HOW TO WRITE A SUCCESSFUL RESEARCH PROPOSAL

Assoc. Prof. Ly Le
School of Biotechnology

WHY RESEARCH PROPOSAL?

- ✓ To get approval from the ethical committee
- ✓ To gain funding for the research
- ✓ To refine our research ideas and plans

BEFORE-HAND REQUIREMENTS

- ✓ Obtaining grant proposal guidelines
- ✓ Understanding eligibility requirements
- ✓ Identifying match/leveraging requirements
- ✓ Checking the submission deadline
- ✓ Determining personnel needs
- ✓ Other administrative requirements

WHAT RESEARCH PROPOSAL?

- ✓ A blue print of a building plan before the construction starts
- ✓ Writing a research proposal = Science + Art
- ✓ Good research proposal based on:
  1) Scientific facts
  2) Art of clear communication

CONTENT

1. Objective
2. Introduction
3. Literature Review
4. Methodology
5. Time frame and work schedule / Gant chart
6. Personnel needed / available
7. Facilities needed / available
8. Budget

1. OBJECTIVE

- Clear
- Specific
- Achievable
- Measurable
- Focusing

2. INTRODUCTION

- Pointing out the problem
- Guiding readers in appropriate way
- Short (1 or 2 pages)
- Closely relevant to one's fields

3. LITERATURE REVIEW

- Showing extensive understanding of the topic
- Summarizing all related studies
- Paraphrazing key ideas
- Readable language
- Gaining insights on different methodologies

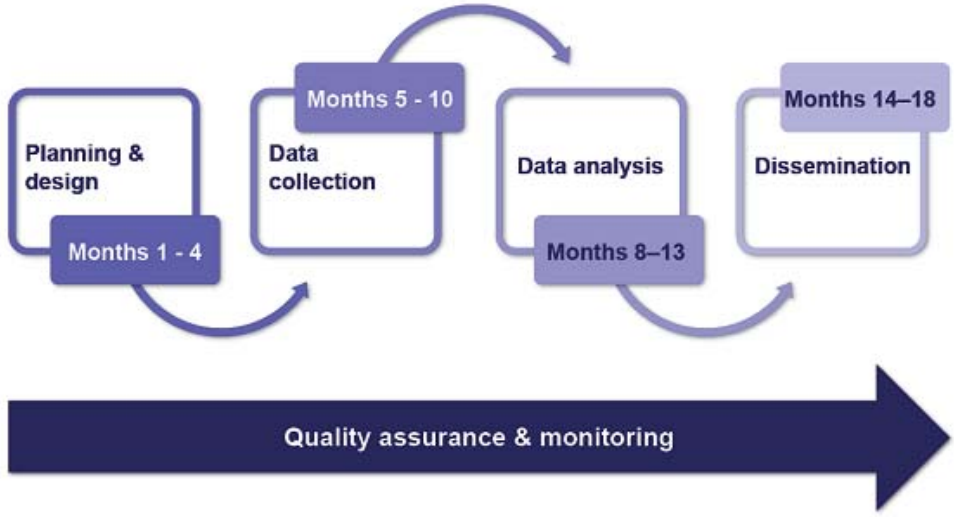
4. RESEARCH METHODOLOGY

- Experimental design
- Study population & Sampling specifications
- Sample size
- Instrumentation
- Specific procedures

5. TIME FRAME & WORK SCHEDULE

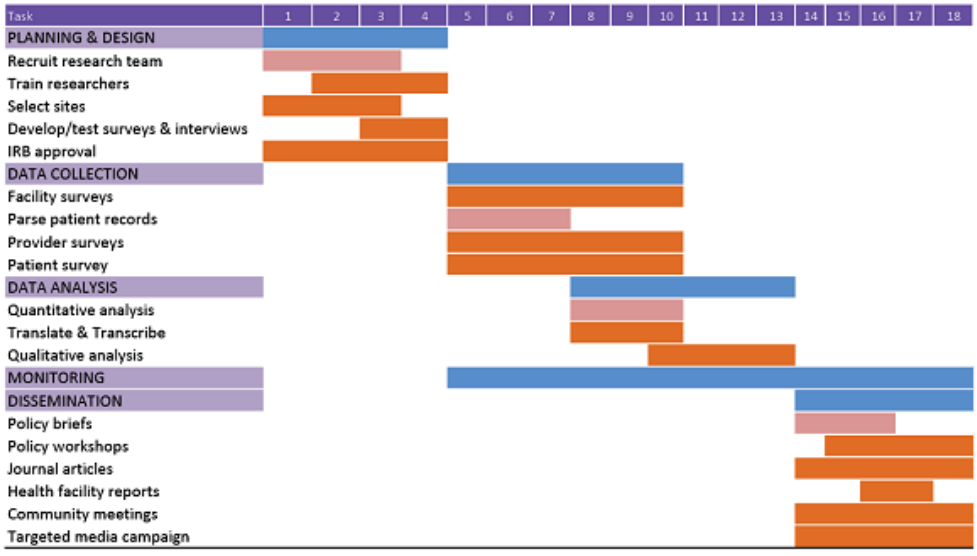
- List of tasks
- Anticipated time
- Personel
- Tabular or graphic presentation
- Flow charts
- Other diagrams of interrelationship between different activities

