

A Few Tips

For Developing / Preparing Your

NSF CAREER Proposal



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About Me

- **Training**

- BS, MS, Ph.D. in Electrical Engineering

- **Ph.D. Research (2001-2007)**

- Signal processing theory
- Models and algorithms for biological sequence analysis
- Applications: gene prediction, sequence alignment , RNA structural alignment, noncoding RNA (ncRNA) prediction

- **Research at Texas A&M (TAMU) (2008-present)**

- **Probabilistic models and algorithms** for biological sequence and network analysis
- **Network biology** (esp. comparative network analysis)

My NSF CAREER Award

- **First Try** (July 2009, declined)
 - Submitted to **NSF CISE/CCF**
 - Title:
“Probabilistic Models for Network Biology: Theory, Algorithms, and Applications”

- **Second Try** (July 2011, awarded)
 - Did not submit in 2010
 - Submitted to **NSF CISE/CCF**
 - Title:
“Models and Algorithms for Comparative Analysis of Biological Networks”

My (Approximate) Timeline

- **March – April**
 - Gathered research ideas
 - Took note of ALL potential research problems
- **May**
 - Selected closely related research problems that should be included in the proposal
 - Decided (preliminary) proposal outline
- **May – June**
 - Proposal writing
- **July**
 - Proposal reviewed by colleagues
 - Revised proposal based on review comments/suggestions
 - Proposal submission

Research

Choosing your research problems &
Deciding the scope of the proposal

Choosing Your Problems (and Scope)

- Things to consider
 - Proposed research problems should be **novel** and **sufficiently different** from your Ph.D. work
 - However, there should be enough **evidence** that
 1. The proposed problems **can be actually solved**
 2. **PI is well-equipped** to work on those problems
 - The CAREER award is for 5 years.
So, you need to be **ambitious**, but not overly so!

Proposed Research (1st Try)

- **Topic 1** – Probabilistic framework for comparative analysis of biological networks
 - **Past experience** with probabilistic models such as hidden Markov models (HMMs) and their variants/extensions
 - Already had a few **publications** in comparative network analysis using HMMs during the first 1.5 years at Texas A&M
- **Topic 2** – Probabilistic network model for integrated data analysis
 - After joining TAMU, I got interested in joint analysis of gene expression + protein interaction data for disease diagnosis
 - My work at TAMU led to several **publications** on this topic

Proposed Research (1st Try)

- **Topic 3** – Application of the developed models and methods in biology and medicine
 - Since I am working in an interdisciplinary area, I wanted to make sure that the theoretical developments will have concrete applications in biology/medicine

Review Comments (1st Try)

- First, the good part:

“Overall the proposal is **well written**, the research is **interesting**, and **appropriately scoped**.”

“ (Proposed problems) are of **fundamental importance**”

- And now, the not so good ones:

“There was discussion about how the (linear) HMM models could be extended for graphs; the **details were not clear**”

“There was concern about ... **lack of positioning with respect to existing work**.”

Proposed Research (2nd Try)

▪ **Topic 1** – Developing a probabilistic framework for comparative network analysis

▪ **Topic 2** – Application of the proposed framework to network alignment and network querying

▪ **Topic 3** – Develop a network synthesis model for benchmark creation & performance assessment

▪ **Topic 4** – Identification and analysis of novel biological pathways

more coherent topics

more specific

Review Comments (2nd Try)

- The changes were viewed very favorably:

“The proposal is **well written** and **structured**, and **different aims are well connected forming a coherent whole.**”

“... ideas are **elaborated very clearly** and the motivation, rationale, innovative aspects are **articulated very well.**”

“ ... **well organized and polished** ... a **nice balance** between computer science and molecular biology”

“The PI described **enough details** and has **enough experience** in the field to suggest that the **project would have a good chance of success**”

Education & Outreach

Integration of research and education &
Broader impacts

Integrating Research & Education

- For a CAREER proposal, a clear and well thought-out educational plan is fundamentally important!

- **A few suggestions:**

1. Include activities that are **natural** and **important** (e.g., course development and/or update)
2. Make your plan more **specific** and interesting.
3. Look for **unique** areas to which you may contribute.
4. Be **realistic**. You have (only) 5-years to implement it.
5. Be **selective**. Choose the activities that interest you most!

Integrating Research & Education

- My educational plan:

1. Develop a new undergraduate course on probabilistic models for network biology

2. Transform an existing graduate course on probabilistic graphical models to a new format

3. Create an assessment tool (i.e., test) for measuring teaching effectiveness in my subject area

Broader Impacts

- Similar suggestions apply to developing plans for broader impacts.
- Again, **choose the activities that interest you most** and you would love to do!

- **For example, my plan included:**

1. Develop open educational resources (OER) in my field

2. Reach out minority students at other TAMU system schools

3. Be part of existing outreach activities at TAMU

General Advice

Getting Help

- **Talk to people** who received NSF CAREER awards in the (recent) past and learn from their experience
- Try to **get examples** of successful CAREER proposals as soon as you can
 - Contact CAREER awardees at your institution
 - CAREER awardees whom you know (e.g., from your alma mater) or have met at conferences
 - Typically, easier to get from more established PIs
- Ask your colleagues to **review** your proposal
 - Especially, ask people outside your field!

When Writing Your Proposal

- **Make it easy for reviewers to review your proposal**
 - Spend enough time to choose the best **structure**
 - Choose the right (and informative) section **titles**
 - Use **bold, italic, underlines** (in a discreet manner)
 - Use **figures** to illustrate your ideas!
- **Write the proposal in a logical manner**
 - The proposed **ideas should be closely interconnected**
 - The **logical flow** (and connections between topics) should be clear
- **Literature review and supporting evidence**
 - A **thorough literature review** is very helpful: (1) clearly shows the importance & novelty of the proposed project, (2) adds credibility
 - **Provide some evidence** why the proposed idea should work

Potential Proposal Structure

1. Project overview

1. Summary of research plan
2. Summary of education/outreach plans
3. **Significance** of the project and **qualifications** of PI

2. Background

1. Introduction to the research problem, terminology, etc.
2. Review of existing work
3. **Preliminary work** by PI
4. **Current limitations** and need for further research

3. Research plan

4. Integration of research & education

5. Broader impacts & outreach

And When Things Don't Go Well

- **Take advantage of your reviews**
 - Many reviewers provide **constructive comments** (overall scope, need for clarification, relevant work, etc.)
 - Reviewers may **not** be **always right**. Nevertheless, their **comments can be still useful!** (e.g., my experience)
- Look at the positive side:

“Still, I have a nice and concrete research plan!”

Thank You & GOOD LUCK!

Any questions?

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