Guidebook For New Principal Investigators

Advice on Applying for a Grant, Writing Papers,
Setting up a Research Team and
Managing Your Time

La version française est en cours de préparation.

Roderick McInnes
Brenda Andrews
Richard Rachubinski

Institute of Genetics, CIHR

Acknowledgements

The authors wish to thank Rémi Quirion (McGill University), and Françoise Baylis (Dalhousie University), Daryl Pullman (Memorial University of Newfoundland) and Margaret Lock (McGill University) for helpful commentary on this Guidebook, particularly in making it relevant to investigators in the social sciences and humanities.

Contents

About This Guidebook

This guidebook is intended for all researchers (new and experienced) who work in areas of interest to the Institute of Genetics. This includes, biochemists, geneticists, developmental biologists, cell biologists, clinician scientists, social scientists and humanists.

This guidebook provides tips about:

- applying for a grant as a Principal Investigator (PI)
- writing papers
- building and managing your research team (and laboratory)
- managing your time

Obviously, these tips are only suggestions, not universal rules. However, these tips are from successful senior scientists who are extremely – and perhaps even overly! – familiar with applying for grants, managing research teams, and running research laboratories:

- **Dr. Roderick McInnes**, Program of Developmental Biology, Research Institute, Hospital for Sick Children; Departments of Pediatrics and Molecular and Medical Genetics, University of Toronto; Scientific Director, Institute of Genetics, CIHR

- **Dr. Brenda Andrews**, Department of Medical Genetics and Microbiology, University of Toronto

- **Dr. Richard Rachubinski**, Department of Cell Biology, University of Alberta

The advice in this Guidebook was initially compiled for the first annual Institute of Genetics, CIHR New Principal Investigators Meeting in November 2002. The New PI Meeting is now an annual event. Approximately 100 new PIs, from all four CIHR Pillars and from across the country, gather to meet with their peers and with leading researchers from a variety of disciplines. The meeting aims to foster peer networks, mentorship and collaboration among Canada's researchers in the area of genetics.

The Top Eight Things to Do to Write Great Grants

Don't even think about doing anything else but these things!

Good grant writing is formulaic, and a learned skill. Some people are naturally better at it, but you can learn to be just as good. So, follow the formula! It's not magic or inspiration at midnight. Obviously, one can successfully deviate from the formula below, but this is a formula that works – so it's a great beginning.

1. Organize an Internal Peer Review Panel

Applying for a Grant	
√	Organize an Internal Review Panel
√	Start writing early.
√	Write well.
√	Write for your audience.
√	Write efficiently.
√	Follow the tips for each section.
√	Apply for an appropriate budget and term.

This is the number one thing to do, by far. Even if your institution doesn't require an internal peer review, our strong advice is to organize an Internal Review Panel with three colleagues, ideally10-14 days before the grant deadline. The panel meets with the PI to review the grant as a team (a key feature, see below). The Research Institute of the Hospital for Sick Children has required this practice for more than 25 years and the grant isn't signed off by the Director of the Institute until the internal review has been done. The internal review is invaluable for:

i) Tremendously improving the <u>presentation and the scientific content</u> of the grant. That this process *invariably* improves grants is true for even the most hardened veterans of the grants wars.

ii) Increasing <u>collegiality</u> within the institution. Your colleagues get a better idea of what your research is all about. Intra-institutional collaborations frequently emanate from these reviews.

iii) Giving PIs invaluable <u>experience in reviewing</u> grants. In turn, this helps improve their own grant writing.

iv) Making you finish your grant application long <u>before the deadline</u>. In fact, this is one of the major advantages.

v) Creating institutional <u>team spirit</u>. The value of this can't be overestimated. You quickly realize that we *all* find writing a compelling, clear grant to be tough, and that eases the pain.

Panel structure: The Internal Review Panel should be composed of two researchers who work in the same field as the applicant but in addition, at least one reviewer should be from outside the field – thus simulating the reality of a typical peer review panel. Since it is much easier to criticize someone else's grant than to write one yourself, your colleagues will always have something to say. You will never get it perfect for this internal review (or at least none of the authors of this Guidebook have, in over 80 person-years of grant writing!).

The process: Reviews generally take at least 90 minutes. One of the three reviewers acts as the Chair. The Chair first invites general comments from all three reviewers. This part of the review is often the most important, and focuses on the summary pages, the overall writing and research approach, and the big problems. Subsequently, the three reviewers go through the grant page by page with the applicant to discuss more specific issues. At the end, the reviewers give the applicant their marked-up copies, for small details that needn't be discussed at the review itself.

