Rudi Eigenmann

UD Electrical and Computer Engineering

NSF "Rotator" from 2013 to 2017
served as Program Director
in the Office for Advanced Cyberinfrastructure
(OAC – formerly ACI/OCI)

and
as NSF Expert in CISE/CCF, currently

NSF Core Mission: Fundamental Research

$7.3 billion FY 2015 appropriation

94% funds research, education and related activities

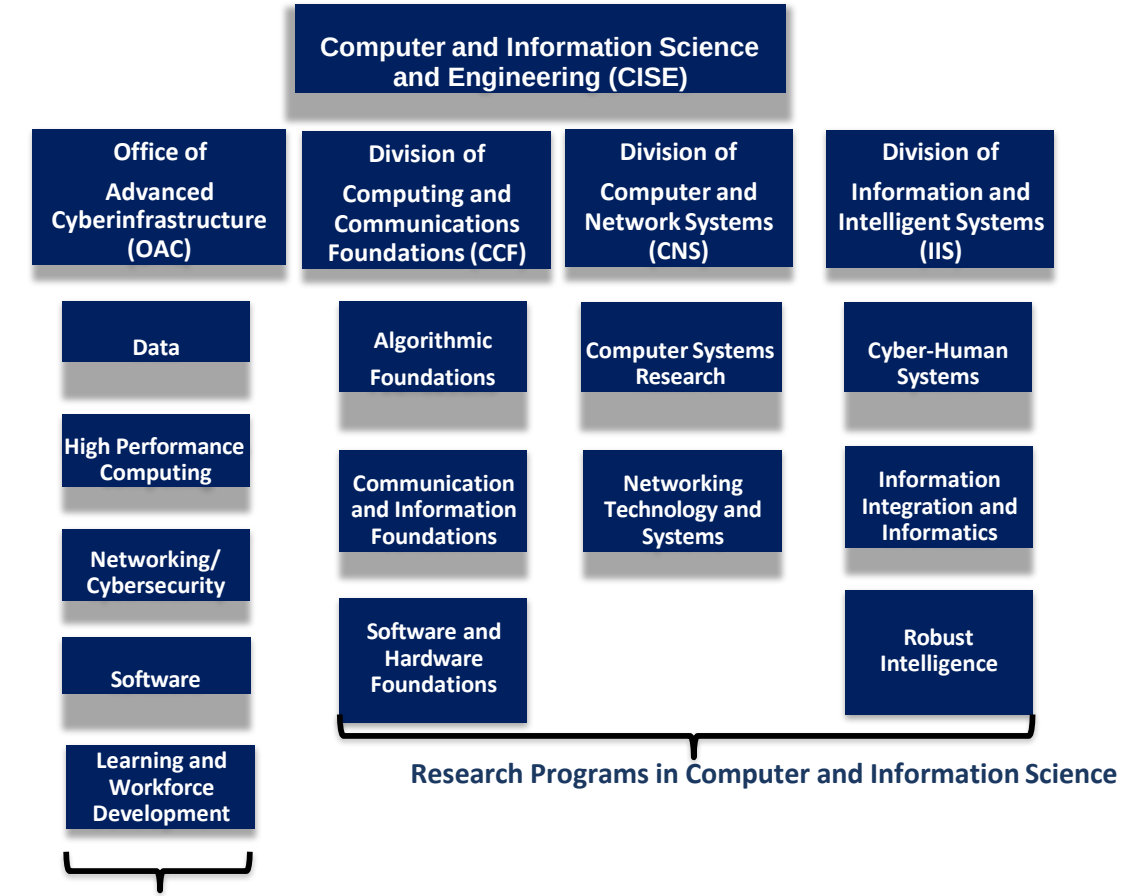
50,000 proposals

11,000 awards funded

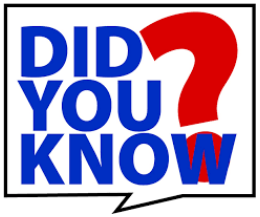
2,000 NSF-funded institutions

320,000 NSF-supported researchers

Fundamental Research


Computer and Information Science and Engineering (CISE)
Office of Advanced Cyberinfrastructure (OAC)
Division of Computing and Communications Foundations (CCF)
Division of Computer and Network Systems (CNS)
Division of Information and Intelligent Systems (IIS)
Data
High Performance Computing
Networking/ Cybersecurity
Software
Learning and Workforce Development
Algorithmic Foundations
Communication and Information Foundations
Software and Hardware Foundations
Computer Systems Research
Networking Technology and Systems
Cyber-Human Systems
Information Integration and Informatics
Robust Intelligence
Research Programs in Computer and Information Science
NSF-wide mission to advance computational and data-enables science&engineering

