

Effective Proposal Development Strategies

With an Emphasis on NSF and NIH Proposals

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Disclaimer

- I do not now, and never have, worked for a federal agency. So my views may not always agree with the official line from the agency.
- I do a lot of reviewing for NIH. In the past I have done a lot of reviewing for NSF, however, I've fallen off their list lately.
- I've also reviewed proposals for the U.S. Department of State, other federal and state agencies, and numerous foreign funding agencies.
- Anything I say today is based entirely on my experiences of getting a lot proposals rejected, several funded, and from my experiences as a reviewer.
- Others will have different opinions and experiences. Learn from all.



What leads to proposal not being funded?

Technical reasons:

1. No compelling justification given; Not an exciting proposal; Not novel
2. Weak and/or disorganized hypothesis or goal; Weak specific aims
3. Not enough preliminary data
4. Poorly written; bad organization; puts reviewers in a foul mood.

Programmatic reasons:

1. Submitted to wrong agency
2. Submitted to wrong program
3. Reviewed by inappropriate study section (NIH)
4. Fiscally poor program, institute, agency
5. Didn't follow agency guidelines – not even reviewed



Components of Effective Proposal Writing

1. Identify a need – Arrive at a compelling argument as to why this need should be addressed.
2. Identify an appropriate funding source – Know your sponsors and what their priorities are. Talk to people. Develop white papers.
3. Gather preliminary data – Lots of it. Plan ahead (years ahead).
4. Generate hypothesis/goals and specific aims – Clear and concise. Not too many, not too few. Short, sweet and to the point. Avoid jargon and fluff. Don't try to impress reviewers with your ability to obfuscate the obvious.
5. Develop an outline of your proposal – Allows you to attack the proposal in bite-sized pieces and to stay focused.
6. Fill in outline – Again, be clear and concise. Tell the reviewers what they already know. Stroke their egos a little bit. Don't try to impress reviewers with your ability to obfuscate the obvious.
7. Submit – For NIH, assignment to proper Scientific Review Panel is key. Ensure that you are submitting to the right program at other agencies.



Identifying a Need

- Not as easy as it sounds.
- What is obvious to you is not obvious to reviewers or program officers.
- The need for the research must be compelling and real (Money and suffering always make for a compelling arguments).
- Need to take a page from a Marketing Handbook – sell your idea.
- Must excite reviewers and program officers.
- Think large scale. Just because your lab has a need, that doesn't make it a national priority!
- If you have a hard time expressing the need for your own research in just a very few concise statements, you will never convince a panel of reviewers that they should give a favorable review.



Identifying a Sponsor

- Are you submitting your proposal to the right agency (e.g., NSF vs NIH)? What are the priorities of the agency or foundation?
- Are you submitting to the right Program? Call around; Ask questions; Find out where similar proposals have been funded; If NIH, what study section reviewed the proposal?
- Who are the reviewers? NIH publishes the study section rosters. Do you know any of the reviewers? Have you irritated any of the reviewers?
- If responding to a PA, are you really being responsive to the call?
- What is the funding rate of the institute or program you submitted to? Some programs and/or institutes have better funding rates.
- Are you submitting the right type of grant? For example, NIH R01, R03, R15, R21, etc.



Preliminary Data

- Rarely can you have too much preliminary data – unless you have published all of your results already and your proposal is no longer novel. Can be a fine line.
- Old (NIH) adage, “If you have 4 Specific Aims, you need to have 2 of them finished, 1 almost done and the 4th must have compelling preliminary data”. This is a bit of an overstatement, but not by too much.
- Even for NIH R21’s (Exploratory high-risk, high reward proposals) you still need preliminary data, even though the instructions say otherwise.
- Plan years ahead. Every piece of data you collect in the laboratory/field is preliminary data for the next grant proposal.
- Treat preliminary data gathering as a component of your career development.
- Preliminary data must be directly relevant to 1 or more of your specific aims. Tell the reviewers which SA the preliminary data is relevant to. Do not make them guess. (Never make the reviewers guess about anything. They will guess wrongly).

