

# Writing NSF Research Proposals

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**UTEP – February 21, 2013**

**Acknowledge**  
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# Overall Guidance

- Proposal Writing: Idea(s)-based
- Craftmanship helps
- It is more an **Art** than a **Science**
- You can avoid Mistakes and Pitfalls
- You **CANNOT** ensure success
- Finding the right program(s)
- Language: Precise, easy to understand, avoid jargon, avoid acronyms
- Aesthetically pleasing, good balance between text and graphics (a picture is worth a thousand words)

# NSF

- The NSF **Mission** is
  - To promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense (NSF Act of 1950)
- The NSF strategic goals are related to:
  - Discovery – advance frontiers of knowledge
  - Learning – cultivate an inclusive S&E workforce
  - Research infrastructure – investment in advanced instrumentation, cyberinfrastructure, tools, etc.
  - Stewardship – support excellence in S&E research and education

NSF funds fundamental research and education in most areas of science, mathematics and engineering

# NSF

- Looks for research proposals that
  - Are innovative and push the frontiers of knowledge
  - Contribute to national needs and priorities
  - Go beyond marginalia
  - Integrate well with educational goals
  - Involve research

# CAREER Awards

- Funds the academic career development of new faculty (it is not a research award)
- Is based on a development plan –“well argued specific proposal for activities that will build a firm foundation for a **lifetime** of **integrated** contributions to **research** and **education**”
- **Requires Preliminary Data**
- Devote real time to develop an educational plan
- Duration: 5 years
- Min (in many programs, it's also a Max.) amount: \$400,000
- Deadline: July each year

# DOs

- Build on your strengths
- Differentiate this proposal from your Ph.D. thesis work and other sponsored work
- Perform thorough literature search and exploratory research before writing the proposal
  - Journal articles (update with personal contact)
  - Read the NSF Grant Proposal Guide (GPG)
- Establish and keep your contacts

# DON'Ts

- Rush
- Wait until last minute (1 month) to contact program directors
- Make the proposed work (whether it be research or education) **too broad**
- Make the proposed work **too narrow**
- Ask for too much (or too little) money
- Ignore rules (Grant Proposal Guide or soliciation) and misc. items

# IM and BI Statements

- They are required; both in Project Summary and in Project Description
- **Separate section in Project Description**
- Your proposal will be rated based on them
- But:
  - What are they?
  - What should you include?
  - How should they shape your proposal?



# Intellectual Merit

- The Intellectual Merit is the contribution that your research makes to the knowledge base and how that impacts the field
- Questions:
  - What is already known?
  - What will your research add?
  - What will this do to enhance or enable research in your or other fields?
  - Why is your contribution important to your research community?
  - How will your results be “transformative”?
  - “Newness” is not enough

# Broader Impact

- The Broader Impact focuses on the benefit to society at large as a result of your research result
- Means to benefit society include:
  - Economic/environment/energy/health/safety
  - Education and training
  - Providing opportunities for underrepresented groups – **Don't get overconfident at UTEP!**

The key issue is how your results will be applied — why would the general public care?

# Proposal Basics

- Write to the reviewers (not to program officers and directors and not to yourself)
- Your proposal will be judged by the reviewers
- Reviewers want to know four things:
  - What is it about (the goals/objective)?
  - How will you do it (the technical approach)?
  - Can you do it (you and your facilities)?
  - Is it worth doing (intellectual merit and broader impact)?
- This is, basically, all the proposal needs to convey – but it needs to convey this

# The Research Topic

- It must be a new research idea
- It must not have been done before
- It must be significant
- There must be higher than probability zero that you can do it
- It must lend itself to a viable plan
- You must have the facilities to accomplish the work

# The Research Objective

- This is probably the hardest part of the proposal and the most important aspect

The objective is a concise statement of what you intend to find out that we don't already know

# The Objective

- Four acceptable ways to do it right:
  - The research objective of this proposal is to test the hypothesis  $H$ .
  - The research objective of this proposal is to measure parameter  $P$  with accuracy  $A$ .
  - The research objective of this proposal is to prove conjecture  $C$ .
  - The research objective of this proposal is to apply method  $M$  from field  $Q$  to solve problem  $X$  in field  $R$ .