Avoid this mistake: Do not ever think that an adequate substitute for an Internal Peer Review Panel, meeting together with you, is to have two or three colleagues independently read your grant application, and then give you feedback on an individual basis. *First*, they rarely do it as conscientiously as when they are part of an internal review process. *Second*, and more importantly, a very constructive synergy develops among the reviewers that invariably improves the quality and richness of the feedback.

Note: When you try to implement this practice at your own institution, your colleagues will invariably and predictably have 206 reasons why they don't want to set up this system. None of those reasons are valid. Yes, it takes time, but everyone benefits altruistically. *Just do it!!!*

If you would like a copy of the HSC Research Institute Internal Grant Review form, please email Jennifer Jennings at jennig@sickkids.ca.

Another good example of a review protocol is to be found in the Internal Peer Review Form from the University of Alberta Faculty of Medicine and Dentistry at http://www.med.ualberta.ca/research/reviewform.pdf.

2. Start Early

Start the preparation for your grant application at least three months before the deadline, by writing the overall research goal and specific research aims. Why so early? Doing so focuses your reading and thinking, and allows you to plan, seek advice and collaborations, and identify topics you need to read up on. You can't do many of these things well in the last weeks before the deadline – at that late point, you will be concentrating on the writing. It is very likely that your initial specific aims will change as you continue to write, and an early articulation of them forces you to focus and to think clearly.

It takes <u>at least</u> six weeks to write a great grant, even for a very experienced researcher.

Grant Application Timeline

12 weeks before deadline	• Write the overall goal and each Specific Aim (objective). • Start gathering accompanying documents. Aim to have these in hand four weeks before deadline.
6 weeks before deadline	Start writing, a little every day.
3 weeks before deadline	Give draft to Internal Review Committee.
2 weeks before deadline	Meet with Internal Review Committee.

3. Write Daily

In preparing a grant application, it is a good idea to commit to writing part of the grant every day. Begin the actual writing *at least* 6 weeks before the Internal Review Committee deadline.

> Researchers, who write daily, even 30 minutes/day, are much more productive and successful than those who leave it all to a last-minute cataclysmic effort.

4. Finish the "Junk" in Month One (but not only the junk)

All the accompanying documents—CV module, letters of collaboration, collaborative details, references, cost quotes—take a lot of time, and generally much more time than you think (often as much as a week). Get it done early. Put the references into Endnote® or Reference Manager® right from the start.

5. Write Well

Write an application that your reader will **enjoy** reading. Aim for nothing less. Remember, your reader is wading through up to 14 other grant applications, so make yours clear, thoughtful and interesting.

a) Getting the style, unconsciously

Get copies of a couple of very highly rated (i.e., successful) grants from PIs in your institution, or somewhere else, preferably PIs at the same career level as yourself. Before you write a particular section of your grant, read those others to pick up on the 'rhythm' of what good writing really is. To get the rhythm of excellence and clarity, always read a few paragraphs of a few good *Nature* "News and Views", and one of Tom Jessell's papers in *Cell*, which are models of clarity and beautiful scientific style. (It matters not that you may not be a neuroscientist, like Jessell).

b) Get it down! - Don't be a sentence "caresser"

Word processors encourage the endless reworking of a sentence, to get it 'perfect'. Don't do this. It is a time waster that creates the illusion of effective progress. To generate a well-written grant, follow these steps:

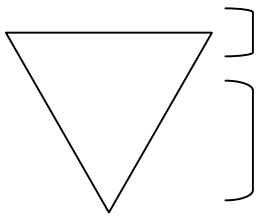
1. Get it *down*, even rough and ugly, too long and incomplete.
2. Get it *right* (factually correct, balanced).
3. Get it *pretty* – now is the time to do some sentence caressing.
4. Get it *out*!

c) Good expository writing has two predominant features

1. Great lead sentences to begin each paragraph. A great lead sentence is interesting and says what the paragraph is about. These are worth spending time on, even in the first ugly draft, since they define the rest of the paragraph. One should be able to get the idea of most of a grant – or a paper - by reading the lead sentences alone! Try it with a Tom Jessell paper—it works!

