



Proposal Writing

Beth Hodges, Director
Research Development

Before we Get Started...

- Thank you to
 - Mike Mitchell, ORD
 - Michelle Bennett, LM Bennett Consulting for Team Science Information

- About Me:
 - With OVPR for 25 Years, working to aid faculty
 - Began OPD (2013)
 - Former Congressional Staffer
 - FSU Alum

Items Covered Today

- Considerations before you get started writing
- Heilmeyer's Catechism
- SMART Goals
- Grant Writing Do's and Don'ts
- Team Science

Why should I seek grants?

- Yes, grant writing is cumbersome and time-consuming
- Yes, not all disciplines REQUIRE external funding
- Yes, they can be very competitive, and, in some disciplines, funding can be limited.

BUT

They provide you with resources

- They support graduate and undergraduate researchers
- They allow you to undertake projects that can influence your discipline
- Can provide prestige

Writing: Expository vs Persuasive

- Expository Writing
 - “I have conducted this experiment, it is based on the theory of science, and here is what I found...”
 - Reports, Articles
 - Past tense
- Persuasive Writing
 - “I want to conduct this experiment, it is based on the theory of science, **and here is why you should give me money to do it...**”
 - Grants, Fellowships, Awards
 - Future tense

Funding Agencies and Foundations:

Do your Homework

Your project should enable the agency to achieve its goals and align with their priorities.

You must understand these priorities BEFORE you start writing a proposal.

Look at:

- Funder's Website (About Us, Priorities, History, etc.)
- Strategic or Annual Reports
- Speeches/Presentations by Top Officials
- Listings of Previous Awards or Awardees
- The Funding Opportunity Announcement

Do Your Homework, continued

- Read some successful proposals to that agency
- Talk to people who have been funded by them
- Look at recent awards
 - Who, and where?
- If possible, check out who the reviewers are

Read the Funding Opportunity Announcement

- **Are you eligible?**
- When is it due?
- Who is the Program Officer?
 - Do you know them, or have you talked to them before?
- How many awards will be made?
- What is the maximum award amount?
- Is cost-share required?
- **Is it a limited submissions program?**
- Read the description specifically for the kinds of projects they are looking for

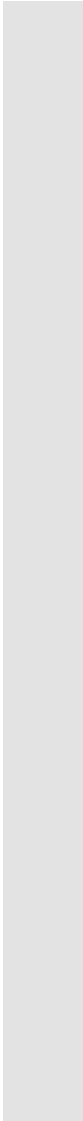

Understand the Review Criteria

- Will be listed either in the funding opportunity, or on the funder's website
- Can't write a proposal until you know what you'll be graded on
- *Write with the intention of providing certain lines that can specifically fulfill certain criteria*

Reviewers

Reviewers (usually):

- Are not always experts in your *specific* area of research
- Must read a lot of proposals in a relatively short time
- May be in a windowless conference room, in a city far from home
- Are either not paid, or not paid well
- Become frustrated



Reduce your reviewers'
cognitive burden

Heilmeier's Catechism

George H. Heilmeier, a former DARPA director (1975-1977), crafted a set of questions known as the "Heilmeier Catechism" to help Agency officials think through and evaluate proposed research programs.



Question #1

What are you trying to do?
Articulate objectives without jargon.

“This project will demonstrate that the”

“The purpose of this project is to generate new knowledge about”

Question #2

How is it done today, and what are the limits of current practice?

“Currently, the law of gravity has been demonstrated as applying to apples. While apples are an important fruit, gravity has not been shown to be applicable to other fruits, specifically the orange.”

Question #3

What is new in your approach and why do you think it will be successful?

“While based upon the law of gravity, our approach differs in its use of oranges rather than the traditional apple”

“We believe oranges will be successful, as they have been observed falling from trees similar to the apple.”

Question #4

Who cares? If you are successful, what difference will it make?

“Demonstrating the law of gravity with oranges is important because...”

“Successful completion of this research will revolutionize orange farming by...”

Question #5

What are the risks (and the payoffs)?