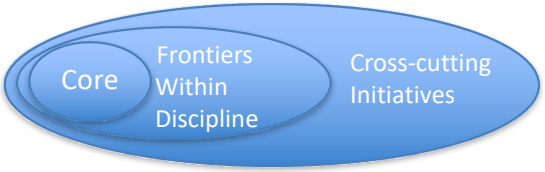
Some NSF Trivia



- ~$6.5…7.9B budget, 2017--2020
- 93% goes to community
  - Program directors do everything on a shoestring budget
- Highest quality science agency, not mission oriented
- Peer review system
- Broad Mission: "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…"
- Rotator system – 50% of all Program Directors, 2-4 years
  - Rotators continue to be on payroll of home institution via NSF grant
- Diversity and agility across NSF, bottom-up processes, PAPPG (and other docs) change frequently
- Is there a political climate?

Research Programs

This is the structure in most science areas



- Important science and technology frontiers
  - Core program
- Cross-cutting initiatives (UtB, BigData, INFEWS, NSCI, Smart Cities)
- Dear_Colleague_Letters, Programs, Solicitations
  - sign up for NSF email
- Unsolicited proposals
- Clearance process and 3-month rule
- Review and Award process
  - Peer review
  - Confidentiality and Conflicts of Interests
  - Review criteria
  - Decision making process, panel recommendations and portfoliomanagement
- Grants and Cooperative Agreements

Recommendations

- Call Program Managers
  - What (not) to ask?
- Participate in NSF workshops - influence programs
- Volunteer as panelist
- Visit NSF - talk to PDs
- Read solicitations carefully, try to find out what they are looking for
  - Look at solicitation-specific review criteria
  - call PDs, but keep in mind that panelists may have their own interpretation of the solicitation
- Look at existing awards – NSF award search
- Reviewers like specifics. Avoid vague, arguable, abstract discussions. Keep "philosophizing" to a minimum. Address all salient points in the summary.
- Never assume reviewers know the context. Make proposals self contained.
- Some reviewers may read the proposal "on the plane to NSF". Make sure your summary contains the "elevator talk".

News

- “No-deadline” pilot programs may be coming
- RAPIDS, proposals in response to urgent needs. E.g., COVID-19 RAPIDS
- Change in NSF Director

National Science Foundation
2415 Eisenhower Ave
Alexandria, VA 22314

Getting Funded by NSF

2020 Faculty Mentoring Workshop

Prof. Rachel Davidson

Dept. of Civil and Environmental Engineering

University of Delaware

NSF Review Process

- Criteria (Intellectual Merit and Broader Impacts)
- Individuals reviews
  - Independent
  - About 6-10 proposals
  - Rankings: Poor, Fair, Good, Very Good, Excellent
- Panel review
  - Group meeting
  - Ranking
    Highly recommend, Recommend, Do not Recommend
  - Recommendation to program officer
  - Panel summary

Intellectual Merit

Potential to advance knowledge and understanding within its own field or across different fields?

Broader Impacts

Potential to benefit society or advance desired societal outcomes?

For both

- Activities explore creative, original, potentially transformative concepts?
- Plan is well-reasoned, well-organized, and based on a sound rationale? Incorporates mechanism to assess success?
- Team is well qualified to conduct the proposed activities?
- Adequate resources available to carry out proposed activities?

What Is the Goal of a Proposal?

To convince someone to support a project with financial or other resources.

→ *KNOW YOUR AUDIENCE!!*

What would it take for you to spend your money on a project?

Need to

1. Understand what you plan to do — *What?*
2. Believe it is important — *Why?*
3. Believe that you will be able to do it — *How?*

Elements of a Proposal (NSF)

1. Project Summary
   - Summary
   - Intellectual Merit
   - Broader Impacts
2. Project Description
   - Introduction
   - (*Summary of new approach*)
   - Objectives and scope
   - Anticipated benefits (IM,BI,fit to prgm)
   - Background / Literature review
   - Preliminary work / Illustrative analysis
   - Work plan (incl. schedule)
   - Education/outreach
   - Prior results from NSF
3. References
4. Supplementary materials
   - Budget and budget justification
   - Facilities and equipment
   - Data management plan
   - Institutional Review Board (IRB)

Project Summary

- Short (often one-page) version of the full proposal.
- A complete summary of what the proposal is about
- May be the only part of the proposal someone reads.
- Stands alone with no figures or references.

