Basics of Scientific Writing

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Why Do We Publish?

- It is the ethical thing to do.
- Share your discoveries and ideas.
- Get recognition for your work.
  - ISI Web of Science Citation Reference Search
- It is essential for promotion in academics.

_If you cannot - in the long run - tell everyone what you have been doing, your doing has been worthless._
Erwin Schrödinger (Nobel Prize winner in physics)
Dispelling the Myths of Writing

• You don’t have to love writing to be productive.
• There are no innately “good” or “bad” writers. All writing can be good.
  – Bad writing can be improved by good editing.
  – Good writing skills can be acquired.
  – Productivity can be increased under any conditions.

• How do you build better writing skills?
  – Observe, practice, corrective feedback, reinforcement, repeat.
  – Seek assistance - you can’t become a better writer on your own.
If you can't explain something simply, you don't understand it well…Most of the fundamental ideas of science are essentially simple, and may, as a rule, be expressed in a language comprehensible to everyone.

Albert Einstein
The crux of good science writing

• Clear, concise, correct communication
  – Get to the point. Be succinct. Cut the filler.

  “Racial and ethnic minority populations in the US, including Blacks/African Americans, Latinos/Hispanics, Pacific Islanders, and American Indians suffer disproportionately from obesity and associated health consequences as compared to non-Hispanic Whites.”

  “In the US, racial and ethnic minorities suffer disproportionately from obesity and associated health consequences compared to non-Hispanic Whites.”
Get past the writer’s block

• Write with healthy detachment.
  – Let go of your words and emotions about the work in progress.

• Build discipline and determination
  – Are you a page-a-day or paper-a-day writer?
    • Know yourself and structure your time & environment accordingly.
  – Embrace delayed gratification
    • Build a reward system for yourself.
  – Set deadlines – calendar when sections are due, when a draft will be circulated.
  – Create milestones.
  – Hold yourself accountable. No one will do this for you until it is too late.
One method to approach writing

Home Improvement Analogy

1. Prep the site.
   1. Assemble data, authors, target journal & format requirements
2. Draft the Plans
   2. Create a working outline
3. Rough-in the fundamentals
   3. Flesh out separate sections – doesn’t have to be in order.
4. Bring in the subcontractors
   4. Circulate to co-authors for input
5. Do the patching and repairs
   5. Remedy corrections & suggestions
6. Clean up the construction site
   6. Re-circulate to co-authors for final polishing
7. Put on decorative finishes
   7. Review formatting, cover letter, submit
Writing as a social endeavor

- Participate in a productive writing group
- Cultivate writing partners, informal editors & peer reviewers
- Leverage co-authors – make them earn their keep
- Get professional help
  - Formal Writing Workshops
  - Hire a Professional Consultant
  - Be wary of the ghost writer
Resources


Improve Your Grant Writing Skills

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About the Presenter

• Co-writing grant applications for 12+ years
  – First grant as postdoctoral fellow
  – 80-100% on extramural NIH grants
• Trainee in NIH development workshops
• Grant reviewer for NIH, AHA, & foundations
• Consultant for Investigators at other institutions
  – pre-review & edit applications prior to submission
Agenda

• Understanding the review process
  – Aiming for a good score?
    • Know the criteria & make allies in the process

• Common criticisms of new grants
  – Minefields to side-step

• Key “grantsmanship” strategies
  – Put the art into the science of writing

• Where to get started with grant writing
What we won’t be covering...

- Developing your program of research
- What to put in each section – depends on the topic
- Document formatting requirements
- Grants.gov uploading process
- Supporting documents
  - Key Personnel, biosketches
  - Budget pages, checklists
- Supplementary materials
  - Letters of support, appendices
Embrace the Learning Process

• You will get time & room to make mistakes.
• People want to help you – allow it.
• Success and failure are measured on a spectrum.
• Hold on to good ideas (but get confirmation).
• Grant writing is a game – and you can learn how to play it.
Understanding the Review Process

• Know what happens when a grant is read.
  – You are not presenting an idea, you are *selling* it.

• Put the right emphasis in the right areas.
  – Specific criteria are used to evaluate your application.

