Strategies for Obtaining a Faculty Position in the Biomedical Sciences:

Views from Both Sides of the Job Search Process

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Table of Contents

Acknowledgments	**page 2**
Introduction	**page 4**
Chapter 1. Are you Faculty Material	**page 6**
Chapter 2. Putting Together an Application	**page 13**
Chapter 3. Applying for Faculty Positions	**page 24**
Chapter 4. Rejection	**page 30**
Chapter 5. Job Talks and Chalk Talks	**page 32**
Chapter 6. The Interview	**page 43**
Chapter 7. The Letter of Offer and Negotiations	**page 55**
Chapter 8. Acceptance and Preparing for Your New Job	**page 61**

Appendices

A. Faculty Position Advertisement examples
B. CV examples
C. Research Proposal examples
D. Cover Letter examples
E. Teaching Philosophy/Teaching Interests examples
F. Application Update examples
G. Example of typical start-up costs for a cell biology lab in 2004
H. Check List for an Interview
I. Interview Schedule examples
J. Letter of Offer sample
K. Negotiation Email sample
L. Additional Resources

About the Author

Introduction

When I talk to grad students and postdocs about applying for a faculty position, I repeatedly hear the same three questions: 1) Do I need a *Cell*/*Science*/*Nature* paper to get noticed by the search committee? 2) Do I need to have a grant to get noticed by the search committee? and 3) Is it extremely competitive to obtain a faculty position? Surprisingly, the answer to the first two questions is "No." While having publications in top journals and evidence of a history of funding are both attractive qualities to a search committee, neither quality is essential for getting an interview. As a case in point, when I applied for my faculty position in 2003-2004, I had no first author *Nature*/*Cell*/*Science* papers to my credit, nor did I have any grants to bring to a faculty position. One of the most important ideas I want to convey to you is that you DO NOT need a *Cell*, *Science* or *Nature* paper to get a faculty position and that having one will not guarantee a position. The answer to the third question is "definitely." With a glut of postdoctoral fellows (postdocs) and a limited number of positions, there simply aren't enough academic positions for all of the postdocs on the job market. Academia has become the "alternative career."

Therefore, if you choose to compete for a faculty position, be aware that the competition can be stiff. There may be up to 400 people applying for only one (1!!!) faculty position. On the other hand, there are some highly specialized faculty searches with only 50-100 applicants. Of the various applicants, up to half may not fit the profile of the faculty candidate a search committee is seeking. One out of 25-200 odds don't sound as bad. If you make the cut for interviews, you will become one of two to six candidates being closely considered for the position. Those are very good odds. While getting the position is the overarching goal, your immediate concerns are making your application stand out and getting invited for an interview. As I will describe in Chapter 6, once you have reached the interview stage, whatever differences exist between the candidates on paper, the playing field becomes more level and great CVs can give way to a poor speaker or a modest CV can be complemented by your natural teaching ability and collegial attitude.

If getting your application noticed is the key, how can you make your application stand out? Many postdocs I speak with are surprised and mystified by aspects of the application process. The intent of this book is to provide a personal perspective of what to anticipate, mistakes to avoid, and a framework for understanding what a search committee is seeking. This book will help the reader make a realistic assessment of his or her prospects and consider the strategies that I employed to get a faculty position. In the Appendix, I provide multiple examples of application materials that resulted in interviews and job offers. Importantly, I'll tell you about improved and updated strategies. I'll tell you about some of the strange things I saw and heard, as well as share some stories from other young assistant professors that also recently went through the job search process. Equally importantly, as I've now been on the other side of the faculty search process, I will share some insights I've gained as a member of a faculty search committee. In addition, there are several helpful resources for people seeking a faculty position. See Appendix L.

