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The Keys to Preparing Successful Research Grant Proposals

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ABSTRACT

This article seeks to demystify the competitive grant recommendation process of scientific peer review panels. The National Research Initiative Competitive Grants Program (NRICGP) administered by the U.S. Department of Agriculture-Cooperative State Research, Extension, and Education Service (USDA-CSREES) serves as the focus of this article. This article provides a brief background on the NRICGP and discusses the application process, the scientific peer review process, guidelines for grant writing, and ways to interpret reviewer comments if a proposal is not funded. The essentials of good grant writing discussed in this article are transferable to other USDA competitive grant programs.

Key Words: *competitive grants, national research initiative competitive grants program, NRI, USDA-CSREES.*

Over the last decade, as Federal and state formula funds have declined, universities have placed a greater value on attracting external funding, which has carried over into faculty evaluations (USDA-CSREES, 2000; Ballenger and Kouadio; Norton, Colyer, Anders Norton and Davis-Swing). This article seeks to demystify the recommendation process of scientific peer review panels and provide insights to improve proposal quality and enhance funding success. My comments focus on the National Research Initiative Competitive Grants Program (NRICGP) administered by the U.S. Department of Agriculture-Cooperative State Research, Extension, and Education Service (USDA-CSREES), which has approximately a 25-percent overall funding rate (USDA-CSREES, 2000). Although I focus on the NRICGP, the essentials of good grant writing are transferable to nearly all other USDA competitive grant programs. Additionally, the NRICGP selection process protocols are modeled from other programs, e.g., the National Science Foundation (NSF); thus, again recommendations are transferable. This article provides a brief background on the NRICGP and discusses the application process, the scientific peer review process, guidelines for grant writing, and ways to interpret reviewer comments if a proposal is not funded.

NRICGP Background

The NRICGP was created by the 1990 farm bill for the purpose of increasing the quality

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and quantity of research to solve problems related to agriculture. Beginning in 1992, the NRICGP was the primary source of competitive Federal funds for agricultural economists via the "Markets and Trade" program (Section 61.0) of the NRICGP and to a lesser extent the "Rural Development" program (Section 62.0). In 2000, slightly over $4 million dollars were awarded in these programs out of $119 million for the overall NRICGP. Thus the social sciences receive a very small proportion (3 percent) of the total program.

Application Process

Two key USDA-CSREES publications are essential in preparing a NRICGP grant proposal: (1) the *NRICGP Program Description and Guidelines for Proposal Preparation,* referred to as the *Program Description* and (2) the former *NRICGP Application Kit,* now called "Application Forms."[1] These publications are available online at www.reeusda.gov/nri. The *Program Description* is available each fiscal year, typically in August. In addition to describing the program, important changes from the previous year (e.g., deadlines, page limits, or indirect cost formulas) are included under the "Please Read" section. The *Program Description* is now subdivided into three main areas.

"Part I—Program Description" describes the following:

- The types of projects funded (e.g., standard research grants, conferences, postdoctoral fellowships, new investigator awards and strengthening awards) and eligibility requirements.
- The scientific peer review of applications, including the review process, evaluation factors for each type of project funded (e.g., standard research grants, postdoctoral fellowships, new investigator awards, conferences, and strengthening awards).
- Research program categories (Natural Resources and the Environment; Nutrition, Food Safety, and Health; Animals; Biology and Management of Pests and Beneficial Organisms; Plants; Markets, Trade, and Rural Development; Enhancing Value and Use of Agricultural and Forest Products; and Agricultural Systems Research).
- Agricultural research enhancement awards (AREA) which include postdoctoral fellowships, new investigator awards and strengthening awards—sabbatical awards, equipment grants, seed grants or strengthening standard research project awards.

"Part II-Guidelines for Proposal Preparation" contains the following components:

- Submission requirements, including types of proposals—new, renewal, or resubmitted—and format and content of proposals for both conventional projects (standard research grants and conferences) and AREA applications.
- Grant awards and post-award administration.

"Part III-General Information" specifies the following items:

- What to submit and where to submit your proposal.
- How to obtain application materials, materials available on the internet, NRI deadlines, and identification of NRI program staff.
- A checklist, which I find to be particularly valuable, especially as a final check to ensure that one's proposal has all the required elements.
- A link to the "Application Forms."