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Hypothesis or Goal and Specific Aims

The Specific Aims page is the single most important part of your proposal

- *As a reviewer, if I don’t understand the who, what, where, when and why of your proposal by the time I get to the bottom of the Specific Aims page, you will not get a good score from me.*
- Three “C’s”: Clear, Concise, and Compelling
- Avoid too much jargon and obfuscation. But demonstrate that you have a firm, working knowledge of the lingo.
- Need to develop excitement in the reviewers; Put on your Marketing hat; Think in terms of an ‘elevator speech’;
- In 1 page or less, you need to demonstrate a tremendous need for your work, present a solid hypothesis or goal and provide an explanation of how you are going to test your hypothesis (or reach goal).
- If you sound bored, the reviewers will be bored, too.

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Proposal Organization

- A poorly organized proposal with a confusing layout will put reviewers in a bad mood. Don't make the reviewers work to find key information. Put everything in a logical order.
- Put yourself in a reviewer's shoes – can you follow the train of thought and organization?
- Have others read it – can they follow your organizational pattern, or do others find it confusing?
- Avoid too much jargon. Don't try to sound 'smart'. That just turns reviewers off. Write in clear, easy to understand sentences.
- Follow agency guidelines



Proposal Organization – Generic example

Maintain a consistent organizational pattern – Seems obvious, but apparently it isn't

1. Specific Aims (Indent, bullet, etc. each SA – Make them obvious)
2. Background and Significance
3. Preliminary Data
 - a) Preliminary data for Aim 1
 - b) Preliminary data for Aim 2
 - c) Preliminary data for Aim 3
4. Experimental Design
 - a) Experiments for Aim 1
 - i. Experiments
 - ii. Expected results
 - iii. Potential Challenges and Solutions/Alternatives
 - b) Experiments for Aim 2
 - ...
 - c) Experiments for Aim 3
 - ...
5. Outcomes
6. Timeline



Submitting your proposal

Internal:

- Get as many sets of eyes on your proposal before you submit it. Don't worry too much about areas of expertise. Just find successful grant writers and reviewers to read your proposal.
- Give them your specific aims page as soon as you generate it so you don't waste time.
- Eventually, you will get to a point of minimal (zero) return. Do your best to eliminate typos, grammatical errors, strangely formatted citations etc., but accept the fact that some will make it into your proposal. Don't sweat it. A few of these things will not doom your proposal.
- Get it to Sponsored Programs early. Get the budget stuff etc. out of the way very early in the process.



Submitting your proposal

External:

- Include a cover letter that indicates what announcement you are submitting to (Follow agency specific rules).
- If agency allows, indicate what sort of expertise is needed to adequately review the proposal
- If agency allows, suggest reviewers and also list reviewers you do not want
- For NIH: Indicate 1) Study Section 2) Institute or Institutes. Take great care to get your proposal to the right Study Section. (This is the key to the whole thing!)
- Once submitted, ensure that the proposal went to where you wanted it to go. That is, pay attention to the acknowledgement letter or e-mail
- For NIH, did the proposal go to the right study section? If not you can request that it be re-assigned. Talk to SROs and see if your guess as to the right study section was the right one.
- For NIH, check back a few weeks prior to review date – Has the study section roster changed? Are there conflicts?



Final thoughts that didn't fit elsewhere

- Persistence is key; Don't take reviews personally; Don't get discouraged.
- Collaboration is a good thing. Do not look down on being a Co-PI or Co-I. As long as you are named on a proposal, it counts for you.
- Treat your proposal writing as part of your career plan. Think ahead. Think long term.
- You will not get grants if you don't publish.
- You will have a tougher time getting grants if you do not network at conferences, etc. Become active in your professional society and you are instantly considered to be an expert.

Questions?