2. The remainder of the paragraph elaborates on the topic defined by the lead sentence. The content of the remainder is generally less important than the lead. Thus, a good paragraph has an inverted pyramid structure:

A *very* common error is to have a rousing concluding sentence that is generally, when slightly reworked, a superb lead sentence.



d) Who is the audience?

What types of PIs are on the panel? Almost all grants panels, including CIHR panels, are generally very heterogeneous. Therefore, you are usually writing for intelligent researchers who are not expert in your area, except for maybe two to three panelists who will know more. You have to write with simple clarity for the majority, but also convince the two to three experts that you really know your stuff. Being conscious of your audience is a number one issue in grant writing, just as it is in giving a talk.

e) Give the BIG picture and don't drown the reader in details

Three of the most common weaknesses in grant applications are:

1. Failure to give the big picture (who cares?)
2. Drowning the reader in details (the reader doesn't want to know). Some details may be critical, but the application doesn't need equal detail everywhere.
3. Failure to state *Why* an experiment needs to done.

NOTE: NEVER reduce your font below Times 12, or have less than 1" margins.

Write to have the reader ENJOY reading your grant, because it is clear, thoughtful and carefully written. Excessive detail is usually just an inappropriate way by which the applicant is trying to reduce anxiety. Remember, your grant is just one of many that a reviewer will have to read. That is why clear brevity is critical.

f) State a preferred strategy/method/technique

Don't propose 13 approaches to doing something. Clearly identify your NUMBER ONE preferred method or strategy to achieve a Specific Aim, and justify your preference. At the end of that paragraph/section, indicate that, "If this approach proves, unexpectedly, to be unsuccessful, we will use the method of Thorogood Dolots, which has also been demonstrated to be effective (Ref)."

g) For each Specific Aim, state the Expected Outcomes, Potential Problems and Alternative Strategies, and Timelines

What will your experiments tell you, and why is that outcome particularly important to obtain? For example, "These studies will define the role of [your favourite protein] in [your favourite biological activity]. More generally, this work will identify the major interacting partners of [your favorite protein], providing the first link between [whatever you are studying] and [whatever you want to link it with]".

In identifying potential problems and alternative strategies that you will employ if those problems are encountered, be relatively brief. You mainly want to show an awareness of the problems that may arise, and of the alternative approaches that can be used if the problems do indeed occur.

Timelines: Briefly state the estimated time, in months, required for each Specific Aim.

h) Use illustrations

Use Figures to convince the reader of strength of your Preliminary Data. Use a flow chart(s) or figure to give a bird's eye view of your Research Plan. Nothing is more depressing to a grant reviewer than to see page after page of dense text unalleviated by something visual. In-text illustrations do not count toward the total page numbers of CIHR grants.

i) Use the first or third person. Don't be afraid to write, "I will…"

Replace the Verb "To Be"

Instead of…	**Consider…**
"The samples will be analyzed for traces of…"	"I will analyze the samples for traces of…"
"This result is an affirmation of Rachubinski's theory…"	"This result affirms Rachubinski's theory…"

6. Follow This Order of Writing

I. Summary of Research Plan – rough and ugly is just fine, initially! Its structure should follow these lines:

KEY ISSUE: This is the "seduction" page, in which you generate credibility, (or not). If you write this page (and the Summary of Progress) very well, then the reviewer is on your side. If you do this page poorly, the reviewer is already alienated, and your chances of ranking highly have already been eroded. You will have lost before you start!

The objectives of this page are to:

- Generate interest: get the reviewer interested in the research question
- Demonstrate importance: convince her of its importance
- Display good writing: good writing reflects clear and precise thinking. In fact, it often *forces* clear and precise thinking: "Writing maketh an exact [woman] man" - Sir Francis Bacon
- Give concise Specific Aims and an overview of the Research Plan: present a lucid, precise research plan that is well founded both on your experience and on that of the literature. In basic biomedical and clinical science, indicate that you know what the expected results are (and that you have a 'Plan B' if needed – but Plan B shouldn't be given much space, only recognition). In social science and humanities research, you will want to point out how and why your project will complement previous research, rather than simply building on the existing literature.

- Timeframe: outline your timelines at the end of the section of the Research Plan that discusses each Specific Aim. Only a few words are needed.