• Direct your application to the right home.
  – Find the right audience to properly evaluate it.
  – Get acquainted with Program Officers and SROs – these are your allies and advocates.
Grant Submission & Review Process

1. PI submits application to Institution

2. Institutional representative uploads to Grants.Gov

3. eRA Commons confirms receipt, checks for errors, transfers to Center for Scientific Review

4. CSR assigns to NIH Institute/Center and Integrated Review Group

5. IRG specifies Study Section and Scientific Review Officer (SRO)

6. SRO assigns to scheduled Study Section Review Meeting & reviewers
Review Meeting

- Reviewed by minimum of 3 members
  - Read by chair and SRO, *maybe* other members
- Score on Overall Impact and separate criteria
  - Scored on scale from 1-9, identify strengths & weaknesses
- Based on pre-meeting review:
  - “Not discussed” applications – lower 50-60%
    - Summary statement with reviewer comments
- If discussed – 15 minutes to decide your fate
- Scored applications go to Council
  - Council ultimately determine funding
K-series review criteria

• Candidate - do you show promise? Are you a good investment?
• Career Development & Mentoring Plan
  – How will the award advance your career?
• Research Plan
  – Is it a feasible project to enhance your program of research?
• Mentors – do you have the right people behind you? Are they known to be great mentors, not just great researchers?
• Environment – is the institution supportive of your long-term career? What will it do to support you, now and later?
R-series review criteria

- Overall Impact – will this research move science?
- Significance - does it address an important issue? Will it change mechanisms?
- Investigator – are they well suited to the project? Do they have the right background? Are they accomplished?
- Innovation – does this challenge thinking, methods or interventions?
- Approach – will the methods accomplish the aims?
- Environment – will it contribute to the success?
  - Right resources, enough resources?
Help yourself get a better review

• Have your application pre-reviewed
  – Learn your weaknesses from people who understand the criteria

• Research & request IRGs and Study Sections
  – Who are the members? What are their specialties?
  – Find the most appropriate fit – and steer away from a bad fit.

• Suggest NIH Institutes and Centers
  – Where does your topic meet funding priorities?
  – K-awards often reviewed within I&C
  – Identify Program Officers – make friends & influence people
Help yourself get a better review

• Know what matters the most
  – K-awards
    • Candidate, Career Development Plan
    • Mentors, Environment
    • Research Plan
K - Candidate

• Does the candidate show potential to develop as an independent and productive researcher?
• Does the candidate show productivity and demonstrate potential for making outstanding contributions to the field?
Career Development Plan

• What is the likelihood that the plan will contribute substantially to the scientific development of the candidate leading to scientific independence?

• Is the plan appropriate given the background of the candidate, and the stated career objectives?
Mentors

- Are the mentor’s qualifications appropriate and adequate?
- Is there evidence of experience in the fostering development of independent investigators?
- Did the mentor give an adequate assessment of the candidate’s potential, and address areas needing improvement?
- Are there adequate plans to monitor the candidate’s progress?
K - Environment

- Does the institution show clear commitment to and protection of the candidate’s time?
- Are the resources sufficient and of high quality?
- Is there assurance that the institution intends to make the candidate an integral part of the research program?
K - Research Plan

• Are the proposed questions, design, and methodology of significant scientific and technical merit?
• Is the research plan relevant to the candidate’s career objectives?
• Is the plan for developing/enhancing the candidate’s skills appropriate and adequate?
Help yourself get a better review

• Know what matters the most
  – R-awards
    • Innovation, Significance
    • Investigator, Approach
    • Environment
Innovation

• Does the project challenge existing paradigms or clinical practice, or address an innovative hypothesis or critical barrier to progress in the field?

• Does the project develop or employ novel concepts, approaches, methodologies, tools, or technologies for this area?
Significance

• Does this study address an important problem?

• If the aims are achieved, how will scientific knowledge or clinical practice be advanced?