Pursuing Large, Interdisciplinary Team Science Grants

Kathleen E. Halvorsen¹ and Alex S. Mayer²

¹Department of Social Sciences/School of Forest Resources and
Environmental Science

² Department of Civil and Environmental
Engineering/Department of Geological and Mining Sciences and
Engineering

My experience

- ♦ Mostly NSF, mostly NSF SEES (Science, Engineering, and Education for Sustainability)
- ♦ Highly interdisciplinary proposals and grants
- ♦ 3-40 social, natural, and engineering scientists
- ♦ Large (300K-4.8 million)
- ♦ Multi-year (2-5 years)
- ♦ Successfully garnered recent/current NSF WSC, GK12, MUSES, PIRE, RCN, and IDR grants

NSF Interdisciplinary (ID) team science proposals

- ♦ RFP specifies required components: “Proposal Preparation Instructions” and NSF Grants Guide “GPG” (document formatting matters!)
- ♦ 15-20 pp main body of proposal with required sections, can vary across RFPs
- ♦ Document requirements can vary
 - ♦ Project summary: Intellectual Merit and Broader Impacts, etc.
 - ♦ Project description: Intellectual Merit and Broader Impacts, etc.

ID Team Science Advantages

- ♦ ID teams have broader expertise, better fit to complex research problems
- ♦ Can go after multi-million dollar grants
- ♦ Can go after longer term grants
- ♦ 20% of NSF funds = SEES = fundamentally ID team science proposals
- ♦ Learning across disciplines
- ♦ More glory!

Challenges!



- ♦ Bigger \$ = lower odds of success
- ♦ Complex proposal in limited space
- ♦ Massive supporting docs
- ♦ Managing ID science teams is very hard

Research Teams = Small Work Groups

- ♦ Small group development requires:
 - ♦ Identification with group,
 - ♦ Shared norms of respect, trust, processes,
 - ♦ Shared goals,
 - ♦ Structure: leadership and division of labor,
 - ♦ Sustained interaction over time (Babbie 1995)

Interdisciplinarity = Heterogeneity

- ♦ Of knowledge,
- ♦ scientific norms (research questions v. hypotheses; experimental v. research design; credit),
- ♦ language (gradients v. variation),
- ♦ respect (unintended insults: soft v. hard science; science social science; STEM v. HASS);
- ♦ scale, etc.
- ♦ HETEROGENEOUS SMALL GROUP MANAGEMENT IS HARD!!!!

Best Practices

(from Halvorsen and Mayer In Prep)

- ♦ **The development and management of a successful ID scientific team is hard.**
- ♦ **Choose members wisely.**
- ♦ **The development of group cohesion and identity takes time but it is essential to success.**

Best Practices (cont)

- ♦ Draw upon existing relationships helps kick-start cohesion, identity, and commitment.
- ♦ Invest time in the development of team member and/or leader training in social interaction and task skills.
- ♦ Smoothly functioning small groups require clear roles and expectations.

Best Practices (cont)

- ♦ Cohesive, well-functioning groups develop over time through sustained, structured interaction.
- ♦ Successful ID teamwork requires the development of and compliance with shared norms.
- ♦ The creation of successful ID teams requires good leadership.

Best Practices (cont)

- ♦ Successful teams have a shared purpose.
- ♦ Include critical mass of scientists of various types, avoid “tokens.”

Lessons for You

- ♦ Successful grant writing is 33% exciting, compelling ideas; 33% hard work; and 34% luck.
- ♦ Exciting, compelling ideas: synthesize existing science, show a key gap, and how your *innovative, dynamic, credible* research design fills that gap
- ♦ Hard work: EDIT THE HELL OUT OF YOUR PROPOSAL AND SUPPORT DOCS. Don't give reviewers excuses to turn you down, “dot your i's,” do a great job with “non-science” pieces (such as outreach, diversity components)

Lessons for You

- ♦ You Can Increase Your Luck: Talk to program officers about fit. Agencies frequently request suggested reviewers – TAKE THEM UP ON IT! BUT ultimately your reviewers mostly come from the luck of the draw.
- ♦ Take advantage of resources:
 - ♦ Centers
 - ♦ Staff support
 - ♦ Senior scientists

Lessons for You

- ♦ For ID team science proposals, full INTEGRATION of all the sciences throughout: from significance of research to peer reviewed lit review to research questions/design is key

New Course: SS5340 Principles of Interdisciplinary

Sustainability Research

- ♦ Offered Fall 2013.
- ♦ Will build student skills in creating and managing ID science teams through hands-on exercises and proposal writing.
- ♦ Open to any graduate student or advanced undergraduate.
- ♦ Diverse group of international social, natural, and engineering science students.

