

# How Funding Works

An introduction for students

A U.S. government study found that university faculty members spend about 40 percent of their research time navigating the bureaucratic labyrinth. (why we are always so busy)

<https://www.scientificamerican.com/article/dr-no-money/>



~ Half of these slides were adapted from Erica Whitney, Associate Director of UC Berkeley Research Office

# Outline

- My proposal experience (an example)
- An example budget
- How do you get a grant?
- Types of funding opportunities
- What goes into a proposal?
- Dealing with rejection and how to respond



You can **request to help!** Just keep in mind that if it's close to a deadline some may prefer to do themselves.

# My Proposal Experience

## (Note there are many experts here)

- Undergrad: helped typo check and manage the collection of documents for multi-investigator proposal
- Grad: assisted with scientific ideas (20 person group)
- Scholarships and fellowships (full tuition and 2 grad)
- Beamtime proposals (~2 per year then, now more)
- Major Research Instrumentation grant for PLD (Co-PI)
- Higher Education Policy Commission (Co-PI)
- Served on various types of review panels (helpful)
- Recently: NSF, DoE & American Chemical Society



# You Fall Before You Learn to Walk

## My Rejections: (National acceptance rates 10-20%)

- Reducing Magnetic Dead Layers in Complex Oxides for Increased Interface Coupling, DOE Early Career, 2010
- Controlling Interface Valency in Complex Oxides for Increased Magnetolectric Coupling, DARPA Young Faculty Award, 2010
- Optimizing Interface Physics to Magnetize Students and Materials (M. Holcomb, PI), NSF-Career Award, 2010
- High-Resolution and Low-Temperature Magnetic/Ferroelectric Microscopy for Nonlinear Optical Imaging of Multifunctional Oxide Nanostructures (M. Holcomb, PI, David Lederman and Stuart Wolf), DOD DURIP, 2010
- Interface Engineered Multilayer Thin Films for Room-Temperature Precision Magnetic Sensing, Air Force Young Investigator, 2010
- Interface Engineered Complex Oxides for Room-Temperature Precision Magnetic Sensing, ONR Young Investigator Program, 2010
- MRI-R<sup>2</sup>: High-resolution and Low-temperature Magnetic Microscopy for Nonlinear Optical Imaging of Complex Nanostructures (M. Holcomb, PI, A. Bristow, F. Ganikhanov, S. Wolf, N. Wu), NSF, 2011
- MRI-R<sup>2</sup>: Acquisition of a Field Emission Scanning Transmission Electron Microscope for West Virginia University (X. Song, PI, D. Lederman, E. Sabosky, S. Urazdin, N. Wu), NSF, 2011
- Rural Workforce Development in STEM Fields (E. Toth, PI, Z. Dinu, R. Hensel, M. Holcomb, and D. Simien, Co-PIs), NSF, 2011
- Depth-Dependent Studies of Factors Influencing Magnetic Dead Layers (M. Holcomb, D. Lederman and N. Tolk), NSF, 2011
- Reducing Magnetic Dead Layers in Complex Oxides for Increased Interface Coupling (M. Holcomb, PI), DOE Early Career, 2011
- Material Interfaces for Efficient, Novel Generation and Conversion of Energy (M. Holcomb, PI), Petroleum Research Fund, 2011
- Optimizing Interface Physics to Magnetize Students and Materials (M. Holcomb, PI), NSF Career Award, 2011
- Improving Device Energy Efficiency and Speed by Optimizing Interfacial Coupling (M. Holcomb, PI), ARO, 2012
- Rural Workforce Development in STEM Fields (E. Toth, PI, Co-PIs: C. Dinu, M. Holcomb, and D. Simien), NSF/ATE, 2012