First paragraph of Summary of the Research Plan – setting the stage (about 1/3 of the Summary page)

- Give a few introductory sentences that set the general (biological/health/social) stage and then the research stage. The level here should be comparable to a "News and Views" in *Nature*. For example, "The development of the brain is one of the most complex biological processes known. Each neuron in the brain contacts about 1,000 other neurons, but the molecular mechanisms by which axon guidance and synapse formation are regulated are poorly understood. A number of inherited disorders have been shown to be associated with incorrect axon guidance."
- "The general objective of our research is to identify critical regulators of…"
- "To attain this objective, we have three Specific Aims: … ." State them now.

Second paragraph – Research Plan (about 2/3 of the Summary of the Research Plan):

A commonly ignored yet essential component of the Research Plan is to state WHY you are undertaking the proposed research (experiments). You can force yourself to do this by using the structure: "To identify molecular regulators of axonal guidance, we will … ." or "To establish what family members think about genetic testing, we will … ." Then, state WHY you are using a specific strategy: "Our approach will be to identify homologues of CUB domain proteins expressed in the developing brain, since proteins of this class have been shown to … .", etc. or "The research is designed to produce replicable empirical data about the social ramifications of genetic testing.

Last paragraph, on the significance of the work.
It is imperative to do this well. Thus, "This work will enhance your understanding of the biology of … and to provide a foundation for understanding the … ."

II. Research Plan – *NOT* more than ~1/2 of the allotted pages

We suggest that you write the Research Plan before the Background section, since your Research Plan will indicate to you the background

information you should include. Otherwise, one often ends up writing background that isn't ultimately relevant to the Research Plan.

Begin with a short paragraph summarizing points that were probably made earlier, but which can always bear brief repetition, for a tired reviewer. Thus, state where both i) current knowledge, and ii) your preliminary/previous work have led you. If you want to put in a Rationale paragraph, this is the place for it. "Rationale" paragraphs are tricky and variable. They can be useful in indicating why you are particularly well equipped to tackle the proposed research, and why your approach is ideal.

- Restate the overall objective and Specific Aims.
- Write the Research Plan around each Specific Aim.
- Be sure to discuss how you would respond to your Research Plan's most likely pitfalls and potential setbacks.
- Give the expected outcomes and significance of your studies.

III. Background. Not more than 1/2 of the application.

Introductory paragraph - the bird's eye view. In this paragraph, give a brief overview of the field and why this area of research is important: What are the big questions? For example, "The major question in inherited neurodegenerative diseases is why a neuron born with a mutant gene takes years to decades to die." OR "With regard to genetic information, a major ethical and legal question concerns the extent to which an individual's right to privacy and confidentiality can be overridden by the rights of family members to be apprised of genetic information that could have direct consequences for their health."

Then, write the rest of the background to provide the necessary excitement and information to make your Research Plan appear appropriate and brilliant. Thus, you should be conscious of *why* you are providing each bit of background information. This is the reason for writing the Research Plan first: you want to lead the reader up to your Research Plan so that she actually senses what you will be proposing before she has read the Plan.

IV. Significance. A short (6-10 lines) paragraph at the end of the grant.

This paragraph is obligatory and expected, but frankly, the significance of your research should be apparent right from the first sentences of your Summary of Research Proposal. This is a good place to bring out some

additional implications of your work, and to sketch a brilliant future for the area of your research.

7. Miscellaneous

Don't apply if your track record of productivity won't support it. For example, if you have one CIHR grant but haven't published any or many papers as an independent PI yet, don't apply for another CIHR grant until you have those papers.

In general, submitting two grants to one panel is a problem, unless you KNOW that they are both terrific, and unless you have a track record that has demonstrated that you can do the research for both. The panelists will be doubly unhappy to be reading two grants from one applicant if one (or both) is/are weak.

In choosing external reviewers, choose people known to be fair and respected, rather than your buddy. In general, don't suggest New PIs as externals – they tend to have 'young faculty' syndrome, which makes them excessively critical.

8. Apply for an Appropriate Budget and Term

Keep your budget reasonable. For example, it's generally reasonable to ask for:

- one technician, or one research assistant
- one or two graduate students, and
- for lab-based research, $15,000 per person-year in supplies and general operating costs for each member of your research team who is at the bench.

If you are requesting funds for a post-doc or summer student, it is much more convincing if you have a specific individual in mind.

Apply for a three-year grant. Reviewers rarely give longer-term grants to new PIs.

Justify your budget. If you can, link specific personnel to Specific Aims. Some committees spend much of their time looking at the budget and its justification.