Project Timeline



Source: http://www.who.int/tdr/publications/ir-toolkit/Module2_Session3-Slides_final.pdf

Project Timeline



6. PERSONEL

Including:

- Principal investigators and co-investigators with proof of qualifications, research experience, etc.
- Major roles of each member

7. FACILITIES

Important facilities required / available for study

- Computers
- Laboratories
- Special equipment …

8. BUDGET

Major items

- Salary for staff
- Travel
- Purchase of equipment
- Printing / Xeroxing
- Consultancy charges
- Institutional overheads

CASE STUDY

- Title
- Referees
- Co-applicants
- Budget
- Other Operating Grants
- Non-scientific Summary
- Summary

Title of Research Project

Good

- Concise tittle for general sense of what you are investigating.

Ex: Understanding the role anti-cell death protein BNIP3 plays in brain cancers.

Reject

- Too long and technical → NO gain in the reviewer's attention or interest.
- Too short and broad → TOO critical of grant.

Ex: Determining the mechanism of action of Bcl-2 family members in regulating apoptotic signaling complexes within the mitochondria leading to a cure in cancers.

Referees

Good

- Choose referees in your field of research.
- Choose a scientist/colleague that will be objective but not too critical of the science.

Reject

- **NO** close collaborators.
- **NO** competitors in your field with divergent views.
- **NO** top scientists in your field since they will not respond and will be too critical in general.

Co-applicants

Good

- This could be strength if you are a junior investigator with a limited track record.
- If the investigator lack specific skills, a co-applicant can bring these skills to the research project.

Reject

- It is a weakness to add a co-applicant if they just give you a reagent.
- Co-applicant will do most of the project in their laboratories.

Budget

Good

- Give a detailed account of where you will be spending the money.
- Approximately one third of the budget should go to supplies.

Reject

- Request too much.
- Do not justify spending all the budget on personnel.

All other Operating Grants

Good

- Declare all operating grants.
- Declare 0% or 100% overlap.
- In this granting environment, it is reasonable to apply from multiple sources to get funding.

Reject

- Do not state 25-50% overlap with CCMB operating grant.
- The review committee going to treat this grant as 100% overlap.

Non-Scientific Summary

Good

- Press releasing.
- Acronyms avoidance
- Clear statement of why this project is important.
- Declaration of the research impact on cancer or other diseases.
- Give it to a non-research friend to read.

Reject

- Technical language
- **NO** acronyms even if you define them.

Summary

Good

- Short but informative background for project justification
- Clear statement of the hypothesis.
- Statement of the objectives and/or aims
- Statement of the research impact, significance and innovation
- Identification of acronyms as much as possible.

Reject

- Technical and condensed phrasing of the project.
- **NO** blurry statement about purpose of the project.

Details of Research Proposal

Order of Proposal:

- Goals or objectives
- Background
- Rationale and hypothesis
- Specific Aims
  - Rationale
  - Hypothesis (optional)
  - Approach
  - Expected Results
  - Pitfalls or Alternative approaches
- Significance and/or Impact of this proposal

Goals or Objectives

Good

- One paragraph telling the reviewer everything they need to know about this research proposal to enhance opportunity to gain the reviewers interest and excitement.
- Detailed background on importance of this research, hypothesis, and objectives.
- Clear demonstration about the innovation, significance and impact of this project.

Reject

- **NO** goal or objective statement at the start of the proposal.
- **TOO** technical and condensed → difficulties in reading comprehension.
- **TOO** short → lacking of necessary information for reviewer
- **TOO** long → reviewer confused about the importance of the project

Background

Good

- Necessary information to understand the objectives and approaches
- Background structure must go from general to specific
- Answering the unsolved issues remained form pervious studies.
- Section within the background to discuss preliminary data. Connection from preliminary data to background. In case of limited preliminary data → spending time on the innovation such as using unique resources at CCMB for this proposal.

Reject

- **NO** expand background to unnecessary information.
- Background should not be over 1/3 of proposal.
- **NO** preliminary data will negatively impacts the proposal in two ways.
  - **NO** indication that the proposal will feasible.
  - **No** indication the applicant can do the proposed work.

Rationale and Hypothesis

Good

- Clear statement of the hypothesis or number of hypotheses that will be addressed in the proposal.
- Rationale of why this hypothesis is important to investigate.