“This project depends heavily upon the availability of oranges. If adequate supplies of oranges cannot be obtained, grapefruits will suffice, but with less impressive splatter”

“The risk of inadequate supplies of oranges is offset by their greater splatter potential”

Question #6

How much will it cost?

Ask for exactly what you need

If you “pad” the budget with extra expenses, reviewers will call you on it

If you ask for too little, reviewers will question if you can accomplish your tasks

Make sure to budget for all tasks

“How are they going to do it if they don’t have any money?”

Work with your department/college financial staff to complete the budget according to the funding opportunity’s instructions.

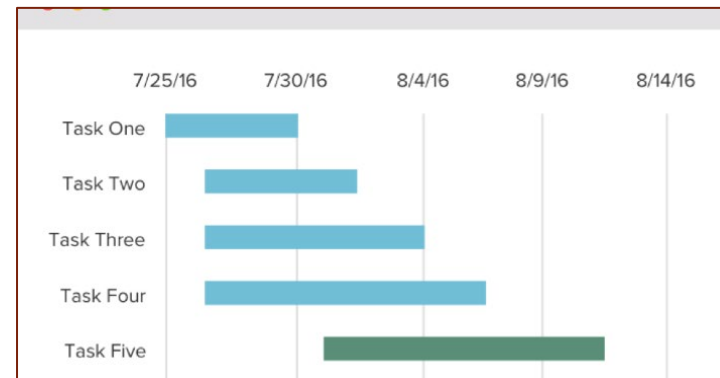
Question #7

How long will it take?

How long total.

How long for the different tasks.

Gantt charts are good for this.



Question #8

What are the midterm and final "exams" to check for success?

"By then end of year 1, we expect"

"When the project is completed, we will evaluate our results to determine whether we have successfully demonstrated ..."



SMART Goals

SMART Goals



Specific: Writing specific goals means writing targeted statements instead of general ones.



Measurable: Writing measurable goals means that you have the ability to measure or quantify the work.



Attainable: Achievable, reasonable, and possible under conditions expected (i.e. budget and timeframe).



Relevant: Your goal relates to the mission of the agency and also is relevant to your experience/expertise.



Timely: The work is doable within the performance period of the award

Not
SMART.

This project will examine teachers to see how they learn, what influences their teaching, and will use the results to help them be better at their jobs.

SMART

This project will conduct a statewide survey of **1,047 mathematics teachers and 35,304 students** in 6th through 8th grades in 201 middle schools, and case studies of eight middle schools in Missouri to **address the following research and educational objectives:** 1) examine the nature of mathematics teachers' opportunity to learn for instructional improvement, 2) examine how work contexts influence the quality of teacher learning opportunities, 3) examine the impact of teacher learning opportunities on changes in student mathematics achievement over four years, and 4) work with district and school administrators to promote instructional improvement and student achievement by effectively providing learning opportunities to mathematics teachers. **Survey of students in County A will occur in Year 1, and County B in Year 2 of the project.** The information collected in the survey will allow us to evaluate the influence of factors such as those stated in our project summary....



Things to Avoid

Avoid: Grandiose Language

Examples of Grandiose Language:

- “The proposed project will revolutionize the field of science”
- **“The proposed research represents a total paradigm shift”**
- “This project will be the most important work in physics since the days of Einstein”
- “No one in the world has ever done research even similar to this”

Avoid:
Run-on sentences

Acquaintance with ongoing research projects at FSU related to electric ship technologies, superconducting power systems, and cryogenic systems, as well as the development efforts in collaboration with many Navy contractors provide opportunities for the students in NEEC Program to connect their individual research efforts to powerful future superconducting ship technologies, and prepare them for future engineering careers in these fields which are rapidly expanding due to the needs of a 21st century Navy which is faced with evolving geopolitical threats.