- Strategic Approach to Identifying Coupling Mechanisms at Heterostructure Interfaces (M. Holcomb, PI), NSF/CMP, 2012
- Depth-Dependent Studies of Interfacial Mechanisms in Complex Oxides (Holcomb, Lederman, Stanescu, and Tolk), DOE, 2012
- Improving Device Energy Efficiency and Speed by Optimizing Coupling (M. Holcomb, PI), NSF/EPMD, 2012
- Center for Strongly Correlated Oxides for Revolutionary Electronics (SCORE) (S. Wolf, PI, R. Averitt, B. Butler, G. Dionne, J. Eckstein, J. Floro, A. Ghosh, L. Harriott, M. Holcomb, D. Lederman, S. Levitan, A. Lukaszew, J. Lu, C. Mewes, T. Mewes, J. Poon, C. Ross, K. Smith, M. Stan, B. Weikle, J-M Zuo, Co-PIs), SRC/DARPA., 2012
- 3D Architecture from 2D Devices (A. Ramirez, PI, E. Andrei, A. Bristow, S.-W. Cheong, M. Chhowalla, L.C. Feldman, L. Fu, E.L. Garfunkel, G.-H. Gweon, D. Heiman, J. Heremans, M. Holcomb, S.M. Kang, N. Kobayashi, D.V. Lang, D. Lederman, J. Moodera, S. Oh, K. Pedrotti, W.E. Pickett, T. Siegrist, T. Stanescu, M.A. Subramanian, D. Vanderbilt, Co-PIs), SRC/DARPA, 2012
- Critical Mechanisms Responsible for Magnetic Dead Layers in Complex Oxides (M. Holcomb, PI, Collaborator: S. Satpathy), NSF-CMP, 2013
- Rural Workforce Development in STEM fields (Toth, PI, Holcomb Co-PI), NSF/ATE, 2013
- Magnetizing Students and Materials by Investigating Science at Its Boundaries (Holcomb PI), Research Corporation, 2013
- MRI: Acquisition of High Resolution and Low Temperature Magnetic Microscopy for Nonlinear Optical Imaging of Complex Nanostructures (M. Holcomb, PI; A. Bristow, C. Cen, P. Gannett and D. Lederman, Co-PIs), NSF/MRI, 2013
- Project/Proposal Title: DMREF: Searching for Emergent Electronic Phenomena at Interfaces in Fluoride-Based Materials (A. Romero, PI; C. Cen, M. Holcomb, D. Lederman, and T. Stanescu, Co-PIs), NSF/DMREF, 2013
- Electronic and Optical Properties of Stacked Two-Dimensional Materials (D. Lederman, PI; Y. Glinka J. Heremans, M. Holcomb, C. Tao, Co-PIs), ERFI 2-DARE, 2013
- Chemistry at Low Symmetry Interfaces (M. Holcomb, PI), Chemical Society, 2014
- Depth-Dependent Studies of Interfacial Mechanisms in Complex Oxides (M. Holcomb, PI; D. Lederman and T. Stanescu, Co-PIs), DOE, 2014
- OP: Optical Measurements of Capping Layer Effects on Strongly Correlated Oxides (M. Holcomb, PI), NSF,, 2014
- Reanimating Magnetic Dead Layers: Enhancing Magnetism in Strongly Correlated Oxides (M. Holcomb, PI), DOE Early Career, 2015
- Interfacial Properties of Designed Peptides Coated onto Metal Nanostructures (PI: Lewis; Co-PIs: Holcomb and Guillion), NSF-CBET, 2015

**Point: Lots of them**



# Why Do You Need a Grant?

Need money to do your research:

- Personnel
- Equipment (not all grants)
- Supplies
- Travel

Build a record of funding

Employment, tenure/promotion

Salary

Prestige/Respect



# An Example Budget (They Vary)

- Typical NSF grant for three years ~ 450K (~300K for single)
- University takes ~ 1/3 for “overhead”
- 300 K left, ~100 K per year
- Student salary ~ 24K
- Plus benefits makes it more like 26.5K
- Two students would be over half of remaining \$
- Typically 10-20K supplies or shared facilities (exp)
- Travel, varies, a few K if not doing field research
- Need any equipment? (Not room for anything expensive)
- 0.5-1 month of PI time. Are there collaborators?
- Example 36K subaward with NCSU



