Research Projects and Proposals: An Introduction to the World of Research Funding

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Motivation

- Why did I choose this topic?
  - I'm certainly no expert on the funding of research, but it's an area that I wanted to learn more about
    - Dr. Barrett is going to give a presentation on this topic at Community Speakers next semester – he's probably an expert on grantsmanship
    - This is the amateur version
  - Why learn how to obtain funding for research? Well, why do research?
    - I'm a curious person by nature and I like to learn
    - So how do I get paid to learn?
    - Start by going to graduate school
    - Trade my labor, in exchange for classes and living expenses
    - But the pay is sort of low, and eventually I'll run out of classes to take (and/or get tired of taking them)
  - How do I get paid to learn after I've taken all the classes in a certain discipline?
    - One option is to do research

Motivation

- What is research?
  - Scientific investigation which adds to the body of human knowledge
  - It's knowledge that we want to gain because
    - It gives us satisfaction to know it
    - It benefits the health of our society
    - It's fun to figure out
    - It may give us a competitive advantage in the world – this is the reason most research is funded
- How does one go about getting research to work on?
  - It's given to you by a principal investigator and it's fully funded
  - You create a research topic and fund it via some part-time job
  - You create a research topic and obtain funding for it
    - Sell someone on your idea, so they'll fund it
    - Sounds pretty good! What could be better than doing interesting work and getting paid to do it?

Motivation

- Being skilled at obtaining funding for research is a great skill to have
  - It has the potential to give you more career flexibility
  - You're company or university will value you if you bring in money for them and create jobs
  - Sounds great right?
  - How does one learn how to obtain research funding?

Outline

- The truth, is that it's a difficult skill to master and it takes a lot experience, training and talent
- But reading a book about it might help
- This talk is essentially a synopsis the first three chapters of a book called, Research Projects and Research Proposals: A Guide for Scientists Seeking Funding, by Paul G. Chapin
  - Chap. 1 - Selecting a research topic
  - Chap. 2 - Project planning
  - Chap. 3 - Identifying funding sources

Chap. 1 - Selecting a Research Topic

- Often the most difficult task – beyond the ability of a book or teacher to impart this skill directly
- A research topic successfully balances a set of desirable goals
- One needs to balance
  - Focused vs. extended
    - Topic must be focused enough to be clear, but broad enough to be interesting
  - Novel vs. grounded
    - Only truly novel work can make the kind of contribution to our knowledge that merits support from a funding agency
    - Literature review: shows how the topic is related to established scientific knowledge and how it is novel
  - Feasible vs. challenging
    - The project should be a challenge to carry out; it should lie just at the threshold of feasibility
    - Show to the sponsor that you will stretch the resources provided to you and make the most effective and productive use of them

Chap. 1 - Selecting a Research Topic

- One needs to balance between
  - Theoretical vs. empirical:
    - Have a theoretical model, however tentative and incomplete
    - Avoid a “fishing expedition”; a proposal that proposes a set of data to collect where the investigator expects patterns in the data to become self-evident
    - A model will contain gaps that generate questions to explore and these questions will provide a plan that has direction and purpose
  - Near-term vs. long term results:
    - Typical length of funding that a new investigator can expect receive is 2 to 3 years (5 years at most)
    - Typically need to show results after 2 to 3 years to get more funding
    - A topic whose possibilities will exhaust before 2 years is probably too narrow
    - Have a long-term vision and plan (connected to your career goals), but divide it up into individual stages of a few years each

Chap. 2 – Project Planning

- Once you have a topic, the next step is to plan the project
  - Try to plan out on a month to month basis
  - Try to be methodical here and think through possible paths and contingencies
- A plan is useful because
  - The planning process can reveal problems and pitfalls that may arise
  - The plan guides an motivates and guides work during periods between flashes of inspiration
  - Ensures that all members of the research team have a common understanding of what must be done
  - After careful project planning the proposal should flow naturally
  - Will allow you to determine if you're dividing your research time among the major project components roughly in proportion to their relative importance to the main project goals
- At this stage of planning a certain level of background preparation must be complete
  - Classes under one's belt, have practical and theoretical skills, read the literature, gone conferences, maybe completed a pilot project to demonstrate a technique
  - Proposing a project for which you have done no background preparation is very unlikely to be successful