The former *Application Kit* contained proposal forms including the Application for Funding cover page, Project Summary, Conflict of Interest, Budget, and Current and Pending Support, among others. These are now available directly on the USDA-CSREES NRICGP website under "Application Forms" or through the above link in Part III of the *Program Description.*

The Project Summary includes a list of different proposal types. Check each box that applies to you, your project, and your institution.

[1] As of fiscal year 2002, many components of the former *Application Kit* have been appropriately transferred into the *Program Description.* Forms within the former *Application Kit* are now listed as "Application Forms" on the USDA-CSREES NRICGP website.

Proposal types include standard research grants, conference grants, and agricultural research enhancement awards.

The AREA awards described in Part I of the *Program Description* have specific eligibility requirements but are worth considering if you meet the criteria. Eligibility for both new investigator awards and postdoctoral fellowships is based on the individual and dependent on time from Ph.D. graduation (e.g., five years for new investigators). Additionally, postdoctoral fellowships are limited to U.S. citizens and other stipulations apply. Both new investigators and postdocs submit their proposals to the appropriate research program categories described above. Proposals are evaluated by the same panels as standard research proposals. The difference is that these proposals get a "second chance" if they fall slightly below the funding line, as described below.

Strengthening awards are a component of the AREA. Unlike the new investigator and postdoc categories, eligibility for strengthening awards depends on the eligibility of one's institution. These awards are quite appealing if the applicant is eligible since they include sabbatical awards, equipment grants, seed grants, or grants strengthening standard research project awards.

Strengthening awards are targeted to faculty of small and mid-sized institutions that are not among the most successful universities receiving Federal funds for science and engineering (identified in table one of the *Program Description*) and institutions eligible for USDA EPSCoR (Experimental Program for Stimulating Competitive Research) funding as identified in the "AREA Strengthening Awards" section of the *Program Description*. EPSCoR eligibility is complex; see the flow chart in figure one of the *Program Description* to determine eligibility. Note that faculty from EPSCoR or small and mid-size institutions who have received a NRICGP competitive research grant in the past five years are not eligible for strengthening awards.

As with the new investigator and postdoc proposals, these proposals are submitted to the same research program categories as standard research grants; no separate panel reviews them. However, strengthening proposals may have different due dates than standard research grants. They are also evaluated separately from conventional projects, since their criteria differs slightly from standard research grants due to their uniqueness (see the "Evaluation Factors" for all NRICGP proposal types in Part I of the *Program Description*).

Evaluation factors for standard research grants, postdoctoral fellowships, and new investigator awards include the following:

- "*Scientific merit of the proposal, consisting of:*
  - Novelty, uniqueness, and originality.
  - Conceptual adequacy of hypothesis or research question.
  - Clarity and delineation of objectives.
  - Adequacy of the description of the undertaking and suitability and feasibility of methodology.
  - Demonstration of feasibility through preliminary data and/or for postdoctoral fellowships, publication record of the mentor.
  - Probability of success of project.
- *Qualifications of proposed project personnel and adequacy of facilities:*
  - Training and demonstrated awareness of previous and alternative approaches to the problem identified in the proposal, and performance record and/or potential for future accomplishments (for postdoctoral fellowships, this specification applies to the mentor as well as to the postdoctoral applicant).
  - Time allocated for systematic attainment of objectives.
  - Institutional experience and competence in subject area.
  - Adequacy of available or obtainable support personnel, facilities, and instrumentation.
- *Relevance of the project to long-range improvements in and sustainability of U.S. agriculture:*
  - Documentation that the research is directed towards a current or likely future problem in U.S. agriculture.

- Development of basic research ideas towards practical application."

Additional criteria for postdoctoral fellowship applicants are specified in the "Evaluation Factors" section of the *Program Description.*

The section on "Submission Requirements" in Part II of the *Program Description* is crucial. The "Format and Contents of Proposals" section clearly lays out the order of the proposal and items to be included for each type of proposal. Additionally, resubmitted proposals must be identified on the Application for Funding page and must include a "Response to Previous Review" section placed directly after the Project Summary.