• What will be the effect of the study on the concepts, methods, technologies, treatments, services, or preventative interventions that drive this field?
R - Investigators

• Is the work appropriate to the experience level of the principal investigator and other researchers?
  – Consider the mechanism. Are you R01 ready?
• Does the investigative team bring complementary and integrated expertise to the project?
Approach

- Are the conceptual or clinical framework, design, methods, and analyses adequately developed, well integrated, well reasoned, and appropriate to the aims of the project?
- Does the applicant acknowledge potential problem areas and consider alternative tactics?
R - Environment

• Does the scientific environment in which the work will be done contribute to the probability of success?
• Do the proposed studies benefit from unique features of the scientific environment, or subject populations, or employ useful collaborative arrangements?
Beware the Common Reasons for Lower Scores

• Significance
• Approach
• Innovation
• Investigators
• Resources/Environment
Significance

• The problem is more complex than the investigator appears to realize (they don’t know what they don’t know).
• The problem has limited reach or applicability.
• The research is scientifically premature (better suited for pilot study?).
• The research as proposed is overly involved, with too many elements under investigation (too much going on, won’t know what was cause or effect).
• The aims are unclear and not sufficiently detailed (can’t be measured as stated).
Innovation

• The research lacks originality (ho-hum aims, methods, tools, expected outcomes).
• The anticipated findings are unlikely to change current thinking or practice (knowledge for sake of knowledge).
Investigators

• The investigator appears to be unfamiliar with pertinent literature or methods (didn’t do homework; working in a silo).
• Other responsibilities would prevent sufficient time and attention to research (poor estimate of commitment).
• The investigator needs more or better mentoring (mismatch with selected advisors).
• Insufficient expertise (gaps in the team).
Approach

• The proposed methods or procedures are unsuited to the stated objective (mismatch of method to aim).
• The description of the approach is too vague to adequately evaluate. (methods are not adequately described)
• The overall design of the study has not been carefully thought out. (missing the big picture)
• The statistical plan won’t adequately test the question. (don’t know what they are doing with data)
• The number of observations is insufficient (poor math).
Resources/Environment

- The needed equipment or personnel are unrealistic (the project cannot be practicably done).
- The setting is unfavorable (not the right place for this project; doesn’t have infrastructure).
How can you avoid the common pitfalls?

• Start writing early...
• Don’t write like a hermit...
• Set realistic expectations in the first round...
• Let go of being “right” about your decisions...
• Heed the reviewer criticisms carefully...
• Seek clarification with the SRO and PO...
• Do not give up on an application...
• Improve your grantsmanship
Grantsmanship

• Put the art into the science
• Enhance the quality of your proposal by adhering to unwritten rules of grant writing
• Good grantsmanship can’t salvage bad science, but poor grantsmanship can torpedo a good project.
  – Don’t let bad writing get in the way of good ideas
Key Grantsmanship Strategies

1. Stay on message
2. Keep review criteria in mind
3. Don’t make assumptions
4. Do the homework
5. Show your math
6. Don’t make more work for the reviewers
1. Stay on message

- Hone in on a novel, challenging but feasible topic.
- Articulate clear, *specific* aims & objectives.
- Back up your aims with compelling justification.
- Present an efficient, well-conceived plan to achieve the goal.
- Provide evidence that you have the right people to accomplish the aim.
- Show how your institute is suited to help.
2. Keep review criteria in mind

- Can you spot the areas where you have specifically addressed the essential criteria?
  - Did you draw attention to those areas?

- Do you make a convincing argument?
  - How do you know if you’ve done this?
    - Have others critique your proposal to spot the evidence.
    - Comb through your summary statement to see reviewers’ assessment of the criteria.
Keep Review Criteria in Mind

Good Grantsmanship (R21 exploratory grant):
The results of the proposed work are expected to advance our understanding of how older adults effectively use this innovative technology to obtain health information that can positively impact their health, and provide much needed effect size estimates for subsequent research in this area.