# SUMMARY

YEAR 1

G. OTHER DIRECT COSTS			
1. MATERIALS AND SUPPLIES		10,000	
2. PUBLICATION COSTS/DOCUMENTATION/DISSEMINATION		0	
3. CONSULTANT SERVICES		0	
4. COMPUTER SERVICES		0	
5. SUBAWARDS		37,367	Ouch!
6. OTHER		1,062	
TOTAL OTHER DIRECT COSTS		48,429	
H. TOTAL DIRECT COSTS (A THROUGH G)		109,221	
I. INDIRECT COSTS (F&A)(SPECIFY RATE AND BASE)			
Modified Total Direct Costs (Rate: 50.0000, Base: 95792)			
TOTAL INDIRECT COSTS (F&A)		47,896	
J. TOTAL DIRECT AND INDIRECT COSTS (H + I)		157,117	
K. SMALL BUSINESS FEE		0	
L. AMOUNT OF THIS REQUEST (J) OR (J MINUS K)		157,117	
M. COST SHARING PROPOSED LEVEL \$		0	AGREED LEVEL IF DIFFERENT \$
3. ( 2) GRADUATE STUDENTS		43,125	
4. ( 0) UNDERGRADUATE STUDENTS		0	
5. ( 0) SECRETARIAL - CLERICAL (IF CHARGED DIRECTLY)		0	
6. ( 0) OTHER		0	
TOTAL SALARIES AND WAGES (A + B)		50,233	
C. FRINGE BENEFITS (IF CHARGED AS DIRECT COSTS)		6,269	
TOTAL SALARIES, WAGES AND FRINGE BENEFITS (A + B + C)		56,502	
D. EQUIPMENT (LIST ITEM AND DOLLAR AMOUNT FOR EACH ITEM EXCEEDING \$5,000.)			
TOTAL EQUIPMENT		0	
E. TRAVEL			
1. DOMESTIC (INCL. U.S. POSSESSIONS)		4,290	
2. FOREIGN		0	

# How Do I Get a Grant? (Details later)

- Define your research question.
- Define why anyone should care about this question.
- Match your research question to a granting agency that has awards that would meet your needs.
- **Get feedback** from at least one successful, trusted mentor.
- Write a grant proposal.
- Edit the grant proposal.
- **Get feedback** from more successful, trusted mentors.
- Edit the grant proposal again based on feedback.
- Have people (students?) check it for typos & other errors.
- Don't be ashamed to ask for help. There are resources.



# Define Your Research Question

- Identify a gap in knowledge in your field.
- Identify a problem whose solution will be a big step forward for the field, rather than an **incremental** step.
- Choose a problem that is going to matter to more people than just you.
- Discern whether or not someone else has already asked your question.
- Often someone has, but have they done it well enough? Remember that you don't want **incremental**.



# What do you need to do work?

- What do I need in order to do my research that I don't already have?
- How much do I need?

Your budget limits how much you can accomplish and how quickly.

Who do I need to help me?

Collaborators, students, technicians, staff



# Sources of Funding

## Federal Government:

- – National Science Foundation
- – Department of Energy
- – Department of Defense
- – NIH, etc.

## State/Local Government

Corporations (Warning: often don't like to publish)

Foundations (Mission driven)

Your university (internal funds)



# Match Your Research Question to an Agency

- Identify the right type of grant for your research question.
  - E.g., an equipment grant, career development grant, etc.
- Every funding agency has a mission.
- Your research **MUST** address their mission to be funded.

**Talk to a mentor** you trust (ideally one with funding from selected agency). Share your ideas and **listen!**

– **You should then talk with an agency program officer before writing the rest of the proposal** to seek their advice on whether your topic is a good fit.



