one panelist is an expert in the specific area, the panel may defer to that reviewer).

Insights from an Experienced Program Officer

General characteristics of people making decisions on your proposal

Program director

Generalist in your field
Busy
Looks at all proposals
Runs merit review
Helpful, can be cranky
Wears reading glasses
Counsels PIs

Reviewer

Technical expert in the field
Very busy
Reads one proposal in detail
Wants to be doing anything else
Often helpful, can be grumpy
Has eyestrain

Panelist

Broad Expertise
Very, very busy
Has glasses & eyestrain

Reads many proposals (~50)
Compares and ranks proposals
Just wants to be done

Source: Gisele Muller-Parker; Western Washington University

Insights from an Experienced Program Officer

Common Reasons for High Ratings

- "This proposal suggests a clear, elegant, well-documented approach to a problem that has plagued this field for decades."
- "The PI has a beautiful plan. Undergraduates or new graduate students can step right into this work, yet it solves a major problem and will be publishable in a first-rate journal."
- "This is certainly adventurous, and I frankly would have doubted it could be done. Yet the PI has proven the method in preliminary work *AND* had it accepted by a peer-reviewed journal!"
- "This reads like a dream. I have rarely seen a proposal, even from long-established investigators, that shows such careful thought and meticulous presentation."

Source: Gisele Muller-Parker; Western Washington University

Insights from an Experienced Program Officer

Common Reasons for Low Ratings

- No well defined hypotheses or tests of same. Lack of focus. "Why all the rambling, this seems like a fishing expedition."
- Extraneous aspects or PIs. "What does that component/co-PI have to do with the central focus of the proposal?"
- Important information on experimental and sampling procedures is omitted. "I really can't tell what is going to be done and how."
- The work can certainly be carried out, but it doesn't address any topic of broad current interest. "I would probably not read a paper describing the results."
- Scope of the work is out of proportion to the budget and amount of time needed to do the work.

Source: Gisele Muller-Parker; Western Washington University

NSF Reviews

If your proposal is reviewed by NSF, you will receive several documents.

Elements of an NSF review:

- Context statement.
  - Gives information about the overall competition.
- Individual reviews.
  - Individual reviewers' comments and ratings before the panel discussion.
- Panel summary.
  - A summary of the results of the panel discussion.
- Program Officer letter.
  - May contain additional information.

Working with Reviews

NSF reviews are very valuable. Pay careful attention.

Key tips for working with reviews:

- Review comments show how your proposal came across.
- Read them multiple times.
- Give yourself a break to blow off steam if necessary, then come back.
- Look critically at the proposal from the perspective of that reviewer.
- If there is a misunderstanding, consider how it could be avoided in the future.
- Are there structural or language changes that would help reviewers understand your project?
- If all your reviewers point to the same issues, pay attention!

Refining a Proposal

After carefully reviewing your reviews, reach out to your Program Officer to discuss potential revisions.

The PO can help you:

- Interpret different reviews: if reviewers disagreed, the PO can help you decide who to listen to.
- Decide whether to revise and resubmit to this program: you can ask the PO directly whether the program is still a good fit, or if you should take the project elsewhere.
- Understand the kinds of project design changes that may be necessary.
- Understand what kinds of technical "grantsmanship" issues need to be addressed.

Do not reapply to an NSF opportunity without consulting the PO!

Applying to NSF

- NSF Overview
- The NSF Proposal Process
- The NSF Review Process
- Building Competitiveness with NSF

Build Competitiveness Through Strong Projects

Strong concepts make strong proposals.

Build your competitiveness by proposing:

- Transformative work
- Timely work
- Work that has a high potential for payoff / strong return on NSF's investment
- Original work
- Cost-effective work

Your project concepts should be exciting for people in your field—you want your reviewer to say "I wish I had thought of that!"

Build Competitiveness Through Experience

Experienced investigators are more competitive for funding.

Build your competitiveness by:

- Publishing your work
- Learning new methodologies
- Collaborating with experienced investigators
- Establishing a record of funding (even internal funding)
- Participate in research training
- Participate in STEM outreach activities

Remember: grants lead to more grants; start small and it will snowball.

Be a reviewer!

The best way to build competitiveness with NSF is to serve as a reviewer!

Reviewing can help you:

- Understand the review process better.
- Empathize with reviewers.
- Learn how to present your project in a way that works for reviewers.
- Understand the dynamics of panel review and how to prepare for it.

Contact your Program Director to volunteer to serve as a reviewer. They will appreciate it!

Hanover Research supports CWU faculty and staff members throughout the grant development process. We work on one project at a time, with the following core capabilities:

Proposal Revision

We lead the proposal revision process by reshaping a previous submission to incorporate new project elements, responding to reviewer comments and heightening the proposal's responsiveness to the solicitation. *Timeline: 8 weeks*

Proposal Support

We supplement the work of project teams by providing partial proposal writing support and consultative grant narrative editing and review. These services vary based on client needs and submission deadlines. *Timeline: 6 weeks*

Proposal Review

We provide a strong review, edit, and critique of client-drafted narrative materials, helping the project team ensure compliance with submission guidelines to heighten the competitiveness of their proposal. *Timeline: 3 weeks*

Contact Research & Sponsored Programs to request Hanover support.


QUESTIONS?

HANOVER RESEARCH

CONTACT

Mallory Waters
Content Director
202.499.6736
mwaters@hanoverresearch.com
www.hanoverresearch.com