How to Write a Good Research Proposal (PhD and Postdoc Retreat)

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Why apply for funding?

- To get salary for your own position (e.g., your own postdoc position).
- To get funds to invite guests and to travel and for equipment.
- To get funding for PhD students and postdocs.
  - To increase the number of ideas you can investigate (hopefully you have more ideas than you have time to investigate on your own...).
  - To help educate the next generation of researchers.
  - To have fun! (the most enjoyable part of my job is to work with students and postdocs)
- Because it is expected, a part of your job.

Motivation

Challenges:

- Competition is getting tougher, both wrt the number of competitors and the amount of funding available (success rates are very low).

Good news:

- The general standard of research proposals is low, so not hard to shine.
- A strong proposal is in a lottery, but a weak one is dead.
- If you can learn to improve the standard of your proposals, you are at least in the lottery!

Sources

- Plenty of online resources if you search for information on how to write a good research proposal.
- These slides are heavily inspired by slides of Mogens Nielsen and in turn Simon Peyton-Jones from Microsoft Research Cambridge, see
  - research.microsoft.com/en-us/people/simonpg

  for more related information.
- Foundations also provide their own advice (read if you want to apply there!).
- Departments often also provide advice, e.g.
  - https://cs.staff.au.dk/boards-and-committees/research-committee/research-application/
- Always check local information (funding is different from country to country) and talk to senior colleagues to get additional advice!

Choosing your funding agency (where to apply)

- Make sure *your case for support* mathces the *priorities of the agency*.
- Read the call carefully — and make sure to address *ALL* issues, even if you think some issues are obvious (write, e.g., "PhD positions will be announced internationally to attract the best candidates")
- Some considerations:
  - Pure-, strategic-, applied research.
  - Blue sky vs close to market.
  - Science vs innovation.
  - Bottom-up vs top-down.
  - Discipline-oriented vs thematic-oriented.
  - The applicant(s) vs the project description.

Some Public Agencies

- Aarhus University
  - Aarhus Univ Research Foundation (AUFF)
- Denmark
  - The Independent Research Fund Denmark (DFF): FNU / FTP / ...
  - Danish Nat'l Research Foundation (Grundforskningsfonden)
  - Innovation Foundation (Innovationsfonden)
- EU
  - European Research Council (ERC)
  - Marie Curie Fellowship
  - Future and Emerging Technologies (FET)
  - Syngergy grants
  - ...

Some Private Agencies / Foundations

- Denmark
  - Novo Nordisk Foundation
  - Velux Foundations
  - Carlsberg Foundation
- See also: https://www.researchprofessional.com for more info on agencies and calls (available to all researchers at AU).

Understand your audience

- Obtain as much information as you can about the criteria and the members of the panel/council/board of your funding agency.
- With luck, your proposal will be read carefully by one or two experts.
- But it will certainly be read superficially by nonexperts - and THEY will be most often be the panel members. You have a few minutes of their time to catch their attention.

Challenging:

- you may need to include some bits for the experts and some for non-experts.

For all audiences: tell a story

- Here is an interesting and important problem (evidence...)
- Here is an original and promising idea (evidence...)
- Here is the methodology we intend to exploit
- Here are the results we aim to achieve (gains, risks...)
- Here is the ideal team for the project (evidence...)
- Here is what we need in order to succeed (justified...)

The Problem

- Is it interesting (i.e. is it research)?
- Is it important (who are the "customers")?

Bad phrase:

- As we all know, we need to understand the Analgesic and AntiInflammatory Activities of Salicylaldehyde 2-Chlorobenzoyl Hydrazone (H2LASSBio-466) and Their Zinc(II) Complexes

Good phrase:

- The emerging ubiquitous computing needs alternatives to traditional security mechanisms (passwords, keys, certificates, etc.), since...

The Idea

- Is it original and novel in addressing the problem?
- What are your hypotheses?

Bad phrases:

- We aim to gain insight into...
- We shall continue to study...

Good phrase:

- We propose trust based technology as a novel security mechanism in ubiquitous computing, and our hypothesis is...

The Methodology

- Do you have a plan for achieving your goals?
- What is in place and what is needed in order to carry out your plan?
- Present a concrete plan: include, e.g., a Gantt chart or a table showing what the PhD students and postdocs should work on each year.

Bad phrases:

- We shall bring together a number of researcher...
- We shall write a number of papers...

Good phrase:

- We shall develop a model for trust, and a prototype implementation testing our hypothesis...

The Results

- What are the success criteria ?
- What are the risks ?

Bad phrases:

- We hope to provide some insight into...
- We shall improve our understanding of...

Good phrase

- The criteria for success will be a prototype security system demonstrating the following properties:...

Additional Criterias

You and Your team

- Highlight *all* your strong points *relative to the project*.
- Be BOLD, not modest.
- All team members should have a proper role to play.

Esp. in Denmark: Internationalization (a plus word in Denmark)

- Mention international collaborators, enclose STRONG letters of support (at least until mid-career level) or give other evidence of how your proposal will strenghten the internationalization of Danish research.

The Summary / Abstract

- This is the most important part of your proposal!
- It will be read by (almost) all panel members and reviewers.
- Make sure it contains succinctly all your strong points, every word is precious.
- Advice: write it both at the beginning and at the very end of the process.

The Budget

- Make sure that the money you ask for is argued well from the project.
- Make sure that the money you ask for fits the guidelines of the funding agency.
- Make sure that it fits the guidelines of your university.
- Get appropriate help to ensure details are done correctly:
  - I usually make a back-of-the-envolope calculation and then ask somebody to help implement that as a proper budget (taking salary increases, holiday pay, overhead, etc. into account)

Typical reasons for rejection

- Some criterias in the call have not been met (remember: you need to address all of them!).
- Formalities are not in order – e.g., missing cv from co-applicants, or some other attachment is missing.
- Not above the cut.
- Unlucky with reviewers (cf. reviewing of research papers...).
- In Denmark you get feedback from public foundations, but not from private.

Remember:

- Most proposals are rejected and high profile professors also get their proposals rejected all the time, so remember your elephant skin and get back up on the horse again...

Calls you can apply for

Postdoc funding:

- DFF International Postdoc Grant, https://dff.dk/ansogning/opslag_frie_midler_2021_dk.pdf (see page 9)
- Sometimes the Carlsberg Foundation has grants for postdocs, check https://www.carlsbergfondet.dk/en/Applicant/Apply/Call-and-Guidelines.
- ERC Marie Curie fellowship.
- Villum International Postdoc for Women https://veluxfoundations.dk/en/villum-international-postdoc.
- DFF Sapere Aude (if you have several years of postdoc experience).
- Keep checking Novo Nordisk foundation; they are expanding into CS area.

Apart from that, not many calls you can apply for — maybe help your advisor with applications, if you would like to get some early experience.

Final Remarks: Career Advice

- Nurture your CV.
- The activities you engage in should ideally be aligned with interests of (some) funding agencies.
  - if you would like to be able to apply for big Innovation Foundation like grants, then you need to build up connections with companies etc., so try to join some innovation networks or engage in other collaborations with companies
  - push your research far enough that it gets visible impact (then it is easier for referees to argue for your research proposal)