# If the program officer likes it (congrats)

## First step: Read the D\*?! Directions

Follow proposal instructions exactly.

Format varies with sponsor.

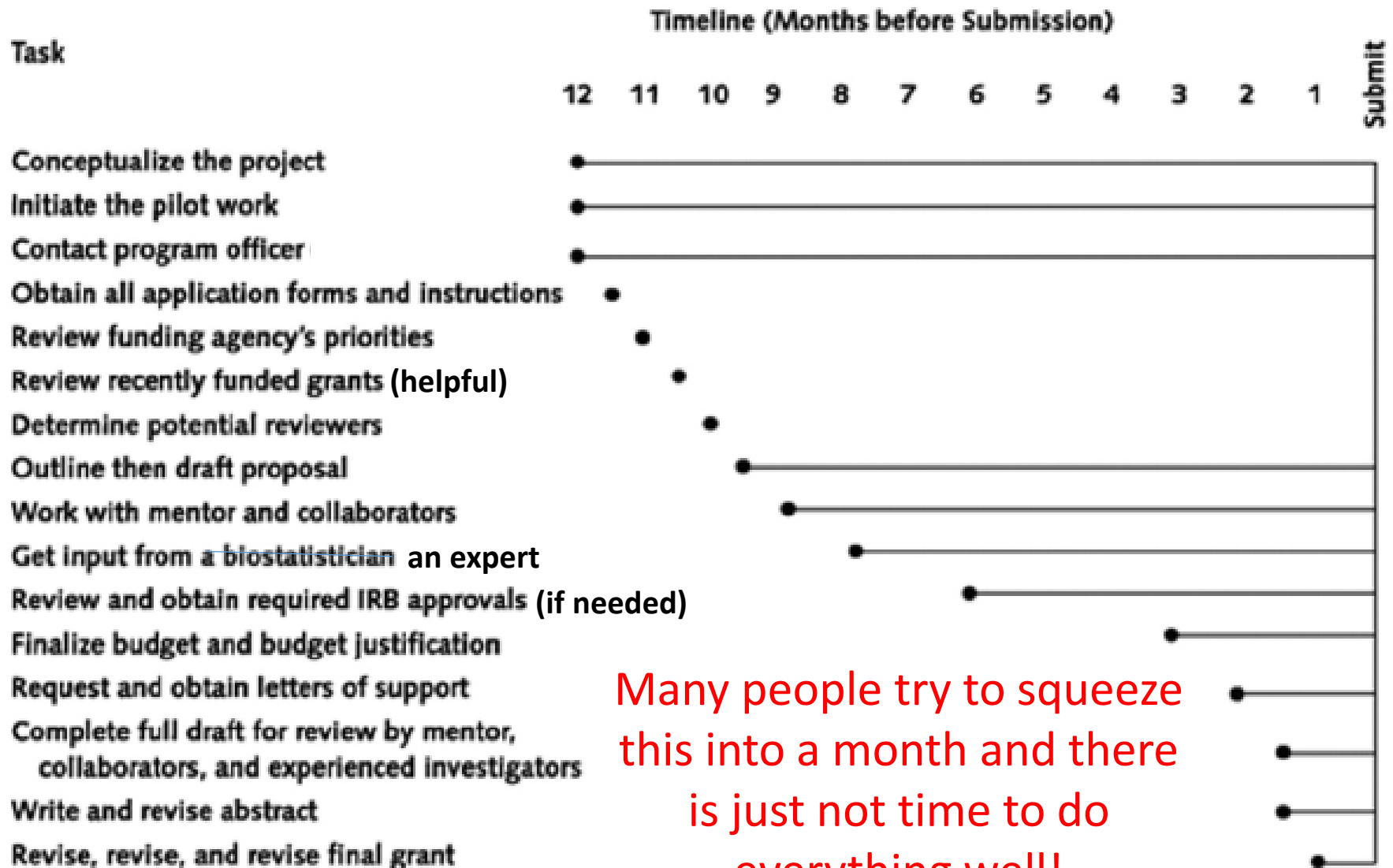
Don't try to get around length limits by using tiny fonts, small margins, or appendices. (Some reviewers have old eyes and impressions matter!)