Scientific Peer Review of Grant Proposals

Review Process before Panel Meeting

The *Program Description* briefly describes the scientific peer review process which includes written evaluations of submitted proposals by selected "ad hoc" external reviewers and subsequent assessment and ranking of the proposals by a panel of peer reviewers. Once a grant proposal is submitted the principal investigator (PI) is sent a notification of receipt within 60 days of the deadline. The USDA-CSREES NRICGP program director for the specific program of application (e.g., Markets and Trade) briefly reviews each submitted proposal to see if it is in the correct program. On occasion, a program director will consult with the PI and transfer a proposal to a more appropriate NRICGP program, as long as the deadline for the alternative program has not been missed. This is done to ensure the appropriate expertise is available to evaluate the proposal.

Once this initial review occurs, the panel manager[2] works with the program director to identify the "ad hoc" reviewers as well as panelists. Ad hoc reviewers and panelists are chosen based on their expertise, education, and diversity (*Program Description*). The panel manager seeks to link the science in the proposal to the expertise of reviewers. The NRICGP database helps to achieve this match.

In recent years, the "Markets and Trade" program submissions have ranged between 75 and 85 proposals. Each proposal must be evaluated by at least four ad hoc reviewers. Thus, for 80 submissions, over 300 reviews must be completed. The panel manager tries not to assign more than three proposals per ad hoc reviewer, since these proposals can range from 50 to 70 pages in length even with the 18-page limit for the project description. Ad hoc reviewers are given approximately four to six weeks to return written reviews of the proposals based on the above criteria. Additionally, at the bottom of the evaluation form they are asked to check an evaluation box—excellent, very good, good, fair, or poor. Their written reviews are distributed to peer review panelists before the panel meeting in Washington, D.C. and ultimately returned to the principal investigator, less any item that would identify the reviewer.

The number of panelists varies depending on the number of submitted proposals. For the "Markets and Trade" program, with 75 to 85 submissions, the number of panelists has ranged from 9 to 10 members. In selecting panelists, the panel manager takes into account the science in the submitted proposals and seeks to select panelists with corresponding expertise. For example, if there are numerous proposals on biotechnology, it is important that one or more panelists have this specific expertise.

Panel members are first sent the Project Summary sheets for each proposal to identify review preferences. Thus, each panelist sees the cover sheet for all submitted proposals. Each

[2] The panel manager is an academic from the discipline for the specific program category within the NRICGP. For example, past panel managers for the "Markets and Trade" program have been agricultural economists; similarly for the "Rural Development" program, where past panel managers have been rural sociologists. Panel managers become part-time Federal employees due to the intensity of work and length of assignment. The panel manager oversees the review process with the program director; neither is part of the actual evaluation or recommendation process of the proposals.

panelist will review about 25 proposals, with the panel manager assigning proposals to panelists trying to honor their preferences. Each proposal will be reviewed by three panelists.

Panelists are assigned three levels of review—primary, secondary, and reader. Both primary and secondary reviewers must provide written reviews using the same proposal review sheets as the ad hoc reviewers. These reviews, along with the ad hoc written reviews, are ultimately returned to the principal investigator. The reader is not required to provide written comments. Before the panel meeting, panelists will receive written reviews from ad hocs and other panelists for each of their assigned proposals.

Panel Review Process

Once the scientific peer review panel convenes in Washington, D.C., they meet the evening before for an orientation session with the USDA-CSREES NRICGP program director and the panel manager. The program director takes the lead on the session, emphasizing confidentiality, conflict of interest, the role of the program director and panel manager—to ensure that every proposal receives a fair review—as well as the process of reviewing proposals over the next three days.

For each proposal, the panel discussion begins with the primary reviewer presenting the proposal to the rest of the panel, including the topic, goals and objectives, methods, and expected results. The primary reviewer then evaluates the proposal based on the above criteria—scientific merit, qualifications of the PI and institution, and relevance to U.S. agriculture. Next the secondary reviewer adds to the primary reviewer's presentation saying whether he/she agrees or disagrees with the primary reviewer and adding any additional points. Next, the reader provides his or her view as well as an overview of the ad hocs' written reviews. The panel manager asks if there are any questions or comments from other panelists. If so, discussion occurs.

After these presentations and discussion the panel manager then asks the reviewing panel members for a proposal ranking—outstanding, high priority, medium priority, low priority, some merit, or do not fund. These rankings correspond to columns on a board in the front of the room for all panelists to see. The panelists consult and usually come to a consensus. They make a recommendation and then the panel manager places the proposal's number and PI's name in the appropriate category.