I cannot promise that reading this book will guarantee you a job as an assistant professor. Rather, this book will impart what I learned in the process of my own job search and later as a member of a faculty search committee. I want to provide a realistic perspective how the search committee is likely to view both your application and you. Utilizing the strategies described in this book will help you to persuade the search committee to make the most informed decision about your application. Simply enhancing the clarity of your application and job talk will permit the search committee to evaluate you without having to guess at what you are getting at in a vague research proposal or job talk.

A few of the suggestions and strategies will be mind-numbing minutiae for some of you and pure gold for others. I have tried to be comprehensive with the information because I have encountered these situations personally either during my own job search or when interviewing faculty candidates.

My hope is that you will find at least a few nuggets of information in this book that help you get the job you want.

Chapter 1. Are You Faculty Material?

A tenure track faculty position requires a diverse skill set, which is part of the reason for all of the steps in the faculty job search. You will be judged as a future colleague, an innovator, a teacher, and for your ability to bring in grants for yourself and the institution. The final point is critical. Universities and departments operate on cash, not good will. View yourself and your skills in business terms and the application process begins to make more sense. Your research statement and chalk talk tell the search committee whether you have the ability to write grants. Your job talk illustrates both your scientific prowess and your teaching skills. Individual meetings with the faculty help the committee see how you will fit into the department and what you can offer the department as a future collaborator. Ultimately, you are selling yourself and your research. If you are unable to sell your research, you should either think seriously about a predominantly teaching position or consider a nonacademic job. Despite the business analogy, your science is not secondary to your funding track record. Good science is the number one reason that you will get a job offer. The other items tend to naturally follow.

A Brief Digression

Before starting the intense process of applying for a faculty position, it is worth asking why you want to be an academic researcher. For years, the generally held model of Ph.D. training is that the trainee will become an academic. Today, that model is simply not true. According a recent survey by the National Science Foundation, only 7-10% of postdocs go onto faculty positions (https://www.nsf.gov/statistics/srvygradpostdoc/). I'm not the first to point out that faculty positions are the real alternative career. A number of institutions now have postdoc associations and frequently offer some sort of exposure to non-group leader career options. However, there is little, if any, practical training to prepare postdocs for nonacademic careers. There are numerous career options available to a person with a PhD. See the excellent book, Alternative Careers in Science edited by Cynthia Robbins-Roth (*Alternative Careers in Science: Leaving the Ivory Tower*. Second ed. New York: Academic Press, 2005.), for in depth descriptions of the various careers that you can pursue with a PhD in the biomedical sciences. Even if you know that you want to become an academic, you owe it to yourself to examine your other career options to make a more informed decision. The skills needed in industry, patent law, journal editing, science consulting, etc. are inherently different from what most postdocs learn during their training. If you think you are one of the 60-80% of postdocs that will not pursue academia, you should arm yourself with as much information about alternative careers as possible. You should start networking ASAP and determine what you can do to improve your prospects for your career track.

I'm explicitly talking about tenure track type faculty positions, e.g., assistant, associate, and full professor. These positions include a lab, startup funds, the ability to hire postdocs and techs, as well as train graduate students.

The Plusses and Minuses

What can you expect as an assistant professor? First, the Rewards. An academic position is one of the most intellectually rewarding jobs available. You will have the freedom to pursue research that you design. You can train new scientists and impart ideas and ways of thinking that reflect your scientific values. You will be surrounded by colleagues that share your passion for knowledge and interest in your field of research.

However, there are pitfalls to the academic career track and I'd like to take a moment to describe the Negatives of academia. Grant funding was exceptionally tight when I wrote the early versions of this book. A large portion of your time will be spent writing grants. Many academic positions include heavy teaching loads. You will be expected to serve on multiple committees, which can be time-

consuming. Young academics are often faced with an up and out evaluation system. That is, if you don't make tenure or get promoted to associate professor, you can lose your job and must seek out a new position somewhere else. Promotion to associate professor often requires publication of two or more papers per year and getting and renewing an NIH R01 grant. Given the demands of teaching and committees and a competitive grant funding climate, making associate professor can be challenging. Parents face additional issues with balancing the demands of an academic position and of raising a family (see the Women in Cell Biology, American Society for Cell Biology. "WICB/Career Strategy Column." http://www.ascb.org/wicbcareer-strategy-column/ for a more in-depth discussion). Finally, while it is possible to make a satisfactory salary, one does not become an academic to become wealthy. There are better paying jobs to be had. Also, the cost of living in some areas (e.g., San Francisco, Boston, and New York) can be difficult on a faculty salary and very challenging for families with children.