**Many agencies reject such grants without review!**

**(After you've spent months, this is no fun.)**



# Give Yourself Plenty of Time!



Many people try to squeeze this into a month and there is just not time to do everything well!

# Tips when writing the proposal

- Use the active voice where possible.
- Write to your audience.
- Don't rely on spell-check. 😊
- **Have others read and critique your proposal!**
- Particularly if English is not your first language, but we all make mistakes. (particularly when rushed)
- At least one of your readers should be an expert in the field (they catch problems with the science), but will typically not be bothered with typos
- Your grad students are great medium level readers and may also bring up good scientific points.
- Also get someone who is a perfectionist. They do not have to be a scientist, but that can help. (Grammar/format help)



# What goes into a proposal?

Most include:

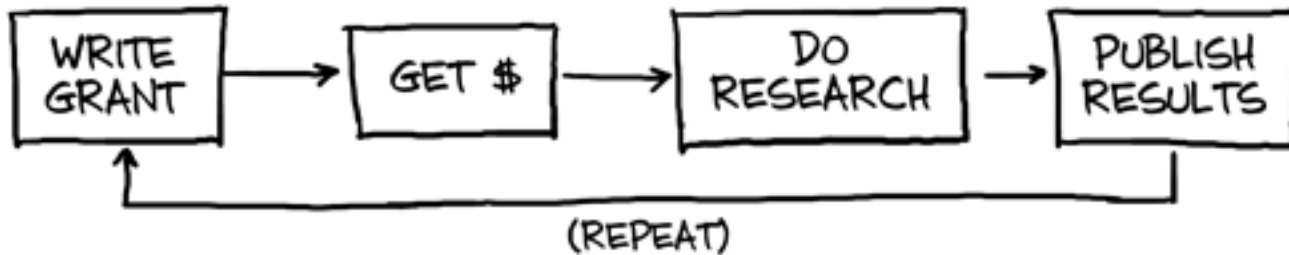
- Abstract/Summary (up to 1 page)
- Problem statement: What is the problem you will address
- Specific aims/goals
- Significance and Background (why the taxpayer should care and what's already been done)
- Research Plan (the experiments you plan to do, what they will tell you and what you will do if they don't give you the results you expect)
- Preliminary data/feasibility (**proof** you can do it!)
- Timeline
- Resources and facilities
- Personnel list and biosketches/CVs
- Budget