Avoid: Walls of Text

BAD

The Florida Department of Agriculture and Consumer Services (FDACS), Office of Energy, and Office of Agricultural Water Policy, will establish the Farm Renewable and Efficiency Development (FRED) program, an innovative approach/incentive program to promote the adoption of technologies and practices that increase energy and water efficiency, as well as renewable energy use in Floridian agriculture. Florida's 47,500 farms produce nearly 300 different commodities on more than 9 million acres of land. Florida's agriculture industry employs 2 million people and contributes more than \$104 billion to the state's economy each year. Currently, FDACS (in a partnership with NRCS, the University of Florida, the Florida Farm Bureau, and numerous Florida counties and private partners) operates the Mobile Irrigation Lab (MIL) program, which provides to farmers free, site specific, evaluations of irrigation systems and opportunities for water conservation. MILs are made up of one or more trained irrigation specialists who evaluate the performance of a farm's irrigation system through measurement and observation. MIL teams use these observations to develop site specific irrigation water management plans. 16 MILs operate in 66 Florida counties, and have proven to be highly successful; since 2004, MILs have conducted 6,300 evaluations on 247,000 acres of land saving an estimated 10 billion gallons of water per year, with the potential to save 24 billion gallons per year if all recommendations were implemented. The proposed program will expand the capabilities of the MILs and create Mobile Efficiency Labs (MEL) that will conduct on-farm evaluations of the potential for energy and water efficiency as well as renewable energy upgrades. After participating in an evaluation, farmers will immediately be eligible for financial assistance for the implementation of the MELs recommendations. Outreach to farmers fitting the criteria for historically underserved producers (as defined by 7 CFR 1466) will be a priority. Finally, FDACS will conduct a study on the effectiveness of the program, and the future energy and water needs of agricultural producers in Florida. To promote the adoption of energy and water efficiency best management practices in the Florida agricultural industry, particularly amongst historically underserved producers, through the use of the Mobile Efficiency Labs. To stimulate the implementation of energy/water efficiency and renewable energy technology that will benefit individual farmers by decreasing energy and water costs and increasing productivity and efficient use of resources. To study the impact of the FRED program on participating agricultural producers, and to identify future energy/water needs and areas for improvement. The FRED program will be comprised of three phases: MEL teams of trained energy and water specialists will target EQIP eligible farmers to conduct an evaluation of their energy and water usage through observation and measurement. Based on this evaluation, the team will provide a report recommending ways to improve the performance and efficiency of the farm's energy and water systems. This report will consist of best management practices for water and energy, as well as recommendations for specific infrastructure upgrades intended to maximize efficiency, which may include the utilization of on-farm renewable energy generation (solar, wind, biomass, etc.). Whether or not the farmer chooses to make the recommended upgrades, the increased knowledge of their energy and water usage, combined with the best management practices, will likely result in a change of behavior resulting in greater efficiency. This benefits the farmer, in terms of costs reduced and production increased, and the environment, in terms of reduced water usage and reduction of environmental pollutants. After receiving their evaluation report, farmers will be eligible to immediately apply for up to \$25,000 (with 20% cost share) in funding to implement recommended energy/water efficiency and renewable energy upgrades. Applications will be accepted on a rolling basis until funds designated for implementation are expended. The immediate eligibility will result in a dramatic reduction in the lag time between when a farmer

Walls of Text (This example reduces Cognitive Burden)