It should be clear that being an academic is not for everyone. The job can be highly stressful and even disillusioning. However, for the individual that loves basic scientific research and is driven by intellectual curiosity, there are few more satisfying careers than a faculty position. I absolutely loved my job as an assistant and later associate professor. For me, the plusses vastly outweighed the negatives of the academic career path.

What to Expect.

Being an academic is not a 9-5 job. It consumes a great deal of time and I have been assured by my more senior colleagues that promotion entails even more travel time, attending meetings, serving on grant study sections, more grant writing, and more committees. Despite this busy schedule, I still manage to spend time with my spouse, play with our cats, work in my garden, travel, and read nonscientific books and magazines. An academic research career is truly a lifestyle. Anyone contemplating this career path (and their spouse/partner) should be aware of the time commitment.

My typical workday as a junior faculty consisted of:

1-2 hours of committees
1-2 hours of seminars and meeting with seminar speakers
1 or more hours of answering emails and sending reagents
2 or more hours of designing experiments, interpreting experimental results, and troubleshooting experiments that are not working
2 or more hours thinking about and writing grants and papers
2 or more hours performing experiments
plus time for reading journal articles, reviewing manuscripts, ordering reagents, managing people in the lab, preparing for and teaching lectures, preparing to give talks at meetings and other institutions, interviewing students/postdocs/faculty candidates, and advising colleagues on experimental design and interpretation.

If you look closely at the schedule, you will notice that most of the time is spent doing, interpreting, and discussing science. I thrive on this immersion in science and this is why I became a scientist in the first place.

Where do I sign up?

Getting a faculty position in the biological sciences today is exceptionally competitive. It is no secret that there is a glut of postdoctoral fellows in the United States. Conservative estimates by the NSF report that ~7-10% of life sciences Ph.D.'s are in faculty positions five years after completing Ph.D. programs (https://www.nsf.gov/statistics/srvygradpostdoc/). Note that this is a national average and

rates can very substantially between individual postdoctoral training institutions. Furthermore, grant funding available through traditional government agencies can be difficult to come by. Over the past 20 years, I've seen grant funding range from the top 1-18% of grant scores at the National Institutes of Health. Again, note that there are grant mechanisms that improve funding likelihood for new investigators. If I can get funded, there is hope for anyone that gets a faculty position. Interestingly, preparing for a chalk talk includes many of the same elements that make for a fundable grant. This is not a coincidence!

Assuming that the academic lifestyle appeals to you, it is necessary to assess your potential to obtain a faculty position. Completing a postdoctoral fellowship is a minimal requirement for becoming eligible to apply for a faculty position. Beyond this there are several factors that establish your suitability as a candidate. In general terms this includes:

1. Strong evidence of productivity in research
2. Strong letters of recommendation
3. A fundable research proposal
4. Evidence of teaching ability
5. A sense of novelty or creativity
6. History of funding.
7. Expertise in technology or methodology
8. Confidence

In more specific terms,

1. Strong evidence of productivity. This is the meat and potatoes of your application and what immediately sets you apart from other candidates. How many preprints have you posted, papers have you published, in what journals, and are you first author? Quite simply, if you find yourself nearing the end of your postdoc with no papers or preprints, you can generally forget about applying for a faculty position. There are exceptions to rules. A good friend of mine did obtain a faculty position without a single paper published as a postdoc (see The Exception to the Rule box). The reputation of her postdoctoral advisor, the quality of her research project, and her presentation skills helped her land a job based on a faculty search committee's confidence that she would be highly fundable and successful as a professor. Still, her situation is definitely an exception and you should not count on obtaining a position through this route.