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Effective Proposal Development Strategies

BEYOND THE RESEARCH PLAN

Chris S. Anderson
Office for Institutional Diversity

April 3, 2013

1

NSF's BROADER IMPACT =

Promoting teaching, training & learning



Broadening participation (diversity*)



Enhance infrastructure for research & education



Dissemination



Benefits to society

*"NSF is committed to the principle of diversity and deems it central to the programs, projects, and activities it considers and supports."

2

**DEVELOPING BROADER IMPACT
COMPONENT/S
STEP ONE**

What do you want to do?

What is Michigan Tech currently doing?

How can you broaden or enhance efforts?

What resources do we have?

3

BROADER IMPACTS- ACTIVITY EXAMPLES

Support an undergraduate research student/s

Support a new graduate student

Develop a visiting scholar series

Support a community college research faculty
experience

Develop an interactive lab or demonstration for
middle or high school students

Present public lectures at a local school district

Develop partnership, i.e. with a Minority Serving
Institution (MSI)

4

*For more examples see Appendix B and NSF Merit Review Broader Impacts
Criterion: Representative Activities*

PROGRAMS

- A Comprehensive Approach to Diversity
(handout)

An excerpt from *Diversity Facts 2012*

5

PARTNERS

At the National Level

Michigan Tech is an _____ institution

- **ADVANCE** – Increasing the Participation and Advancement of Women in Academic Science and Engineering Careers
www.nsf.gov/advance & <http://advance.mtu.edu/>
- **LSAMP** – Louis Stokes Alliances for Minority Participation
<http://www.nsf.gov/pubs/2011/nsf11543/nsf11543.htm>
<http://www.engin.umich.edu/students/mi-lsamp/>
- **AGEP** – Alliances for Graduate Education and the Professoriate
<http://www.nsfagep.org/> & <http://michagep.org/>
- **GEM** – Graduate Education for Minorities
<http://www.gemfellowship.org/>

6

PARTNERS

At the National Level

Michigan Tech is active in

- **SWE** – Society of Women Engineers (collegiate & professional)
- **AISES** – American Indian Science & Engineering Society (collegiate)
- **SHPE** – Society of Hispanic Professional Engineers (collegiate)
- **NSBE** – National Society of Black Engineers (collegiate)
- **WEPAN** – Women in Engineering Programs & Advocates Network (professional)
<http://www.wepan.org/>

7

PARTNERS

At the State Level

Michigan Tech is a King-Chavez-Parks (KCP) Initiative Partner

- **MICUP** – Michigan College/University Partnership/MI-Louis Stokes Alliances for Minority Program
- **GEAR UP / College Day**
- **FFF** – Future Faculty Fellowship Program
- **VWMLS** – Visiting Women & Minority Lecturer/Scholars Series Program

8

PARTNERS

At the State Level

Michigan Tech collaborates with the

- **DAPCEP** – Detroit Area Precollege Engineering Program
- **GRAPCEP** – Grand Rapids Area Precollege Engineering Program
- **CCISD** – Copper Country Intermediate School District Science/Mathematics Center
- Individual School Districts & Community Colleges
- Individual Minority Serving Institutions (MSI)

9

PARTNERS

At the University Level

Established Internal Infrastructures & Expertise

- Cognitive and Learning Sciences Department (Education division)
- Office of Institutional Diversity
- Center for Diversity & Inclusion (CDI)
- Center for Precollege Outreach (CPO)
- Graduate School
- Individual faculty, staff & administrators
- ME-EM Engineering Education faculty group
- Civil & Environmental Engineering, Great Lakes Research Center – Environmental Outreach Office
- Hybrid Electric Vehicle (HEV) Mobile laboratory
- Summer Undergraduate Research Fellowship (SURF)

10

**WRITE THE BROADER IMPACT PLAN
STEP TWO**

Leverage existing programs and partnerships

Know your partners and invite their input

Be explicit-need, current research, activities,
expected outcomes, etc.

11

**ALSO INCLUDE
STEP THREE**

A Reasonable Budget

Assessment and Evaluation

Goal/s ⇨ Actions ⇨ Outcomes

Accountability

Measures

Institutionalization Discussion

Dissemination Plan

12

NSF REASONS TO INTEGRATE DIVERSITY

Diversity enriches the educational experience.