Project Description: Introduction

- What you propose to do (objectives)
- Why you propose to do it (motivation)
- Preview of the rest of the proposal

- Consider starting with one sentence summary in bold
- About a page

Project Description: Objectives & Scope

Purpose

Succinctly explain what you will accomplish if funded

Notes

- 3 to 6 objectives
- Short description of each
- Are you developing a methodology? Prototype? Recommendation? Software? Model? Usable product? Testing a hypothesis?
- Don't promise more than you can achieve
- Use specific, active verbs, not *will study*

Project Description: Anticipated Benefits

Purpose

- List all who will benefit if project objectives are met
- Explain how each will benefit, what decisions will be easier to make, what will be easier to do

Notes

- Be as specific as possible
- Support claims with evidence. Avoid words like *really* and *very*
- Be honest, not overstated
- Include benefits of possible extended or improved versions
- Subsections
    - Intellectual merit
    - Broader impacts
    - Fit to program (if applicable)

Project Description: Background/Literature Review

Purpose

- Convince reviewer proposed work has not been done before (you're not reinventing the wheel)
- Demonstrate you know the subject
- Show your idea is informed by what we already know

Notes

- Provide information on existing work that is related to your project.
- Describe how the proposed project builds on and extends existing work, but does not repeat it
- Reference all important literature

Project Description: Preliminary Work/Illustrative Analysis

Purpose

- Provide more concrete description of what results will look like
- Show you know how to do it

Notes

Ideally preliminary work can be a paper

Project Description: Work Plan

Purpose

Convince reviewer you have a plan to achieve objectives

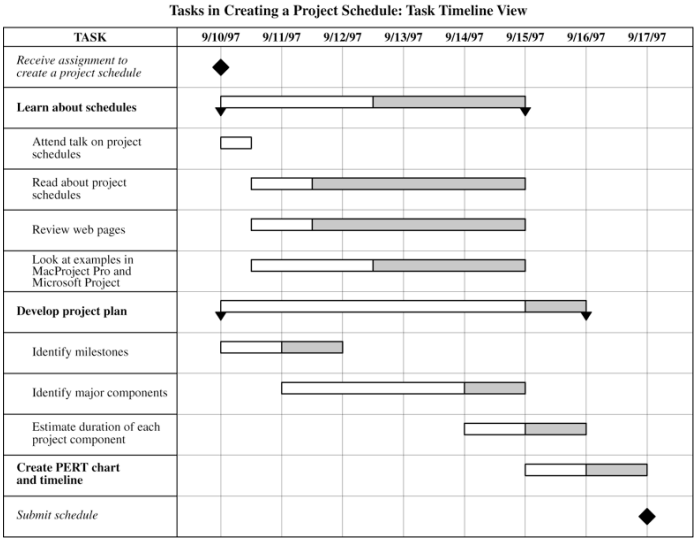
Notes

- Describe how you will deliver on the stated objectives
- One paragraph that introduces all of the steps
- One subsection that describes each step in more detail
- Show that your approach meets methodological standards for the kind of work you propose to do

Project Description: Schedule

Purpose

Show that you have thought about how long it will take to complete each element of the project and the project as a whole.



Task	Year 1	Year 2	Year 3
1. Infer evacuation behaviors, ind. attributes			
2. Model dynamic evolution of behaviors			
3. Develop predictive statistical models			
4. Test, improve traffic model assumptions			
Calls with practitioners			

Notes

- Timeline
- Gantt chart

Project Description: Education/Outreach

Purpose

- Contribute to broader impacts

Notes

- Can relate to UG, grad advising, teaching, K-12, professional outreach, diversity and inclusion, etc.
- One to a few compelling activities better than laundry list
- Tie to research if at all possible
- Tie into established efforts in College, UD, or other orgs.
- Include evaluation

Supplementary Materials

Purpose

- Show you have thought about is needed to complete the project
- Tell reviewers what it will take to complete project
- Explain who will provide what to compete the project

Notes

- Budget and budget justification
- Current and pending
- Facilities
- Data management plan
- Post-doc mentoring plan (if applicable)
- IRB (if applicable)
- Support staff can help with this!