Hasn’t been done before (original, innovative)
Anticipates important findings to inform R01 proposal (goal of R21)
3. Don’t make assumptions

• Do not expect or assume:
  – Reviewers will carefully sleuth for the important pieces
  – Reviewers will easily appreciate or identify the value of your proposed work
  – Reviewers will know as much or less than you
  – Reviewers will be able to differentiate what you write versus what you mean...
Don’t make assumptions

Rationale: Although group-based interventions can raise costs, we argue for the importance of group social support for Latina women. The group model offers an efficacious approach for increasing social support and promoting self-efficacy for behavior change in health care settings. Group visits have shown significant improvements in diabetes and chronic illness outcomes. This study will quantify whether more intensive group-based strategies improve adherence and health outcomes sufficiently to justify the additional expense.
4. Do the homework

• Current & thorough literature synthesis
• Explore methods that are widely accepted and have validity/reliability
• Know how many subjects you will need
• Know what you can do with the data depending on how you collect it
• Confirm available resources
• Anticipate concerns and address with confidence
Do the homework

• The sample size calculations indicate that a total of 210 participants is required for analysis of our primary outcome. We will attempt to recruit 20 participants in each of 15 sites (total N=300). This will allow for a liberal 30% drop out rate. We have already gauged the interest of potentially eligible sites. Sites with over 100 residents will be eligible as 20 residents per site is a minimum number of participants to warrant intervention delivery, and a 20% recruitment rate is a highly conservative estimate for enrollment. There are 32 sites registered in the county that met the criteria. Eighteen were willing to provide letters of support to participate (included in this application).
5. Show your Math

• Present your rationale & defense for major decisions

• Present obvious, alternative options and why you didn’t choose them

• Explain how you arrived at sample sizes, number of sites, types of questions asked, measurements chosen, and planned analyses.
Instrument Development: Sample size and Power Calculation

Previous studies of reliability and validity of food preference measures in children in this age group have used sample sizes ranging from 16-47.\(^{(2,3,29)}\) Measurements of validity based on percent concordance have ranged from 54.1% to 79.8%\(^{(2,3)}\) while Birch found a correlation of 0.80 between stated preference and experimentally observed food choice.\(^{(25)}\) Measures of test-retest reliability have ranged from 0.16 to 0.76.\(^{(2,3,27,30)}\)

We will recruit 2 Head Start classrooms, with an average of 20 children per class and have allowed for 10% attrition for children who are ineligible or unable to complete the measures for a total sample of approximately 36 children. We believe that we will be able to assess the reliability and validity of this measure with this sample based on the results from previous research.
6. Don’t make more work for reviewers

• Help them do their job *efficiently*
  – Reviewers want to get through your application, assess the criteria, and sum up strengths & weaknesses as quickly as possible

• Follow the expected format
  – Reviewers will not hunt for information
  – Shows you can follow instructions & play by the rules

• Label sections clearly

• Use figures, graphs and *timelines*
Write lean & mean

• Make it easy to read – concise, simple language
  – Reviewers aren’t impressed by huge vocabulary, highly complex thought processes or elaborate technical plans

• Clearly delineate where/how you meet criteria
  – “The novelty of this study is derived from adding a maintenance component to the “usual care” approach to weight loss. The significance of this approach is tied to the prevalence of weight re-gain after “usual care” cessation.”

• Draw attention to important pieces
  – Use formatting to highlight innovative, significant content
Where to start as a new grant writer

• Seek out technical assistance workshops

• Become a reviewer (conferences, journals, study sections)

• These activities:
  – Expose you to others’ successful writing styles
  – Build your professional network
  – Builds your perspective
    • what are current trends, where are funding priorities
Where to start as a new grant writer

• Become co-investigator on others’ grants

• Start small
  – Smaller funds = smaller applications, faster turnaround
  – Internal Funding/Departmental Grants
  – K-series (career development)
  – R03, R15, R21 mechanisms
  – Private organizations and foundations

• You get bigger grants after successful smaller jobs
Remember - Embrace the Learning Process

• You will get time & room to make mistakes.
• People want to help you – allow it.
• Success and failure are measured on a spectrum.
• Hold on to good ideas (but get confirmation).
• Grant writing is a game – and you can learn how to play it.
Where to get more help

- NIA technical assistance workshop

- NHLBI Summer Institute
  - [http://www.nhlbi.nih.gov/funding/training/sipid.htm](http://www.nhlbi.nih.gov/funding/training/sipid.htm)

- Office of Behavioral & Social Science
  - Summer Institutes on RCT, transdisciplinary research
    - [http://obssr.od.nih.gov/training_and_education/training.aspx](http://obssr.od.nih.gov/training_and_education/training.aspx)