What if you have only one paper? Unless it's in a high profile journal in your field, you will have a difficult time getting noticed by the search committee. Two or more first author papers in good quality journals is the minimum number of publications you'll generally need. Additional co-authored papers will illustrate your productivity and ability to work with others (a very desirable quality). Reviews, Methods chapters, and book chapters are great to have on your CV, but do not compensate for a lack of peer-reviewed first author original research publications. There are exceptions to these guiding principles.

At the same time, it is NOT essential that you have a *Nature*/*Cell*/*Science* paper to get a faculty position. I did not, my postdoc did not, my grad student did not, yet we all got faculty positions. Having a paper in a high impact journal certainly can help your chances. Not having such a paper will not necessarily remove you from consideration by a search committee.

Manuscripts classified as "in preparation" or "to be submitted" don't actually count as productivity. Some applications I have seen actually go so far as to say "to be submitted to Science." Again, this is not going to impress anyone and remains purely hypothetical. Anyone that has ever written a paper knows how time consuming it can be to prepare the manuscript and win over the editor

and reviewers. Until your manuscript has been peer reviewed (and hopefully accepted), it isn't worth much. You can identify manuscripts that are under review and even submitted. Don't bother mentioning the journal until the manuscript has been accepted.

Preprints have changed the productivity equation a bit. A preprint is a manuscript. There could still be some preparation involved, but most labs do not post half baked preprints. That would reflect poorly on the lab. Therefore, a preprint, which is now considered referenceable for an NIH grant or a publication reference list, is a great way to demonstrate that you have been productive. Your lab considers the preprint ready to show the world and what remains now is satisfying reviewers and editors, which is quite different from simply claiming a manuscript is in some vague stage of preparation. I do not have any statistics on whether anyone is getting faculty positions based primarily on unpublished preprints. My feeling is that preprints do not yet equal to peer reviewed published papers, but a first author paper plus a first author preprint could now qualify as "productive."

The Exception to the Rule

One friend, Dr. A, obtained a tenure-track faculty position at a medical school without going through a formal application process and without even having a first author publication from her postdoctoral training. In her case, Dr. A had four first author publications in good journals from her graduate training. She was postdoc'ing in a high profile lab and had a compelling research story. Taken together, Dr. A did have a track record of accomplishment. Importantly, Dr. A had the opportunity to present her story as a talk at a prestigious small meeting. One of the attendees was sufficiently impressed by the story that he recommended to a colleague to interview Dr. A, which led to a job offer. First author papers from Dr. A's postdoctoral training did eventually get published and Professor A went on to get an R01 grant. Therefore, it's helpful to remember that every presentation you give is an audition that can change your career.

2. Strong letters of recommendation. Letters of reference are critical for your application. These letters are supposed to be an honest assessment of your abilities and potential to succeed as the head of a laboratory. You aren't supposed to be able to see letters written on your behalf. The important things here are to get letters from the people that know you best and can sell you to the search committee. Typically, one letter will be from your graduate advisor and one from your postdoctoral advisor. Other letters should come from collaborators, thesis committee members, and other mentors. It definitely helps if one or more of your letters are written by a leader in your field/a recognized name scientist. Not all search committee members will know the leaders in your field, but, for better or worse, name familiarity is a frequent enticement to consider your application further. It is not essential that you have a list of famous referees, but it doesn't hurt.

In the past few years, I've been asked about what happens when you've had a bad relationship with your thesis advisor or a postdoctoral advisor. The good news is that I've seen people still get interviews and faculty positions even if they could not ask a former mentor for a letter. There are a few potential solutions. First, if it's your thesis advisor, in the US, you typically have a thesis committee and the other members are often supportive of you. Assuming your thesis advisor is the person that is being unfair or difficult, you could ask a thesis committee member to write a letter helping to explain the situation and verify that you did great work for your thesis. If it's your current postdoctoral advisor, then hopefully you have identified one or more individuals that could serve as a second mentor/reference. That second mentor could also help sell your abilities and explain the issue with the

postdoc mentor. A stronger (and longer) option is to leave the first postdoc position and achieve some success in the second postdoc lab.