It promises personal growth and a healthy society.

It strengthens communities and the workplace.

It enhances economic competitiveness.

13

EFFECTIVE PROPOSAL DEVELOPMENT STRATEGIES--BEYOND THE RESEARCH PLAN-- ACCORDING TO DR. KIRKPATRICK!

Identify a need

Identify a target group

Identify potential partners and resources (if applicable)

Use current research (and the expertise of your partners) to strengthen your needs statement and proposed response

Develop your broader impact component narrative keeping in mind the 3 C's—clear, concise, and compelling (and follow the RFP guidelines)

Partners should contribute, review, edit and add to the proposal component (and have an appropriate budget)

Demonstrate working knowledge of the proposal activity, appropriate language (lingo), partner contributions, and research

14



15

QUESTIONS?

**APPENDIX A:
PREPARATION-THINGS TO
THINK ABOUT**

16

Some Questions to Think About

- What aspects of your research will you emphasize?
- On what aspects of broader impacts do you want to focus?
- What group/s might **you** want to target?
- What group/s might benefit?
- What internal resources might you need or involve?
- What external partners might you need or involve?
- How much time and budget do you want to commit each year?
- How could you disseminate this work?
- How will you evaluate this component?

17

Determine your Target Participants or Audience

- Precollege – Students or Educators (elementary or secondary)
- Undergraduate Students
- Graduate Students
- Post Docs
- Community College – Students or Faculty
- General Public
- Faculty



Determine Broader Impact Approaches

- Outreach Programs
- Education Programs – formal or informal
- Professional Development Programs – including your own
- Research Mentor
- Collaborations
- Other

Match Approach/es with Target Audience and Potential Partners

Investigate University Resources

Develop your plan for each year of the award

19

APPENDIX B: A FEW MORE EXAMPLES

20

<p style="text-align: center;">Activity A:</p> <p>Design a one week (36 hours class/field time) exploration highlighting your discipline and research project</p> <p>Impact: ~ 20 diverse students/week; offered multiple years (sustained effort)</p> <p>Time Commitment: Development of exploration week (variable); summer instruction ~ 40 hours</p> <p>Budget: Instruction, supplies & materials, administrative costs, evaluation & dissemination</p>	<p style="text-align: center;">Activity B:</p> <p>Design a partial week module for a current Youth Program offered by your department or related department</p> <p>Impact: ~ 20 diverse students/week; offered multiple years (sustained effort)</p> <p>Time Commitment: Development of exploration module (variable); instruction ~ 6-10 hours</p> <p>Budget: Instruction, supplies & materials, administrative costs, evaluation & dissemination</p>
<p>Resource: Center for Precollege Outreach over 70 different explorations of disciplines and career areas for youth ages 11-17 years (http://www.youthprograms.mtu.edu)</p>	

21

Activity: Interactive laboratory demonstrations of related research

Impact: Variable number of diverse students, dependent on participating schools and number of visits scheduled, sustained effort

Time Commitment: Development of laboratory activities(variable); instruction, etc. (approximately 3 days)

Budget: Travel, instruction, supplies & materials, evaluation & dissemination

Contact: Jeremy Worm, ME-EM
jjworm@mtu.edu

Resource: Hybrid Electric Vehicle (HEV) Mobile Laboratory

22

Activity: Sponsored research related seminars, classroom lectures, collaborative meetings in your research area and related research; introduces campus community to diverse researchers/potential faculty

Impact: An opportunity for our faculty and students to interact with scholars and role models, highlight interdisciplinary work

Budget: \$3,000 – 10,000/year; target Michigan Tech faculty and students

Contact: Chris S. Anderson, Office for Institutional Diversity
csanders@mtu.edu

Resource: Visiting Women & Minority Lecturer/Scholar Series,
Institutional Diversity

23

Activity: Active participant/s as part of PI's research team

Target: Diverse Michigan Technological University or other university partner students, or **community college** students

Time Commitment: ~ 7-10 weeks, summer or academic year (14 weeks); PI and research team mentorship

Budget: ~ \$3,500 – 7,500/student; variable depending on number of weeks, housing and supervision needs, seminar costs, administrative costs for recruitment, evaluation & dissemination