The assigned panelist—formerly the primary reviewer but as of last year the reader—writes up a panel summary which captures the panel discussion and identifies the proposal ranking. This panel summary is signed by the three panelists who reviewed the proposal. It is returned to the PI along with written reviews by the primary, secondary, and ad hoc reviewers. The panel summary is key since it captures the panel discussion, which may conflict with individual pre-panel reviews.

The panel review process takes about 15 minutes per proposal and lasts for at least two full days until all proposals are reviewed. Throughout this process the USDA-CSREES NRICGP program director takes copious notes to capture the discussion of the panel. These notes supplement the panel summary and provide useful information when a PI calls the program director for additional feedback.

Although the reader may appear to have a lesser role in the process, this is not so. I have seen cases where a primary and secondary reviewer had one recommendation, the reader had an opposite recommendation, and the decision concluded with panel consensus based on the reader's recommendation. I have seen similar outcomes based on a strong positive or negative ad hoc review, which differed from the primary reviewer's stance.

Sometimes the panel will not come to consensus on a specific proposal; the panel hits an impasse. In this case, the program director and panel manager will ask additional panelists to volunteer to read the proposal that night and report back the next day. These "volunteers" have heard the arguments and bring back to the panel comments which usually result in panel consensus in a relatively short period of time.

On the last day of the panel meeting, before final ranking of proposals, the panel is asked

to consider re-ranking proposals. Similar to grading students' papers, the panel may grade tougher or easier at the beginning or end of the meeting. The panel strives for consistency and fairness through the process of re-ranking proposals. The rankings on the board are divided into two general categories, noting that the "Markets and Trade" program typically does not fund projects ranked below medium priority:

- Fundable—outstanding, high priority, medium priority.
- Not fundable—low priority, some merit, or do not fund.

Panelists are asked if any proposal should be moved from the not fundable side of the board to the fundable side, and vice-versa. If a proposal moves to the fundable side, and typically at least a few proposals do, then the panel determines the appropriate evaluation category. Once all proposals are in agreed-upon categories, the panel ranks proposals within each category.

Starting from the outstanding category, the panel is asked to put a numerical ranking on each proposal. The top 25 to 30 proposals are identified (i.e., number 1 through 30). This ranking stays intact. The total number of proposals funded depends on funds available in that specific research program category. Additionally, if there is a proposal by a new investigator or AREA that falls just below the funding line, it may be funded depending on available set-aside funds for these additional categories. Finally, the reviewers for each of the proposals recommended for funding is asked for recommendations on the proposal's budget. Given the limited amount of funds in the "Markets and Trade" program, cost savings may result in funding one or two more proposals.

Grant Writing Guidelines[3]

First impressions do matter. As described above, only three panelists (and the ad hoc reviewers) read a proposal cover-to-cover. Most panelists only see the Project Summary of a proposal and hear the panel discussion. Thus, it is essential that the Proposal Summary include its key aspects: long-term goals and objectives, uniqueness and novelty, and anticipated results as they relate to the goals of the funding program. The importance of the Project Summary can not be over emphasized.

Make the proposal easy to read (e.g., use sub-headings). The more transparent the description of your research and its worthiness for funding, the greater the chance that a panelist will become an advocate of your proposal in presenting it to the panel and justifying funding it over the many other worthy proposals. The proposal advocate typically is a panelist, but may also be an external reviewer who writes a positive and compelling review that convinces the panel of a proposal's worthiness.

Consistent with making a proposal easy to read, state clear and concise objectives, preferably within the first two pages of the proposals (Duffy). A principal investigator should capture the interest of the reviewer early in the proposal so that reading the proposal becomes a joy instead of a task for the reviewer. Avoid technical jargon. Reviewers—both panelists and ad-hoc reviewers—may not be experts in your area. The PIs must convey the merit of their project to reviewers. The degree to which a reviewer must work hard to understand a proposal exponentially decreases its probability for funding success.

Proposals are helped if they use timely information and focus on a "hot" topic. Include recent references and up-to-date preliminary data. Current and past hot topics include the following: biotechnology, food safety, waste disposal, agricultural industrialization, and

[3] General references on grant writing include MacKenzie, Cahoon, and Brown; Reif-Lehrer; Ries and Leukefeld; and an online short course from the Foundation Center. Additionally, each year USDA-CSREES conducts a workshop (open to all) on grant writing that includes an overview of all USDA competitive grant programs, guidelines on grant writing, and break-out sessions with program directors from competitive grant programs (e.g., NRICGP, IFAFS, Higher Education Programs, and Integrated Research, Education, Extension competitive grant programs—Section 406).

risk assessment. The *Program Description* also lists topics and examples of needed research for each program area. "Hot topics" make research relevant to today's challenges facing U.S. agriculture, consistent with NRICGP goals.