The Role of Your Previous Supervisor

In your grant application, try to dissociate your research program from that of your previous supervisor. However, this may not be entirely possible, (this is perhaps especially true for basic biomedical scientists who are bringing technologies from their previous supervisor). In that case, cite your previous supervisor in your grant application, where appropriate. A positive letter of reference from a previous supervisor can be very influential with the review committee—particularly if the letter describes how your research program is distinct from that of the supervisor.

If You Don't Get Funded

1. Above all, don't get discouraged. You are not alone. Even great researchers have grant applications rejected. At CIHR, about 50% of applicants ultimately get funded by their third submissions. If you are still not funded after that third submission, then your proposal is likely to have substantial flaws, or simply be relatively uninteresting compared to the other grants submitted. Don't wait: seek the advice of an experienced congenial mentor after the first rejection.

2. High-risk high-benefit research. If your grant is well written and composed, it is possible that you are really are ahead of the wave, and that the panel either doesn't "get it" or, more commonly, that the risk:benefit ratio of the proposed work is unfavourable in their view, particularly when compared to other excellent less risky but high benefit applications. If the latter is the case, try to persuade your department Chair to give you some start-up funding to proceed, and also consider applying to the Institute of Genetics Request for Applications entitled "*New Discoveries: High-Risk Seed Grants*". http://www.cihr-irsc.gc.ca/e/24395.html

3. Focus your thoughts—and your responses—on the Scientific Officer's Summary, because it reflects the panel discussion. The external reviewers do not participate in the panel discussion, which is usually richer, fairer and more balanced than any single reviewer's report. In reading the reports of your grant, the *really* important messages, in general, are the ones in the Scientific Officer's Summary. Specific negative comments in individual reports can appear, misleadingly, to carry more weight than the whole panel gave to that particular point. Don't use the praise in reports from external reviewers to mentally dismiss the concerns of the whole panel, contained in the Scientific Officer's report.

4. Develop a reputation with a peer review panel. In general, stick with the same panel, at least on the first resubmission, even if you worry that they got it wrong the first time you submitted. Be sure it was the panel that got it wrong, and not simply that you didn't like the feedback. Call the panel Chair or Scientific Officer to confirm your impression that the panel is or isn't the right one.

5. Response to Reviewers' pages. Be unfailingly courteous and appropriately brief. NEVER imply that the reviewer was stupid or incompetent, even if he was. Just address the most important criticisms factually and professionally. That approach always impresses a panel and you will be ahead of the game already.

Note: As soon as you can afford the time, and once you are funded, it is useful to be on a grants panel, even an internal one. It will make you feel less paranoid about the process, and make you realize that reviewers are invariably doing their best to be fair and wise. Gaining grant panel experience will also help reinforce good practices, and correct bad ones, in your own grant writing.

Finally: Create a checklist of all the points on grant writing, and go through your pages—as you write and review them—to be sure you have followed the above guidelines. Be sure, however, that the authors of this Guidebook will want to claim some credit when you are funded, but will deny any responsibility if you are not!

The Top Five Things to Do to Write Great Papers

1. Guidelines

Apply the **Write Well** tips outlined above in Section 5 in the Top Eight Things to Do to Write Great Grants.

2. Unconsciously imitate great style

Before writing a paper, read a couple of papers that are really clearly written, in the journal to which you intend to submit your manuscript. As indicated above, our favourite papers invariably include virtually any of those by Tom Jessell (Columbia) in *Cell* or *Neuron*. They are beautiful models of how to write a scientific paper. Don't read the whole paper at once. Rather, when you start writing the Results section, go read a Jessell Results section for a few paragraphs. Don't worry that your data may not be as beautiful – that isn't the point! Once you start the Discussion section, do the same thing, and so on.

3. Write every day

When they have papers to be written, the most productive researchers write daily as an integral part of their research life, even if only for 30 minutes each day. Cultivating this habit will help to make you much more successful. Writing every day is not only a lot more fun and stress reducing (i.e., "Wow—I've actually started!"), it also produces a much better product. In addition, for those who do basic biomedical research, clinical research, quantitative research or qualitative research, if you begin to write months before you plan to submit your manuscript for peer review, you often identify problems or gaps in your data that should be addressed.

4. Order of writing the various parts of a paper

Overarching guideline: You are telling a single story. Everything you write should be built around that story line.

Basic biomedical research, clinical research, empirical research:
write the paper in the following sequence:

I. Figures, Figure Legends and Tables. Always do these first. If well done, the figures and their legends will present the story *almost without the rest of the text!*

II. Results. The results should be a written presentation of the information that is illustrated and documented in the figures and tables, and not a lot more. The **Results** should be able to stand by themselves, as text, even without the reader looking at the figures and tables, if the results are well written.