Formatting

- Readable
- Consistent
- Neat
- Professional
- Use figures to enhance arguments, make more readable
- Use bold, italics, or underlining sparingly to highlight most important points

Characteristics that Strong Proposals Share

Compelling idea

* New, “Transformative”
* Advances knowledge
* Benefits society
* Realistic objectives

Well-crafted

* Methodologically strong
* Well thought out work plan
* Well researched
* Clearly, succinctly written
* Persuasive
* Professionally formatted

Summary Tips

What you'll do (objectives)
Why you'll do it (anticipated benefits: IM, BI)
How you'll do it (work plan)

- Talk to program officer
- Serve on a panel
- Start early—seriously, really early!
- Get input from others before submission

Not Getting Funded by NIH

A 10-step Plan for Writing Bad Grant Proposals

2020 Faculty Mentoring Workshop

Prof. Tom Buchanan

Dept. of Mechanical Engineering

University of Delaware

1) Don't Include Hypotheses (or Very Specific Aims)!

- In reality, the secret to "doing research" is to go into the lab, measure a bunch of things, and see what looks good.
- Just write in your proposal that if you get the grant you will try to do things using plan *A*. If that doesn't work, you'll think of a plan *B*, etc....until you get things working. This is the classical "shotgun" approach and it is especially popular among engineers.
- In fact, this is what separates engineers from scientists (who are confined by the so-called "scientific method").

2) Be Ambitious!

- A good proposal is one that demonstrates to the reviewers that you have lots of ideas, so write them all down.
- Don’t worry if you are proposing enough work for ten or fifteen years—the reviewers will tell you which ideas they want you to pursue.

3) Cool Tools Rule!

- If you have developed a model or an engineering method that nobody else has, write a proposal that uses the model in as many ways as possible.
- These uses do not have to be related to a common problem or even to each other—reviewers will know good science when then see it!
- Show them how cool your method is and do not worry about trendy phrases like “biological relevancy.”

4) For Clinicians: Don't Worry About Engineers!

- Submit your proposal to the NI*H*, not the NSF. There are no engineers at NIH.
- Only use very simple engineering whenever necessary—about the level of a freshman physics course—because addressing clinical problems is key.
- Do not reference state-of-the-art engineering approaches or else the reviewers will not be able to follow you. Besides, what are the chances that they would ask someone like Dawn Elliott to review your proposal?

5) Statistics Are for Anal-retentive People!

- When you write about data analysis, just say something like “I will do statistics on the data.” The reviewers will understand what you mean.
- They all know that you will feed your numbers into a computer and look for the best “p” values, so don’t mess with the details.

6) Remember: Hypotheses Are Simply Your Good Ideas!

- If you feel compelled to formulate hypotheses (despite #1 above), make sure that they are grand and glorious.
- They should not be specific enough to be testable.
  - *Something like "I hypothesize that my approach will be better than everyone else's" is perfect!*
- Furthermore, once they are described in the opening section, you should never refer to them again.
- Your goal (beyond getting funded) is to do science, *not* to test hypotheses.

7) Use Creative Writing!

- The introduction of fictional characters into your proposal who explain things to the reviewer is highly effective.
- This adds the needed human element and helps to avoid all those passive sentences.

8) “Preliminary Work” Is Not Cost Effective!

- The granting agency wants you to do some of the work before they give you the money. Don’t let them trick you!
  - *They are just trying to save costs.*
- If you do substantial previous work, they will fund you for less time.
- Economically, it if far better to have a poorly developed “previous results” section then to solve all of the hard problems without being paid for it.
- Just stress in your proposal that you are a professional and you will be able to solve any problem that arises.

9) Be As Technical As Possible!

- Try to impress the reviewers with your knowledge of math or engineering.
  - *For example, if you are describing the 3D geometry of the surface of a bone, refer to it as "a manifold in n-space."*
  - *Another great strategy is not to assume your coordinate systems are orthogonal.*
- Remember, if the reviewers have trouble understanding your proposal and are left scratching their heads, they can only conclude that you are smarter than they are.

10) Researchers Are Not Bean Counters!

- The “budget sheets” are boring parts of every proposal where you are asked how much money you want. Enter big numbers here.
  - *Don’t mess with a lot of prose justifying why you need a 256-processor supercomputer. We all know that you need it because it will be cool and those who get grants get cool things!*
  - *Never mind that you won’t use it for much beyond word processing. Hey, you are going to need something to write that next proposal a few years from now!*

Review Outline for NIH Grant

- 1. Significance
- 2. Investigators
- 3. Innovation
- 4. Approach
- 5. Environment
- **Overall Impact**