3. A fundable research proposal: The fundability of your program is very important. The ability to conduct research depends on obtaining funds. Equally importantly, your future department and university depend on the overhead costs generated by the grants you obtain. Therefore, your research proposal should be novel, innovative, significant, and achievable by you. In short, your research problems should appeal to grant study sections. As you are probably not a seasoned grant writer at this stage of your career, it is critical to get input from funded investigators and better yet from people that serve on study sections regarding the fundability of your proposal.

Your proposal should also reflect the requested focus of the job advertisement. If the search committee is looking for an NMR specialist, you are wasting your time sending in an application touting your expertise as a *Drosophila* geneticist. See **Step 3: Do your Homework** on page 26 for a more detailed discussion of matching with a department's job search criteria.

4. Evidence of teaching ability: The importance of teaching skill varies with the relative emphasis on teaching at the institution. For jobs in graduate departments at medical schools, with only a few lectures a year of teaching, there may be no criteria for teaching ability. In contrast, undergraduate institutions often will want some assurance that you *can* teach. If there is a strong teaching component in the job advertisement, you probably need to have prepared lectures and taught a class. You may have obtained this experience as a Teaching Assistant in grad school or taught courses as a postdoc at community colleges or night schools. Note that teaching in a summer course, e.g., a Woods Hole or Cold Spring Harbor course, can satisfy the teaching experience criteria for some positions. For many institutions, it helps if you have given at least one lecture to undergraduates or graduate students or taught a hands-on laboratory. Aside from adding to your CV, teaching can improve your ability to communicate with and train young scientists. Also, getting some experience will help you determine whether you enjoy teaching, which will in turn impact what types of faculty positions you want to apply for. Finally, many schools will have a part of the interview when you will be asked about your interest and thoughts on teaching. You will want to have answers for those questions.

5. A sense of creativity: Creativity is an important, but not always tangible quality sought in faculty position candidates. Creativity is best demonstrated by your publications and the letters of reference. Referees will note your ability to ask novel questions, create solutions for difficult problems or interpret data from a different perspective. Your research proposal also reflects creativity, which distinguishes you from someone that is "merely" hardworking. While much scientific progress depends on the countless hours of effort by researchers to move a project forward, projects are entirely dependent on the ability of a researcher to design the project, interpret data, and propose experiments. If you specialize in putting in long hours and depend on your PI to interpret experiments, write manuscripts, outline your talks, etc., then you are not yet ready for a faculty position. You will have to be able to do all of these things in your own lab.

6. History of funding: Previous funding is helpful, but rarely critical. If you have a history of funding, then hurray! You have some experience generating fundable proposals. You may also have a transition award that can be carried over into a new faculty position. Transition awards are strong evidence that a funding agency considers your future research promising, innovative, and fundable. Transitions funds can be very helpful for setting up your lab. Yet, it is rarely held against a candidate if they don't already have a grant. Transition awards (e.g. K99 from the NIH) are highly competitive. I have seen a few places that require a transition award for consideration for a faculty position. Curiously, these ads are

often not posted by the top institutions. My take is that these programs will probably not provide as much in the way of startup funds and somehow think that applicants will view this as a positive thing. Weird.

7. Technical Expertise: Expertise can sometimes get you an interview, even if the other elements of your application aren't strong. Many job advertisements seek a specific skill set- i.e. model organism, proteomics, cell cycle, imaging, etc. If you have trained in a top lab in this area, you may be just what a search committee is seeking. It may be more important to the committee that you can perform a service that several people need, than your productivity as a postdoc. However, be aware that in such situations, you may be viewed more as a core facility operator that is also expected to teach and obtain grants. That is, if you are providing service, you are not necessarily spending time on your own projects.