Reject

- **NO** combining the two together which may confuse reviewer.
- **TOO** long hypothesis → Hard to understand the aim of the research.

Specific Aims

Good

- Limit specific aims to 2-3 and make aim 1 less risky compared to other aims
- Assurance of controls are added to approaches taken.
- Statement of expected results and alternative approaches since pitfalls happen.
- Addressing feasibility of proposed work completion and innovation
- Justifying the use of specific reagents or animal models and confirming results with multiple approaches.

Reject

- NO many specific aims → negative impact on reviewers.
- NO many specificities on experiments.
- Structure aims → Aim 2 is not dependent on aim 1.
- NO avoid issues within the field of research

Significance and Impact

Good

- Last chance to impress the reviewer on the importance of what you are proposing.
- Give a sense of future directions for this research.
- Why is this proposal innovative?
- Impact on the field and/or on the disease being studied should be stated.

Reject

- **NO** significance statement.
- Superficial such as this will cure cancer.

APPLICANT'S CV DETAILS

Good

- List all awards especially awards directly related to your research.
- List all publications in the last five years.
  - Abstracts are an easy why to show productivity.
  - Give impact factors for publications and citations if any.
  - Give ranking of journal in your field of research if possible.

Reject

- **NO** evidence of research activity or track record.
- **ALL** middle authors for publications.

N.I.H. Epidemiology & Diseases Control 1 (EDC-1) Study Section

Feasibility Issues Raised as Major Concerns in 48 Discussed Grants

Inadequate Statistical Power	22/48	(46%)
Study Sample Not Representative	6/48	(13%)
Likely inability to recruit or retain enough subjects	7/48	(15%)
Poor Productivity of Investigators	7/48	(15%)

Scientific Issues Raised as Major Concerns in 33 Discussed Grants: EDC-1 Study Section

Poor Questions	7/33 (21%)
A Poor Approach to the Question	13/33 (39%)
Human Studies Concerns	1/33 (3%)

FELSON'S RULES FOR GETTING A GRANT

1. Choosing Your Question (1-6)
2. People & Your Grant (7-10)
3. Sitting Down to Write (11-17)
4. Where to Submit Your Grant (18-19)
5. So, the Review Didn't Go So Well… (20-21)

CHOOSING YOUR QUESTION

Rule #1. Start With a Good Idea

- Innovative
- Feasible
- Conceptually significant (will benefit the scientific community or public)

Rule #2. An interdisciplinary project is usually more creative than a project emanating from a single discipline

NIH Roadmap (http://nihroadmap.nih.gov/initiative)

Interdisciplinary research integrates the analytical strengths of two or more often disparate scientific disciplines to solve a given biological problem. For instance, behavioral scientists, molecular biologists, and mathematicians might combine their research tools, approaches, and technologies to more powerfully solve the puzzles of complex health problems such as pain and obesity. By engaging seemingly unrelated disciplines, traditional gaps in terminology, approach, and methodology might be gradually eliminated. With roadblocks to potential collaboration removed, a true meeting of minds can take place: one that broadens the scope of investigation into biomedical problems, yields fresh and possibly unexpected insights….

By establishing new awards aimed at building interdisciplinary research teams, NIH hopes to help accelerate research on diseases of interest to all of its components with an eye toward improving the nation's public health.

Rule #3. Be ambitious, but focused - Select one or two single important questions, not many

Rule #4. Don't follow the herd

Rule #5. Don't assume that using a new technology will get you funded

- E.g. genetics, sleep apnea
- Need unique technology
- Need unassailable expertise
- Need the right question and approach

Rule #6. If possible, choose a long-term theme

PEOPLE AND YOUR GRANT

Rule #7. Don't try to do it alone

- Use mentors, colleagues, collaborators.
- Look at old successful grants.

Rule #8. Talk with your statistician early & often

- How many subjects will you need? Will revising your approach to the question make numbers less daunting?
- Do you need to revise your plans because of numbers problems?
- What's the best analysis plan?

Rule #9. Choose the Right Collaborators: Who are they?

- Experts that bring to the project something you do not have
- Collaborators who are researchers and have written papers in the field
- Collaborators who get the work done and are easy to work with
- Ask Mentor or other senior investigators about potential collaborator

Rule #10. Ask for Help with the Other Sections of the Grant

- 40% of work of grant application is unrelated to body of grant: bio-sketches; other support; human studies; budget; resources and environment; abstract.
- Use mentor and experienced support staff in department (or grant office) to help with these parts. Ask for this help EARLY!
- These parts are important!