Chap. 2 – Project Planning

- Details of project planning
  - Start by formulating the current state of your knowledge in precise detail, based on the literature, your own prior research and resources (people and equipment) at your disposal
  - Then look at the end goals and figure out what steps are required to obtain them
  - Estimate the length of each task and translate to a calendar-based sequential schedule
  - Allow for unexpected surprises
  - Estimate costs

Chap. 3 - Identifying Funding Sources

- Now that you have an idea and a project plan it's almost time to start writing a proposal
- One needs to decide where to submit the proposal however; this will affect how the proposal is written
- Possible funding sources
  - U.S. Government
  - Private foundations
  - For a dissertation: your advisor, a company, a fellowship or a part-time job (assistantship)
- U.S. Government
  - Single largest supporter of scientific research in the world since WWII
  - A collection different agencies, each with its own aims and procedures

Chap. 3 - Identifying Funding Sources

- National Science Foundation (NSF)
  - Mission
    - Scientific excellence rather than a particular goal such as defense or health
  - History
    - Established after WWII when it became evident that key military assets were only possible because of basic research that had taken place before the war ever started
    - "This is work that the pre-war government wasn't even aware of, wouldn't have understood if it had been aware, and wouldn't have supported if it had understood."
    - The NSF became the one government agency with the mission to support science for its own sake, rather than a means to some predetermined end.
  - Starting place
    - To find out where you and your work fit in best into the NSF structure go to their website: www.nsf.gov
  - Contact
    - Find a program officer who seems close to your research area, and contact that person, describing your plans and asking how and where they fit within the NSF (good advice for any funding agency)
  - The NSF awards most of its research funding in response to "unsolicited proposals," i.e. not in response to a formal "request for proposals"

Chap. 3 - Identifying Funding Sources

- Department of Defense (DOD)
  - DOD differs from the NSF in some fundamental ways
    - Identify a research need and then identify a researcher who can meet that need; less often do they fund unsolicited proposals
    - A greater degree of managerial oversight; they expect and arrange for a great deal more interaction with investigators
    - Research subject to strict legal restrictions on dissemination of results and descriptions of the nature of the research; may require U.S citizenship or clearance
  - Each branch of DOD research has its own mission, tradition, authority structure
    - Air Force Office of Scientific Research (AFOSR): www.afosr.af.mil
    - Army Research Office (ARO): www.arl.army.mil/aro
      - Most important information for the prospective applicant is in the Broad Area Announcement; list of research areas which the ARO will support
    - Office of Naval Research (ONR): www.onr.navy.mil
      - Awards more grants rather than contracts for basic research
      - Unlikely to fund classified projects in support of basic research or impose citizenship restrictions on PIs
    - Defense Advanced Research Projects Agency (DARPA): www.darpa.mil
      - Independent of the separate branches; operates directly under DOD central command

Chap. 3 - Identifying Funding Sources

- National Institutes of Health (NIH) - www.nih.gov/icd/
  - "Science in pursuit of fundamental knowledge about nature and behavior of living systems…"
- NSF, NIH and DOD agencies award the majority of funding the U.S. Government provides
- Other government agencies that we would be interested in
  - Department of Energy
  - National Aeronautics and Space Administration
- Private foundations
  - 70,000 officially recognized private foundations in the U.S.
  - Many do to not entertain, nor accept proposals
  - A limited number support scientific research
  - It is usually not fruitful for most researchers to devote a lot of time exploring the funding opportunities in the world of private foundations
  - www.foudations.org – Directory of private foundations (not free)
  - http://fdncenter.org – Links to 90 of the largest private foundations

Conclusion

- Ready to write and submit your proposal? Well actually…
- This was a great learning experience, but I realized that trying to obtain funding from the U.S. Government would be a
  - Time consuming and challenging task
  - Probably more than I'm capable of at this time in my career
- An easier way to fund my research would be
  - Fellowships
  - Industry sponsored research projects
  - Part-time work (assistantships)
  - Invitations to work on funded research projects
- However, the ideas mentioned in this presentation would be useful
  - For obtaining funding from just about any source
  - And for planning just about any research project
- I need to remember to refer back to these slides when the time comes

Practical Optics

- Thank you for offering Practical Optics
- This is a very valuable course
- It's great to see presentations from people in industry because
  - I get to learn what their jobs are like
  - Helps me choose my classes and steer my career
  - Important concepts are emphasized in a way that a normal class can only simulate – when you see someone in industry give a presentation saying this is the fundamental concept/formula that my line of work is based on, it has a big impact
- This is a fun course