**All of these take time!**

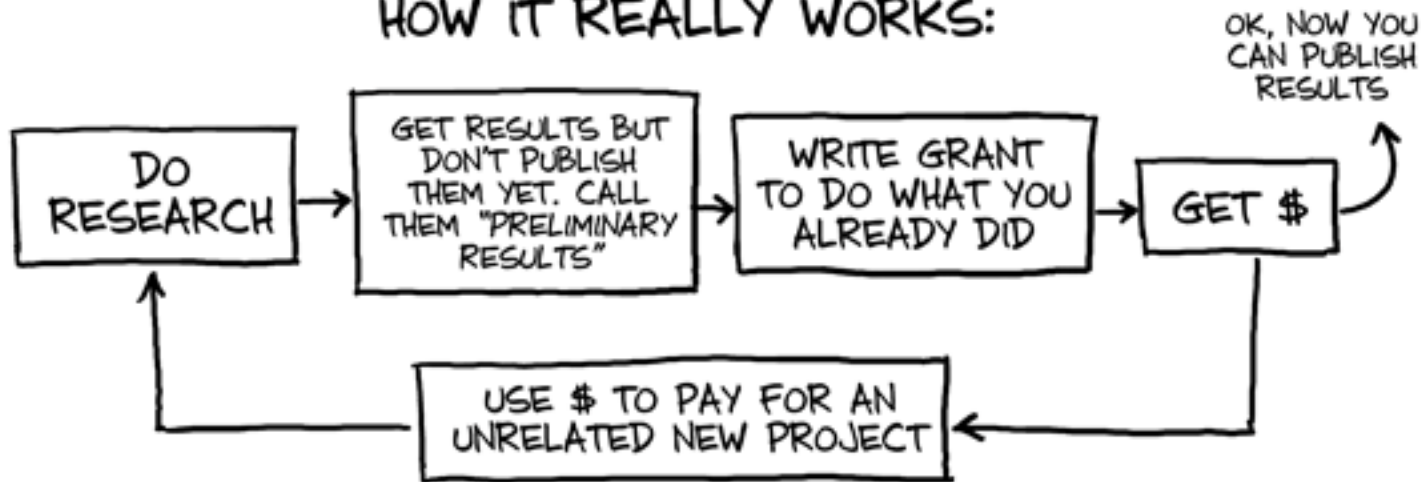


# THE GRANT CYCLE

HOW IT'S SUPPOSED TO WORK:



HOW IT REALLY WORKS:



Not everyone believes it's this bad, but there is some truth to it.

# How are proposals reviewed?

Important to keep your audience in mind

Most: Peer review

- 3-5 scientists in condensed matter will review it
- Agency has set review criteria.
- Provide written critiques and a numerical score.

Some peer review plus stakeholders.

For some foundations and agencies (In-house review)



# How are proposals reviewed?

In a panel, each person reads and reviews 6++ proposals and the panel discusses. (My largest panel 34)

- In-person meetings.
- Internet meetings.
- Written comments sent (may be combined with panel)

**Reviewers are busy scientists. Impressions matter.**



# Dealing with Rejection: Shit Happens

**Nearly every professor has faced multiple funding rejections!**

**Take some time to allow the sting to lessen. (relax your way)**

**Do not call the program officer to complain!**

**Analyze every single rejection you receive**

- If you want to be approved for funding in the future you absolutely must understand why your idea was rejected in the past.

**View rejection as a challenge (easier said than done)**

- Rejection is going to happen, but how you use that rejection can completely transform how much you're able to accomplish.

**Explore other sources of funding**



# A Few Common Reviewer Comments

- One reviewer expressed uncertainty in how the optical measurements “lead to a better understanding of the cause of magnetic dead layers.”
- Had to show preliminary work showing differences between related samples and argue why this information was important to proposal goal. Also discussed alternative experiments.
- Some concern among reviewers that a “closer collaboration” between growth and characterization should exist. (Despite letters of support) **common for theory too**
- Largely why we grow our own films now. Alternative approach: put in some funding for the grower



# Ways You Might Get Experience

- **Discuss with your prof** ways they might appreciate help
- Identifying unusual funding opportunities
- Come up with big ideas (ideally related to current work)
  - Not only have a good idea but demonstrate you can do it
  - Otherwise, consider keeping your idea for your future work
- Literature search, background research (use for thesis?)
- Planning the necessary experiments and back-ups
- Additional Materials (data management, CPs, etc.)
- ~~Bugging~~ Encouraging Co-PIs to submit their materials



# Finding Funding Opportunities

Lots of ways

Use a database.

– [pivot.cos.com](http://pivot.cos.com)

– [grants.gov](http://grants.gov)

Go directly to the sponsor's website.

<http://grants.nih.gov/funding/index.htm>

<http://www.cancer.gov/grants-training>

Sign up for email alerts.



# Some Take Away Messages

- Don't expect to get a grant the first time you write about a new topic....or maybe even the 2<sup>nd</sup> or 3<sup>rd</sup>
- Give yourself plenty of time to work on proposals, partly because errors are easy to miss if you rush
- Get advice from MANY people at different stages, some very early (the idea stage) - also takes time
- Evaluate feedback and consider what you can do to alleviate concerns. What you should do may not be exactly what was suggested.

