Proposal writing: A key to success

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Proposal writing is a key skill in science (and life)

- Asking the right question is as important as answering a particular question
- Proposals are necessary for obtaining needed resources
- Proposals organize ideas, time and effort
- Proposal writing is a creative process
- Success in many fields is often measured as one’s ability to obtain resources
Proposal writing is part of the overall process of doing science.
Several elements are common to all proposals

• Proposal must convince reviewers
  1) that you are addressing an important question
  2) that you or your team are the right person/group to address the question
• Proposal has to fit within the aims of the program
• Proposal needs to establish that the resources provided by the agency or institution will be well spent
Developing an idea is an iterative process

• Ask a question/develop a hypothesis
• Then ask yourself:
  • Can I design an experiment to answer the question/test the hypothesis?
  • If I can answer the question/test the hypothesis, then “So what?”
• Reformulate the question/hypothesis
• Than ask your advisors, colleagues, students the same questions
Develop an understanding of the relevant scientific literature

- Read relevant scientific papers
- Search web for relevant information
- Talk to advisors, colleagues, students
- Attend seminars
- Visit other laboratories
- Don’t follow this adage: “Weeks and months of lab and field work can save an afternoon in the library”
Develop the zen of proposal writing

- **Enthusiasm** counts; get excited
- Give yourself adequate *quality time*
- **Feedback & revision** essential; seek it out
Proposal success is cumulative (first proposal is the hardest)
Low success rates → Try, try, try again

<table>
<thead>
<tr>
<th>Fiscal year</th>
<th>Number submitted</th>
<th>Number awarded</th>
<th>Total $ awarded (millions)</th>
<th>Success rate (%)</th>
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Key aspects of proposal sections

• **Title:** most important words in the proposal

• **Abstract:** 2\textsuperscript{nd} most important words; written for general audience

• **Budget/budget justification:** follow guidelines; realistic needs, not wish list

• **Biographical sketch:** tailor to proposal

• **Research plan:** clear objectives, hypothesis-driven

• **References:** inclusive, complete, consistent
Develop estimates of replication

- Statistical analysis helpful in defining the numbers of replicates required
- Level of replication important in being able to budget (time and money)
- Previous work or preliminary data can provide estimate of variability
- Include the concept of replication in the experimental design
Include a time line/research plan

Important calculation:
Estimated time/2 \( \approx \) Real time

Example time line:

Table 5: The project schedule shows when key deliverables will be produced.

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<td>Performance assessment</td>
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Get the references right

• References need to be inclusive; include potential reviewers & key papers

• Referencing must be consistent; standard style throughout

• References in text need to match references in bibliography


Proposal Number: NSF02-132  
Proposal Title: Molecular probes and monitoring  
Principal Investigator: Ann Example

**Scientific Merit:** This is largely a methods development program of study. The attempt here is to compare molecular probe assay methods in a rigorous series of lab and field experiments.

**Relevance to Program Objectives:** This may be a better fit into a different funding scheme, but accurate analysis of one of the key species is a prerequisite for a monitoring program. There is no direct integration with the management community in this program.

**Principal Investigator Qualifications:** The PIs are clearly qualified.

**Past Research Performance:** A solid and consistent research publication record.

**Facilities for Research:** The PI has all the research infrastructure necessary for conducting the proposed research.

**Costs:** The budget is rather high, partially due to the field component, subcontracts, and technical support.

**Overall Rating:** VERY GOOD
Seagrasses are not a monophyletic group of plants, indeed they are not even true grasses (Poaceae). Rather, "seagrass" is a functional grouping--marine flowering plants that live entirely submersed and share a large number of convergent morphological and physiological characteristics (Larkum & den Hartog, 1989). Recent evolutionary studies using DNA sequences of the chloroplast genome have revealed that the present seagrass diversity probably arose from 3 separate evolutionary events (Waycott & Les, 1996). Thus, convergence of various characteristics of seagrasses has occurred within and between these 3 groupings (Cymodoceaceae 'complex'; Zosteraceae, Hydrocharitaceae). The outcome of this convergence is a suite of common morphological and physiological characteristics (eg., internal gas spaces or lacunae, epidermal chloroplasts, lack of stomata, rapid leaf turnover, reduced respiratory tissue, salt excretion through the plasmalemma). In spite of this convergence, **there exists a wide range of variability between seagrasses in the manner and way that they adapt to environmental conditions and this variability provides the focus of the proposed research.**
Proposal writing takes practice

- Effectiveness of collaborations in proposal writing process is generally a good predictor of the success of the research project.

- Don’t take rejection personally; the best predictor of number of successful proposals is number of proposals submitted.

- Proposal success can be surprising.
Proposals can be converted into presentations & publications

Proposal figure

Publication figure
Research should be guided by, not ruled by, the proposal

• The proposal represents an initial plan and a justification for the research

• Obtaining good results more important than following proposal protocol (ideas change)

• Part of success is willingness to learn from mistakes and adapt

• A series of small experiments can be better than a probably doomed mega-experiment
Further resources

Lots of proposal writing guidance on www:
  National Science Foundation
  University of Pittsburgh

Science communication guidance
  Integration and Application Network

Previous proposals