Good

A. Project Background:

The Florida Department of Agriculture and Consumer Services (FDACS), Office of Energy, and Office of Agricultural Water Policy, will establish the Farm Renewable and Efficiency Development (FRED) program, an innovative approach/incentive program to promote the adoption of technologies and practices that increase energy and water efficiency, as well as renewable energy use in Floridian agriculture. Florida's 47,500 farms produce nearly 300 different commodities on more than 9 million acres of land. Florida's agriculture industry employs 2 million people and contributes more than \$104 billion to the state's economy each year. Currently, FDACS (in a partnership with NRCS, the University of Florida, the Florida Farm Bureau, and numerous Florida counties and private partners) operates the Mobile Irrigation Lab (MIL) program, which provides to farmers free, site specific, evaluations of irrigation systems and opportunities for water conservation. MILs are made up of one or more trained irrigation specialists who evaluate the performance of a farm's irrigation system through measurement and observation. MIL teams use these observations to develop site specific irrigation water management plans. 16 MILs operate in 66 Florida counties, and have proven to be highly successful; since 2004, MILs have conducted 6,300 evaluations on 247,000 acres of land saving an estimated 10 billion gallons of water per year, with the potential to save 24 billion gallons per year if all recommendations were implemented. The proposed program will expand the capabilities of the MILs and create Mobile Efficiency Labs (MEL) that will conduct on-farm evaluations of the potential for energy and water efficiency as well as renewable energy upgrades. After participating in an evaluation, farmers will immediately be eligible for financial assistance for the implementation of the MELs recommendations. Outreach to farmers fitting the criteria for historically underserved producers (as defined by 7 CFR 1466) will be a priority. Finally, FDACS will conduct a study on the effectiveness of the program, and the future energy and water needs of agricultural producers in Florida.

B. Project Objectives:

Objective One: To promote the adoption of energy and water efficiency best management practices in the Florida agricultural industry, particularly amongst historically underserved producers, through the use of the Mobile Efficiency Labs.

Objective Two: To stimulate the implementation of energy/water efficiency and renewable energy technology that will benefit individual farmers by decreasing energy and water costs and increasing productivity and efficient use of resources.

Objective Three: To study the impact of the FRED program on participating agricultural producers, and to identify future energy/water needs and areas for improvement.

C. Project Methods:

The FRED program will be comprised of three phases:

Phase One: MEL On-Farm Evaluations

MEL teams of trained energy and water specialists will target EQIP eligible farmers to conduct an evaluation of their energy and water usage through observation and measurement. Based on this evaluation, the team will provide a report recommending ways to improve the performance and efficiency of the farm's energy and water systems. This report will consist of best management practices for water and energy, as well as recommendations for specific infrastructure upgrades intended to maximize efficiency, which may include the utilization of on-farm renewable energy generation (solar, wind, biomass, etc.). Whether or not the farmer chooses to make the recommended upgrades, the increased knowledge of their energy and water usage, combined with the best management practices, will likely result in a change of behavior resulting in greater efficiency. This benefits the farmer, in terms of costs reduced and production increased, and the environment, in terms of reduced water usage and reduction of environmental pollutants.

Phase Two: Farm Renewable and Efficiency Development (FRED) Grant Program

After receiving their evaluation report, farmers will be eligible to immediately apply for up to \$25,000 (with 20% cost share) in funding to implement recommended energy/water efficiency and renewable energy upgrades. Applications will be accepted on a rolling basis until funds designated for implementation are expended. The immediate eligibility will result in a dramatic reduction in the lag time between when a farmer has an evaluation conducted, and the installation of their chosen upgrades, leading to greater enthusiasm for the adoption of the recommended efficient and renewable technologies. MEL teams will provide assistance to applicants in the development of their proposals, and FDACS will review and approve applications. The choice of which, if any, technologies to adopt will be left up to the individual farmer.