Proofread your proposal. Panelists can be annoyed by "typo's" and may interpret a sloppy proposal as a reflection of sloppy research skills. Realize that the NRICGP review process is single blind in which reviewers know the identity of the PI, but the PI does not know the identity of the panelists or ad-hoc reviewers. Just as important as proofreading is following the NRICGP proposal instructions and guidelines: observe page limitations, margins, and font size; include a publication list and vitae limited to the last five years only; and include letters of support from collaborators indicating their commitment to work with the PI on the proposed project. Not following these instructions can also irritate panelists. Again, PIs want the panelists to be their advocate; they want to make their proposal as "reviewer friendly" as possible. The *Program Description* includes a useful checklist.

To enhance your chances for funding success, ask peers to review your proposal prior to submission. Responding to pre-submission, internal peer review is a common practice for journal article submissions and should be extended to grant proposals. This practice is extremely important and may deter or reduce criticisms from panelists. I suggest having at least two peers read your proposal: a quantitative person for its modeling or technical aspects and a good writer for overall logic and flow.

A key aspect of the proposal's project description is the "Rational and Significance" section. It is important that this section be issues-oriented rather than model-oriented, specifically, issues affecting U.S. agriculture and targeted to the specific research program category area for which you are applying. The rational for your study should directly relate to the goals of the NRICGP in general, as well as specific goals listed in the research program category. It is important to state this linkage within your proposal.

Do your proposal homework. Cover the basics by answering the who, what, where, why, when, and how questions in the project description of your proposal. For example, provide background on your topic via the literature review to answer "what" is the topic and "why" it is important. Identify "who" will benefit from your results and "how" your proposal is unique and different from past research. Your project description must clearly specify in the research methods section "what" work will occur and "how" it will be implemented. "When" is described in your tentative schedule. Specify "where" the work will be conducted. For co-PIs and collaborators at different institutions, specify "who" will do "what" and "where." Reinforce this commitment with letters of support.

In closing, during proposal preparation the two overriding key questions that a PI should address with respect to panelists are Why should we fund this research? and Why are you the right person to do this research? Answering these bottom-line questions is essential to receiving funding.

Interpreting the Outcome and Conclusions

Quick news is good news if your proposal is funded. Typically, the program director, or in some cases the panel manager, will contact successful PIs within a week of the panel meeting. If you do not receive a call, it is important to correctly interpret the outcome. All PIs will receive written reviews from ad hoc reviewers and panelists. These individual reviews are written before the panel meeting and only the panel summary captures the panel discussion.

If your proposal is not funded, it is important to evaluate in which category it was ranked. Due to limited funds, recent "Markets and Trade" funded proposals were ranked outstanding or high priority. Thus, to be ranked a medium priority is encouraging in terms of resubmitting your proposal.

Another way to evaluate the prospects for your proposal is to consider the following assessments as synthesized by David Orden:

- "Not in the game." In this case, panelists do not want to see your proposal again. This is probably in the "do not fund" category. You need to ask yourself how to fundamentally improve the proposed research. Discussions with colleagues may help you to better see what the standard for fundable research is and how to achieve such a level.
- "In the game, but not quite there." This is the best category to be in for resubmission. Panelists are encouraging you to revise and resubmit your proposal. If you re-submit your proposal the next year, be sure to address review comments directly and indicate how you have strengthened the proposal in response to these comments on the original proposal.
- "Good topic, but not a good fit." If your proposal falls within this category you might consider another program area within NRICGP or another grant program.

Finally, contact the program director to get additional information. The program director took notes during the panel discussion to supplement the panel summary. If you do call the program director, be prepared for an honest assessment.

In closing, my intent in this article was to demystify the recommendation process for NRICGP competitive research grants as well as provide some guidance for good grant writing. In regards to grant writing, answering the following bottom-line questions for panelists is essential to receive funding: Why should we fund this research? and Why are you the right person to do this research? In an effort to increase funding success, I encourage you to be active in the process as a reviewer, panelist, or principal investigator.

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