SITTING DOWN TO WRITE

The Sections of an NIH Grant

Specific Aims

- 1st paragraph: why is this important?
- Then: rationale for your hypotheses
- Link specific aims to hypotheses
- Self contained

Background/Significance

- Not a comprehensive review of literature
- Tell what is known relevant to hypotheses
- Then tell what is NOT known and how you will determine the answer

An example of aims from successful grant on causes of gout attacks

- **Aim 1:** To examine the relation of dairy food intake and alcohol consumption to the risk of recurrent gout attacks
  - *Hypothesis 1a: Dairy product intake decreases the risk of recurrent gout attacks.*
  - *Hypothesis 1b: Alcohol consumption, irrespective of type of alcoholic beverage, increases the risk of recurrent gout attacks.*
- **Aim 2:** To assess the association between systemic inflammation induced by acute infection and immunization with the risk of recurrent gout attacks
  - *Hypothesis: Acute infection and active immunization trigger recurrent gout attacks.*
- **Aim 3:** To evaluate the effect of climatic factors on the risk of recurrent gout attacks
  - *Hypothesis: Low temperature, high humidity and high barometric pressure increase the risk of recurrent gout attacks.*

Sections of an NIH Grant

Preliminary Studies

- Document your or your collaborators' experience using methods proposed
- Buttress argument with supportive preliminary data

Experimental Design/Methods

- Start with a general design paragraph
- 'The devil is in the details'
- Should be the longest part of the grant

Rule #11. The likelihood of funding is correlated directly with preparation time

Rule #12. Know your reviewers/audience*

*for NIH, try www.csr.nih.gov for study section descriptions and rosters or ask NIH institute personnel

Epidemiology and Disease Control (EDC-2) (EDC-2 Roster)

GENERAL STATEMENT

This study section reviews applications involving case-control studies, longitudinal (cohort) studies and natural history studies.

community studies, clinical trials and surveillance studies; and epidemiologic studies including some supporting laboratory studies.

Specific disease areas include: cancer, infectious diseases, environmental and occupational risk factors, pulmonary diseases, sleep disorders, and neurological disorders including the epidemiology of Alzheimer's Disease, dementias, stroke and epilepsy.

EPIDEMIOLOGY AND DISEASE CONTROL SUBCOMMITTEE 2

SOCIAL SCIENCES, NURSING, EPIDEMIOLOGY AND METHODS INTEGRATED REVIEW GROUP
CENTER FOR SCIENTIFIC REVIEW

(Terms end 6/30 of the designated year)

ROSTER

CHAIRPERSON

STAMPFER, MEIR J. , DRPH, MPH (01)
PROFESSOR OF EPIDEMIOLOGY AND NUTRITION
DEPARTMENT OF MEDICINE
CHANNING LABORATORY
BRIGHAM AND WOMEN'S HOSPITAL
BOSTON, MA 02115

ANDRYKOWSKI, MICHAEL A. , PHD (03)
PROFESSOR
DEPARTMENT OF BEHAVIOR SCIENCE
UNIVERSITY OF KENTUCKY COLLEGE OF MEDICINE
LEXINGTON, KY 40536

Rule #13
Be nice to your reviewers

- Large Font if possible
- Clarity (a messy grant means messy science)
- Tables/Figures—whenever possible
- Consistency in labels!

Rule #14. Continue the Same Themes Throughout Your Grant

- Restate the specific aims and hypotheses verbatim in experimental design and methods section.
- Outline how you will address specific aims and hypotheses in the analysis section.
- Use exactly the same words and labels to express your concepts throughout the grant.

Rule #15. Tell them how wonderful you are without telling them how wonderful you are

- You must convince reviewers that you are capable of doing the proposed work—they probably don't know you.
- Cite your relevant accomplishments factually.
- List relevant awards, publications.
- Recount prior work that is similar to work proposed.
- Avoid superlatives, self-aggrandizing phrases—let your letters of support provide them!

Rule #16. Write Clearly

- Use acronyms & abbreviations sparingly.
- Avoid passive voice.
- Don't make paragraphs too long.
- Avoid obvious, trite phrases.

Rule #17. A Short Grant is Usually Missing Something

WHERE TO SUBMIT YOUR GRANT

Rule #18. Know the Odds and Maximize Them

- Find out success rates for grants like yours.
- Submit to agencies which offer the highest likelihood of success.
- Search out private charitable organizations interested in funding your kind of research.

Rule #19. If One Granting Agency Doesn't Fund your Idea, Another One Might

Rule #20. If At First you Don't Succeed

- Read pink sheets seriously only after you have slept on them a few nights
- Try again, perhaps

Rule #21. The Reviewer is Always Right (even if they're not!)

- Reviewers try hard to be supportive.
- If they did not get it, you did not explain it well enough.
- Read the pink sheets dispassionately and see if the criticisms were fatal. Ask your mentor.
- If two reviewers express the same concern, take it VERY seriously.

REFERENCE

1) Guidelines from NIH for grant writing

https://grants.nih.gov/grants/how-to-apply-application-guide/format-and-write/write-your-application.htm

THANK YOU FOR YOUR ATTENTION