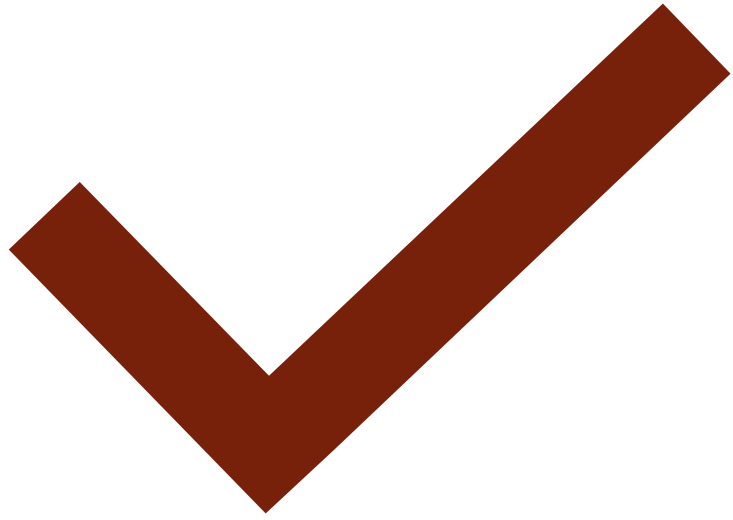
Phase Three: Economic Impact Study

The Office of Energy will procure a qualified contractor to perform an economic analysis of the impacts of the FRED program. Emphasis will be placed on the evaluation' upgrades effect on the net revenue, net cost, yield variability, and other measures of economic risk and impact. The study will consist of data collection and evaluation, as well as case studies of the individual projects. All recipients of funds will be required to provide information on the impact of the project on their farms. The study will aid FDACS and other stakeholders in the development of future programs and policies. Information from the study will also be used to produce pamphlets promoting water and energy best management practices, citing real world examples.

Avoid:

Making the
Reviewer Infer
Meaning

- NO
 - “Based on this prior research, the next step is obvious.”
 - “The results of Process A are shown in Table 1.”
 - “We will work with our partners to complete the project”
- Yes
 - “Based on this prior research the next step is (state the next step)”
 - “The results of Process A are shown in Table 1. These results mean...”
 - “We will work with our partners to complete the project. Specifically, we will conduct process A, they will conduct process B, and we will collaborate on Process C.”



Do These Things

Have a Good Title

Clear Concise “Active” Interesting

- A good title makes the proposal more memorable
- Especially important for proposals to private foundations
- Think about what would “look good in the news”

Use Bold,
italicize, and/or
underline key
points

Project Description

I. Overview and Significance of the Proposed Project

Research: The development of solid electrolytes for all solid-state rechargeable Li/Na-ion batteries faces a few major challenges, including high interfacial resistance, low electrochemical and thermal stability, microstructure-induced short-circuit, and poor mechanical properties. Glass-ceramics, with significant advantages over conventional glass or ceramic alkaline-ion electrolytes (Fig. 1), have emerged recently as a new solution to address these challenges¹⁻⁶. Glass-ceramics combine the benefits of high ionic conductivity, absence of inter-particle transfer resistance, and good stability. However, the properties of glass-ceramics are highly dependent on structures, phase compositions, and ion dynamics in these two-phase composites. The optimization of these parameters largely relies on the trial-and-error approach at this stage. In addition, current glass-ceramic electrolytes are limited to Na superionic conductor (NASICON)-based structures. **This proposed work aims to understand the dynamic structure-property-performance relationships of glass-ceramic electrolytes with in situ synthesis and in operando characterizations.** The objective of the *in situ* synthesis is to achieve predictive and controlled synthesis of glass-ceramics with high Li/Na ion mobility and to expand the variety of suitable glass-ceramics beyond NASICON-based structures. The tools for *in situ* synthesis include the high-temperature high-resolution NMR facility set up by the PI's group at the National High Magnetic Field Laboratory (NHMFL), complemented by *in situ* synchrotron-based X-ray and neutron diffraction at national user facilities. The combination of NMR and diffraction techniques allows probing both long- and short-range structures, which is particularly useful for glass-ceramics containing both ordered ceramic particles and amorphous glass phase. NMR is capable of determining both structure and ion dynamics simultaneously, which permits real-time structure-ion mobility correlation and fast screening of kinetically stable phases for good ion conductors. In addition, first principles calculations will be carried out, in conjunction with experiments, to ensure accurate structure determination with property prediction of ion conduction. The objective of the proposed *in operando* characterizations is to determine suitable structural and compositional characteristics of glass-ceramics for fast ion conduction, low interfacial resistance, and good stability when they are used in all-solid-state batteries. *In operando* characterizations will be mainly performed at the NHMFL with NMR/MRI, complemented by high-resolution transmission electron microscopy (TEM) and X-ray photoelectron spectroscopy (XPS). With these tools, the structure, composition, and homogeneity will be non-invasively probed in the bulk of the glass-ceramic electrolytes and the electrolyte/electrode interface during battery operation and will be correlated with the changing interfacial resistance and long-term stability. The new knowledge in the real-time relationships between structure/composition/homogeneity and conductivity/stability, obtained from *in situ* and *in operando* characterizations, will facilitate the development of high-performance Li/Na glass-ceramic electrolytes for the next-generation all-solid-state Li/Na rechargeable batteries.