8. Confidence. As a postdoc, you depend on your ability to do research and for your PI to continue funding you. The risks of losing the ability to conduct research are relatively low in the short term for the postdoc. As a PI, **everything** depends on you. Success in research depends on your perseverance, creativity, your ability to persuade others of the importance of your research problem, and some degree of luck. To become an academic, you need to have the confidence that you can take the leap of faith that your career will succeed. For those of you with imposter syndrome, and most of us have at least some imposter syndrome, you can learn all of these things. It's OK if you have some doubts. That's healthy. Your Ph.D. training helps prepare you to learn how to learn. To adapt.

Self Evaluation through the Eyes of Others

Viewing Yourself from the Perspective of the Search Committee.

Each of the qualities listed above form part of the evaluation of your merits by a search committee. Exceptions exist for each item I have identified. For example, if you have a transition award, the search committee may rank you as comparable to an individual with letters of reference from famous scientists. Three first author Cell papers will often get you an interview at many institutions even if your other qualities are merely average.

Search committees are seeking faculty candidates that will be future peers and will be able to benefit the department intellectually and financially. You are a commodity and are being evaluated as such. Therefore, even if you and applicant B are both experts in microscopy, you may have a longer history as an instructor and a better research proposal. Anyone considering applying for a faculty position needs to realize that search committees (at most institutions) are hiring peers, not a member of the National Academies of Science or a front-runner for the Nobel Prize. If one looks at websites for junior faculty at many institutions, the common traits that emerge are that the junior faculty often have productive publication records consisting of two or more first author publications in respectable journals, such as Journal of Biological Chemistry, Journal of Cell Biology or Molecular Biology of the Cell (or name of quality journal in your field). Often, junior faculty trained in the labs of scientists with significant name recognition. Most importantly, junior faculty often have proposed potentially fundable research projects. All three of these factors are frequently interlinked- that is, a postdoc in a good lab will tend to publish exciting papers in good journals and will develop novel projects with strong funding potential. These qualities summarize what most search committees seek in applicants for junior faculty positions. Having a *Nature*/*Cell*/*Science* paper or a grant is a plus when being reviewed by a search committee, but is not required.

Viewing Yourself from the Perspective of a Grant Funding Agency

You represent a commodity that can bring expertise and funding to the department. To assess your potential, you need to view yourself as a grant study section would. Here, it is useful to review the

criteria for scoring NIH grants. In addition to the evaluation of the quality of the proposed research, the there is a section on whether the PI is likely to be able to perform the proposed research. This ability is not established by letters of reference. Rather it is a combination of the number and quality of your publications, your preliminary data, where you did your postdoctoral training, your expertise related to the proposed research, and the quality of the institute where you will be performing the research (more on this in Chapter 3). Note that at the time of this latest version of the ebook, NIH and other institutions are trying to minimize the biases that emphasize individual, lab, and institutional reputations. How this will play out in hiring and funding remains to be seen.

Chapter 2. Putting Together an Application

The application process requires a significant investment of time and effort to assemble materials. You will want to begin this process long before you actually apply for jobs. A typical application will consist of the following items:

- *Cover Letter*
- *CV*
- *Research Proposal*
- *Three letters of Reference*

Many applications will also include:

- *Commitment to Diversity Statement*
- *Teaching Statement*
- *Copies of your top three publications*

Each of these items is critical and deserves your full attention. It is useful to think of the applications components serving two roles. There is the basic evaluation. Is the requested item present and how good is it? Equally important, reviewers ask, is there something that can be used to put an application in the do not consider further pile? What I mean is that applications provide a holistic representation of a candidate, but applications are also subject to nitpicking. When one must screen hundreds of applications for a shortlist of candidates, it is faster and easier to search for flaws first. With each mistake that appears, it takes increasing persistence of a reviewer to remain interested in an application. Multiple grammar errors, formatting errors, a last minute essay, etc. can sink an otherwise strong candidate. The competition makes these realities unavoidable. Since it has taken you 5-12 years to get to this stage (on top of your undergraduate training), why undermine your chances with something that might take extra minutes, hours or even an extra week? You owe it to yourself to assemble a high quality application.