Contact: Chris S. Anderson, Office for Institutional Diversity
csanders@mtu.edu

Resource: Undergraduate Summer Research – MICUP, SURF,
Individual Career Award Research Teams, Individual
Community Colleges, LSAMP

24

Activity: Collaborate with faculty member/s at a partner community college or minority serving institution (MSI) to share research and/or develop skills

Activity: Participate in diversity-focused conferences, workshops and field activities

Activity: Organize a series of public presentations

Resource: Institutional Diversity, Graduate School, CDI, other Michigan Tech Faculty

APPENDIX C: DATA & ACTIVITY RESOURCES

Data & Activity Resources

- Institutional Diversity: <http://www.diversity.mtu.edu>
- Institutional Analysis: <http://www.admin.mtu.edu/ia/>
- *Diversity Fact Sheet* (2012 ed.): <http://www.diversity.mtu.edu>
- Michigan Tech's Diversity Framework:
http://www.diversity.mtu.edu/Diversity_framework.html
- Climate Study Report & Recommendations on the Cultural Climate at Michigan Tech:
<http://www.diversity.mtu.edu/Documents/oct07climatestudy.pdf>
- Conference information:
<http://understanding-interventions.org/>
- WEPAN Knowledge Center
<http://www.wepanknowledgecenter.org/home>
- NSF Broader Impacts Review Criteria
<http://www.nsf.gov/pubs/2002/nsf022/bicexamples.pdf>

27

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28

A Comprehensive Approach to Diversity



Institutional Support

Academic Diversity Strategic Plans and Annual Reviews

Alumnae—Presidential Council of Alumnae (PCA)

Corporate Advisory Board for Institutional Diversity

Cultural Climate Study

Dual Career Program

Higher Education Excellence in Diversity Awardee

Little Huskies Child Development Center

Making Our Mark @ Michigan Tech website

NSF ADVANCE Institution

Out for Work Certification

Services for Disabled Students

Special Assistant to the President for Institutional Diversity

University Diversity Framework/Strategic Plan

Women in Science and Engineering (WISE)

Undergraduate and Graduate Groups

African Student Organization (ASO)

American Indian Science and Engineering Society (AISES)

Keweenaw Pride (KP)

National Society of Black Engineers (NSBE)

out in Science, Technology, Engineering, and Mathematics (oSTEM)

Society of African American Men (SAAM)

Society of Intellectual Sisters (SIS)

Society of Women Engineers (SWE)

Society of Hispanic Professional Engineers (SHPE)

Wade McCree Program

Women in Computer Science (WiCS)

Women of Promise

Pre-College Outreach

Michigan Tech/DAPCEP College Access Programs

Engineering Scholars Program (ESP)

Gear Up/College Day

Get WISE Day

NSF Math and Science Partnership/Michigan Teaching Excellence Program (MSP/MITEP)

Women in Engineering (WIE)

Pre-College Summer Academic Programs

Sample University/ Partner Programs

360° Partner Scholarship Program

Detroit Area Pre-College Engineering Program (DAPCEP)

Detroit Compact

Graduate Engineering for Minorities (GEM)

Grand Rapids Area Pre-College Engineering Program (GRAPCEP)

King Chavez Parks Future Faculty Fellowships (KCP FFF)

Louis Stokes Alliances for Minority Participation (LSAMP)

Michigan Alliances for Graduate Education and the Professoriate (AGEP)

National Action Council for Minorities In Engineering Scholars Program (NACME)

Summer Undergraduate Research Fellowships (SURF)

SWE Dine with Industry

Academic and Other Education Programs

Black History Month and Cultural Celebrations

Diversity Education—Professional Development

Diversity Minor

Excelling the Student Experience of Learning (ExSEL)

Hispanic Heritage Month and Cultural Celebrations

KCP Michigan College/University Partnership (MICUP - Michigan Tech/LSAMP)

KCP Visiting Women and Minority Lecturer/Scholar Series (VWMLS)

Native American History Month and Cultural Celebrations

Parade of Nations

Study Abroad

Transfer Scholars Research Program

World Cultures (required course)

Women's History Month and Cultural Celebrations