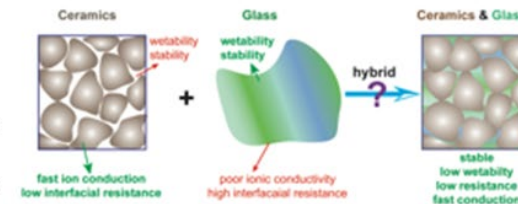


Figure 1. Ceramic and glass oxide electrolytes have intrinsic limitations to fulfill the requirements for all-solid-state batteries. Glass-ceramic composites are a promising solution, but fundamental research is critical to gain necessary knowledge regarding their synthesis, processing, and in device performance.

Education: The proposed educational activities are derived from the proposed research component and the outcomes of the educational plan will in turn support the research. The objectives of the educational component are to engender self-sufficiency, to promote broad participation in scientific research, and to enhance critical thinking skills of the participants. **The first proposed activity is to train young scientists nationwide how to make, modify, and repair probes for NMR/MRI.** This activity is motivated by two realities: i) almost every institution has at least one NMR facility or is in the processing of acquiring one; ii) the monopoly of the NMR probe market by a single vendor, the limited permission from the NMR vendor for modifying the probe, and the high-cost, long waiting time for repair. Probe workshops will be organized

Have Good Graphics

Good Use of Graphics

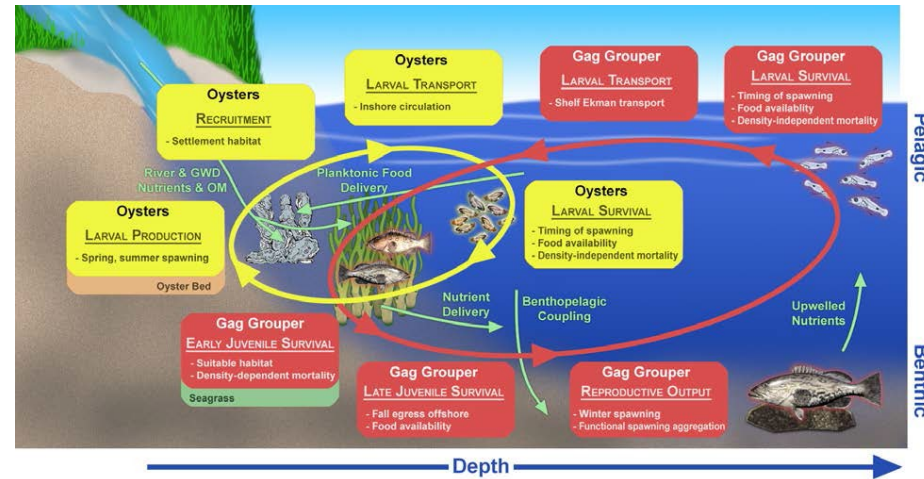


Figure 1. Schematic of interactive pathways of abiotic and biotic factors of fish in the Gulf of Mexico

Bad Use of Graphics



Figure 1. The Gulf of Mexico

Write Specifically to Review Criteria

- “The proposed project has the potential to advance the field of science by....”
- “The intellectual merit of the proposed project is based on...”
- “The proposed project fulfills the Department of Science’s long-term goal of advancing science by...”
- “I believe I have the potential to be an impactful recipient of the NSF GRFP because...”
- “This project will benefit the local community through its use of ...”
- “The broader impacts of this project include...”