Make yourself begin each paragraph that deals with a new result, with the words "To determine … " or, "To define… " Or, "To establish whether… .", and so on. **Don't even dream of doing anything else (usually).** However, you may sometimes want to precede that first sentence with an introductory one(s), indicating the issue that was being addressed by the objective stated in your sentence beginning "To determine….". (Small point: use the phrase "In order to… " infrequently. It quickly wears thin.

Other infinitives that are used in Results: To identify, define, test, assess, ascertain, investigate, discover, establish, find.

Common error: putting Discussion in Results. This is rarely to be done, and only if you are not going to include a relatively small point in the Discussion.

III. Discussion. In the first paragraph, it is often useful to very briefly summarize your results, but do so in language that is usefully different from the Abstract of the paper. In the rest of the Discussion, discuss each of the Results, from two points of view. *First*, discuss the data itself – what does it mean, what does it allow you to conclude? *Second*, discuss each result in terms of the bigger picture of the field, of biology, and of medicine.

IV. Introduction. In the first paragraph(s), introduce the big picture underlying your story. In subsequent paragraphs, if you are allowed the space, introduce the specific issues that each of your major results addresses. Sometimes it is difficult to decide whether some background information should go in the Introduction or in the Discussion. In the Discussion, you will often want to provide more context on an issue than you were able to present in the Introduction or in Results.

V. Abstract. To write a great abstract, it is very useful to read a few great ones from a current issue of the journal to which you are submitting the manuscript. That is all the guidance you need. Writing a good abstract takes at least one day. In this PubMed® era, your abstract may be the only thing that most people will read, so devote at least a day to it, look at it again a few days later, and have it vetted by a colleague who is not intimately familiar with the work in that manuscript.

Methods: It doesn't much matter when you do them. Just don't pretend that by getting them done, that you have accomplished much. You haven't!!! Refer to previous papers for details, when possible. Most journals now allow/encourage you to put most of the details of methods into the Supplementary Information section of a paper, on the Web.

5. Some other really important issues

- Never, ever submit a sloppily prepared manuscript. You have lost the battle before you start.
- Submit to the correct journal. If it's a lovely *JBC* paper, don't send it to *Nature*.
- However, aim high.
- If you and your colleagues think the paper is really terrific, and it was turned down for the wrong reasons, you can always call the editor. Be VERY polite and deferential, and never be combative.
- If that journal still won't re-examine it, then go to another fine journal at the same level. Amazingly, that often works.
- Review for a journal every chance you get, and then do a great job. The editors will begin to develop a favourable impression of you.
- It is usually really foolish to send out a paper without having a colleague look at it first.
- Always suggest reviewers.

Building and Managing Your Own Research Team

If you're like most new PIs, you are undoubtedly a bit intimidated by the prospect of having to develop your own research team or set up your own research laboratory.

Building Your Team

If you can, directly contact, preferably by phone, all references for technicians, graduate students, etc. At the very least, contact references directly if the reference letter is generic or contains half-hearted recommendations like "This person would work well in the right environment." (This is code for "Call me!")

Technicians. If you are setting up a lab, technicians are usually your first hire, so advertise for them as soon as possible. It is quite all right to hire someone who has just graduated from university. Recent graduates may stay with you longer (thus providing continuity as your lab grows), and they won't bring any experimental bias to your lab.

When you interview potential technicians, administer a quiz to assess their experience and expertise. Ask them to describe their strengths and weaknesses, and verify this information with their previous employer. In addition, ask them to describe research projects with which they have been associated. If they can't articulate the background, rationale and significance to you, at a basic level at least, be wary! Evaluate technicians carefully during the probationary period (usually three to six months). Work with them closely. If their work is not satisfactory, let them go. It is always stressful to end someone's contract, but it will be both stressful and much more difficult to dismiss them after the probationary period. If their work is satisfactory, ask them to make a commitment to you for two to three years. Finally, make it clear to them at the beginning that, if they decide to move on, they should give you as much advance notice as possible, and preferably 3–6 months, so that their skills can be transferred to their replacement.

Graduate students. Graduate students require a special kind of commitment on your part. You have an obligation to train and mentor your graduate students to help them reach their full potential (remember, one out of four graduate students will become a PI).