# The Research Objective

- How to do it right:
  - The research objective of this project is to measure the cross-section of the muon-neutrino interaction at 5 GeV accurate to 10%.
  - The research objective of this proposal is to test the hypothesis that chip formation in high-speed machining of brittle materials is determined by parameters  $x$ ,  $y$  and  $z$ .
  - The research objective of this project is to determine whether on-demand peer tutoring using i-pods can enhance learning in organic chemistry.

# The Research Objective

- Doing it right:
  - Begin: “The research objective of this project is...”
  - Limit: 25 words or less
  - Be specific about what you intend to find out
  - Be specific about what you intend to find out
  - Be sure your statement is comprehensible
  - Be sure your objective leads directly to a research procedure to accomplish the objective
  - Put it up front—sentence one, paragraph one, page one
  - Do not give a long-winded account...



# Writing the Summary

- The most important statement is your statement of the goal(s)/objective(s)
  - It should be sentence 1 of paragraph 1
  - Do not begin with a descriptive report: “The sky is falling. Tools are breaking. Designs are failing...”
  - Do not begin with a state-of-the-union address: “Business is moving off shore. Manufacturing is going to the ...”
- Remember, this is not a tech paper, it is not a murder mystery (where we find out what the objective is on page 15)
- Don’t forget the Intellectual Merit and Broader Impact statements

# What We Want to Know

- What is your research objective?
  - This is what directs your proposal to the appropriate program
- What is your approach?
  - Outline — just two or three sentences
- Why is your contribution important to your research or education community (the intellectual merit)?
- If successful, what will be the benefit to society (the broader impact)? Why is your project important to society?

# Remember

- Your proposal may (will) be returned without review if:
  - You fail to include explicit statements of intellectual merit and broader impact (entitle them Intellectual Merit, Broader Impact)
  - You use the wrong font or it is too small
  - The margins are too narrow
  - Your bio is incorrectly formatted
  - You have an unauthorized attachment
- NSF will return, and you anger the reviewers anyway
- Submit **ON TIME**

# Tips on Proposal Writing

- Use only font types and sizes allowed (Arial, Courier New, or Palatino Linotype at a font size of 10 points or larger; Times New Roman at a font size of 11 points or larger; or Computer Modern family of fonts at a font size of 11 points or larger. No more than six lines of text within a vertical space of one inch – Spacing – exactly 12.
- Do not use figures or tables as filler—everything should contribute
- Everything should be legible—do not use 2 point font on figures or tables
- Be sure to include a clearly stated set of goals/objectives
- Use only the required format
- Be sure to include intellectual merit and broader impact statements in the body of the proposal

# The 15 Page Narrative

- The next 15 pages of your proposal give supporting information and detail to your summary
- Start with a restatement of your **goal(s)/objective(s)**, clarify it, and provide a plan to accomplish it
- Provide a convincing argument that you can carry out your proposed plan
- Restate and provide detail on your intellectual merit and broader impact
- Requires a separate broader impact section!
- **A picture is worth a thousand words**

# Tips on Proposal Writing

- Don't include letters of support if
  - They aren't very supportive
  - Letters from several companies/universities are identical
  - They are letters from previous proposals
- Don't cut and paste together new proposals from old declined proposals
- Set the proposal aside for a week then proofread your proposal before you submit it (and ask a friend to proofread the proposal)

# My “Ideal” Proposal

- Based on “just-published” article – preliminary data, accepted by community – proof of concept
- One or two Graphics that clearly describe(s) overall concept
- Easy to read/understand, avoids jargon
- Concise but explicit and convincing
- Avoids duplication
- Precise language
- Flows unaided (acronyms, structures, formulas)