Remember that
your proposal is
more than just
your program
description

- Proposals also require additional documentation beyond the project narrative
- Biosketches/CV's, letters of support, equipment and facilities descriptions, data management plans, post-doc mentoring plans, etc.
- These will take longer than you think to collect and format

Not completing your proposal as instructed can get you rejected without review

Working in Teams

"Team Science is a Marathon, not a Sprint"

Three Pillars for Effective Teams



Trust



Psychological
Safety



Development of
a Shared Vision

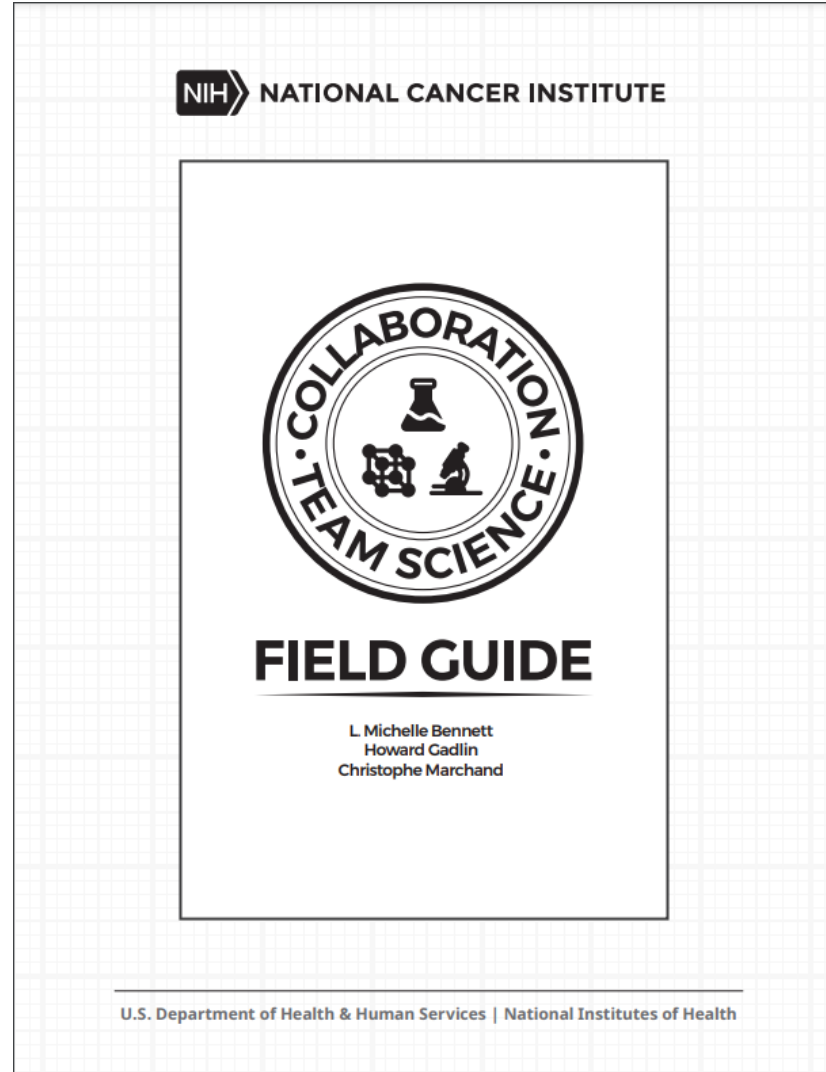
Setting Expectations

No secrets or surprises

- Communication
- Regular Meetings with Clear Agendas
- Authorship/Sharing
- Jointly created agreement among collaborators to build trust is a good design, including:
 - How meetings will be run
 - Vision and goals
 - Setting expectations: everyone knows what they are doing and everyone agrees
 - Achievable workloads
 - Holding each other accountable
 - Decision-making and problem-solving

Preparing Yourself for Team Science

<https://www.cancer.gov/about-nci/organization/crs/research-initiatives/team-science-field-guide/collaboration-team-science-guide.pdf>



Collaboration Agreement Resource

<https://doi.org/10.5281/zenodo.6394789>

The Collaboration Agreement Template is designed to help cross disciplinary research teams be explicit about the details of their collaboration.



Questions?