Post-doctoral fellows (PDFs). If you hire PDFs remember that they should be capable of functioning at a very high level and that they too can be excellent mentors for your graduate students. At the interview stage, ask

potential PDFs to give a presentation to a larger group, and ask the group for feedback. Obviously, PDFs who are competitive for national funding will be an asset to your research team lab.

It is also important to discuss with all prospective PDFs the nature of their career goals. If they definitely aim to become a PI after leaving your lab, they will expect to be able to take a project from your lab to start their careers. This issue must be discussed *before* you hire them, so that their expectations are not unrealistic, and so that you realize that you must have a project they can "own" once they leave, if they have done good work with you. Not all good PDFs necessarily want to become a PI, in which case a graduation project is not an issue.

Mentoring Your Team

Some members of your research team will expect you to mentor them, and that is one of your major roles. If you take this role seriously, you will find that mentoring keen and capable graduate students and PDFs is one of the most rewarding parts of your job. Some mentoring advice:

- Adapt to the needs and desires of each student. Every student is different.
- Be a career counselor.
    - Tell your students what they must do in order to advance along the various possible career paths.
    - Identify career resources and opportunities.
    - Offer career advice.
    - Help them network and make contacts in the field.
    - Teach them time management skills.

Give your students genuine responsibilities and learning opportunities. For example, have your students write the first draft of the paper themselves; have them do the experiment themselves (even though you could write the paper/do the experiment better and faster). Then give them feedback to help them improve.

Reflect on how your previous supervisor mentored you. Were you mentored well?

Remember, it is in your interest to have your team members succeed. Not only will you feel personal pride, but also peer review panels take into consideration your ability to produce qualified and successful researchers. After a trainee has been in your lab for several years (and often sooner), it will be clear to you that a career as a PI is not likely to be a good career

choice for many individuals. In this case, you need to recognize where each person's strengths lie, and guide them appropriately.

Getting Advice

Actively seek mentorship and advice from other more established PIs as you start to establish your research program. Consider doing the following:

- Ask senior colleagues for advice; they are usually happy to provide it.
- Use your institution's mentoring programs to formally connect with a suitable mentor.
- Meet monthly with other junior colleagues or new PIs.

Managing Expectations

Meet individually with each person on your team every few months and set clear, specific and reasonable expectations. You can usually hold these meetings every six months (although some individuals will require more frequent meetings). In particular, remind your graduate students that you expect more of them than you would of undergraduates. They will have to think independently and creatively, not just master techniques. (To motivate your graduate students, consider sending them to conferences to become aware of the intensity of other graduate students' research). Early on, hold a team meeting to clarify your financial rules and expectations.

At the same time, **manage your team members' expectations of you**: at your six-month meetings, ask your team members what they expect from you for the next six months, and discuss whether you can realistically meet their expectations.

Running a Research Lab

As a first step, reflect on the labs where you have worked in the past. Were those labs well run? What mistakes can you avoid? What successes can you repeat? What practices contributed to a positive and productive work environment?

Obtaining Resources

Try very hard to establish a good relationship with your Chair or Director. This person controls the amount of space and infrastructure available to you, as well as teaching and administrative assignments. In addition, your

Chair or Director can provide you with a useful and different point of view on your research program.

Keeping Your Lab Running Smoothly

Being a PI is a human endeavour. Have an open-door policy for both professional and personal matters. Encourage your team members to come see you. When they do, listen and try to help.

However, some team members will be reluctant to come see you, so maintain a physical presence. If you work in a lab, do some experiments at the bench, especially in the first few years. Keep your eyes and ears open for potential problems and conflicts:

- What is frustrating people?
- Are there personality conflicts?
- Is the organizational structure working?
- Is anyone experiencing a personal problem?
- Are projects in the hands of the appropriate people?

Also notice the positive things:

- What are people enjoying?
- Who gets along well with whom?

Try not to hover, though–especially with your good students. Tell them what to do and then trust them to do it. Generally speaking, your team members want you around occasionally, but not all the time.
Instill enthusiasm by being enthusiastic yourself. Convey the message that the research team can make a significant contribution to knowledge. (For inspiration, reread your successful grant application!).

Show enthusiasm for your students' individual work and achievements. For example, celebrations for newly accepted papers will have a great affect on morale.

Be open and honest, but never gossip to one student about another.

Have team meetings every one or two weeks and insist that all team members attend. Use these meetings to:

- keep everyone up-to-date on all of the on-going research
- decide where papers will be published, with whom and when
- discuss staff-related issues (five minutes per meeting is time well spent)
- brainstorm on topics as needed
- avoid misunderstandings and promote intra-team communication

Generally speaking, it is in your long-term best interest to be supportive and flexible with your team members. Be particularly supportive if they have health problems (e.g., unwarranted or excessive anxiety, depression). If you take care of your people, you will see the positive effects in your research program. Furthermore, you will develop a positive reputation as a good person to work with, and other students will want to train with you.

On the other hand, if a team member behaves inappropriately, it is your obligation, as the PI, to address the problem. The buck stops with you. You will save both time and aggravation by dealing with problems immediately when they arise. Don't just hope they will go away – they will only amplify, affect others in the lab, and get worse. Call team members into your office individually and insist that they act professionally (obey rules, behave civilly, meet expectations, etc.). Be friendly but firm. Never, ever become angry.

Key point. If you do not know how to handle a human resources problem, consult with the Human Resources staff at your institution, and make your department head aware of the difficulty. By taking these two actions, you will begin to work towards a solution, and also protect yourself.

Communicate your expectations to your team and articulate to them the consequences of their behaviour. Document your expectations and their inability to meet those expectations. Document specific incidents. If the problem persists, consider physically relocating people or helping them find a more suitable position.

Managing Your Time

There is more to being a new PI than honour, glory and universal veneration. You will experience significant new demands on your time. Particularly with the additional responsibility of running your own research team, you will have to manage your time like never before. Ask yourself, "Is my research program progressing?" If it's not, ask yourself why. The problem may be poor time management.

You **must** say "no" to lower-priority requests. Until you have been a faculty members for five year or so:

- Limit the number of graduate committees you are on.
- Try to avoid sitting on an external peer review panel, unless you've been renewed once.
- Avoid excessive collaborations where your research is not the main focus: collaborations that are helpful to others but not part of your core research program can dissipate your time, focus, money and energy.
- Do not "chase" publications. Focus on quality, not quantity.

Do not try to keep up with the literature completely. It can't be done. Instead, schedule some time each day to read about the most salient issues in your field, and learn to accept that there have been new developments that you don't know about.

Create a workday schedule that reflects your work priorities, and stick to it. If you leave your schedule open-ended, your time will get spent on unproductive, lower-priority activities.

In the same way, create a **24-hour** schedule that reflects your **life** priorities too, and stick to it. Don't let your work take over your life. Keep work fun by keeping it in its place.

References

Recommended Books

Many university career centres will have copies of the following books.

Barker, K. (2002). *At the Helm: A Laboratory Navigator.* Woodbury,NY: Cold Spring Harbor Laboratory.

Babbie, E.R., Benaquisto L. (2002). *Fundamentals of Social Research*. Scarborough, Ont.: Nelson Canada

Barker, K. (1998). *At the Bench: A Laboratory Navigator.* Woodbury, NY: Cold Spring Harbor Laboratory.

Bernard, H.R. (2000). *Social Research Methods: Qualitative and Quantitative Approaches*. Thousand Oaks, California: Sage Publications Inc.

Feibelman, P.J. (1993). *A Ph.D. Is Not Enough: A Guide to Survival in Science*. Cambridge, MA: Perseus Publishing.

LeCompte, M.D., and Schensul, JJ. (1999). *Designing and Conducting Ethnographic Research*. London: AltaMira Press, A Division of Sage Publications Inc.

Ramon Y Cajal, S. et al. (1999). *Advice for a Young Investigator.* Cambridge, MA: MIT Press.

Roskams, J. & Rodgers, L. (Eds.) (2002). *Lab Ref: A Handbook of Recipes, Reagents, and Other Reference Tools for Use at the Bench*. Woodbury, NY: Cold Spring Harbor Laboratory.

Sambrook, J. et al. (2001). *Molecular Cloning: A Laboratory Manual (3-Volume Set)*. Woodbury, NY: Cold Spring Harbor Laboratory.

Recommended Web Sites

CIHR Grant Writing Advice Links
http://www.cihr-irsc.gc.ca/e/1465.html

CIHR Grantscraft Video
http://www.cihr-irsc.gc.ca/e/25145.html
This video includes a discussion of CIHR's internal review processes, including its evaluation criteria.

Tips for Writing a Successful CIHR Grant Application or Request for Renewal
http://www.cihr-irsc.gc.ca/e/24550.html