I suggest tackling them in the following order:

1. Prepare your CV. You already know whether you have the minimum requirements to apply for a faculty position (see Chapter 1). Your CV is one of two foundational items in your application (along with your Research Statement) and it is something that you will need to provide to the people that you ask to write letters of reference.

There are many styles for preparing CVs and this is not meant as the only possible template. A good CV will be concise (brief is good), easy to read (no fancy fonts), and informative. I have included an example of the CV I submitted when I applied for a faculty position. **See Appendix B for examples**.

Important Tips

Use a legible font- Arial, Helvetica, Times size 11 or 12. Don't get fancy and don't try to pack too much information into a line.

Limit the number of manuscripts in preparation to manuscripts truly in preparation. Many people, myself included, will list things that have not yet been submitted to a journal for review. If the majority of the work is done and you can talk about the story during your interviews or even better have the

preprint posted and/or manuscript submitted by the time of your interviews, then you can update the search committee on your progress. See pages 8-9 for more thoughts on manuscripts in preparation.

Limit your CV to two to three pages. The search committee will have to read hundreds of applications and will appreciate your brevity.

Provide information relevant to a faculty position. This can include any journal review duties in which you (not your mentor) are solicited by editors to review manuscripts, committees you served on as a postdoc or grad student, courses you taught, research-related awards you have won, etc. Do not include items such as hobbies (you probably have hobbies, but the search committee wants to know that your main goals are to establish your lab, get grants, write papers, and teach) or information related to college or high school unless it is related to relevant research experience. One time, a colleague got a CV from a candidate that listed testing life vests for the Coast Guard as "research experience" for a protein chemistry job. The applicant didn't get an interview.

Do include your name in a header or footer in your CV and all other application materials. Also, number pages of each file, separately. Make it easy for the search committee to keep your materials in order.

Your Online Presence In the modern CV, there are some opportunities for you to demonstrate that you are internet savvy. For your bibliography, you will want to include an ORCID, the leading persistent digital identifier, and a link to My Bibliography. The first of these uniquely identifies you from all other John Smiths, Sue Jones or Justin Wangs of the world. Set up an account at http://orcid.org. NIH expects you to use a slightly different bibliography in your grant biosketches, so it's a good idea to already have one ready. For instructions, see: “My Bibliography,” My NCBI Help. NCBI, 2016. http://www.ncbi.nlm.nih.gov/books/NBK53595/ More recently, NIH now permits use of ORCID.

2. Prepare your Research Proposal. The Research Proposal/Research Statement/Research Plans document is the other foundational piece of your application. You want to share this, along with your CV, with referees. The Research Proposal links to your job talk, your chalk talk, your cover letter, and even into your teaching statement (see below). At Janelia, we strongly encourage postdocs to hone their Chalk Talk (see Chapter 5) before writing the Research Proposal. We’ve found that as the applicant develops his/her/their Chalk Talk, the aims change and the sales pitch changes. It IS OK if there are differences between your Research Proposal and Chalk Talk, but with some preparation, this is unnecessary. More importantly, if your sales pitch is strong in your application materials, it’s more likely that you’ll attract the attention of the search committee and get invited for an interview. Remember, you do not give a Chalk Talk, unless you are invited to an interview and your top priority for your application materials is to get interviews.

The Research Proposal is a brief statement of what you did in graduate school and less brief about your postdoc and mostly about what you will do when you start your own lab.

The latter part directly reflects what, if anything, you will be taking with you from your postdoc lab. This means that you will have had at least one conversation with your postdoctoral advisor to identify what research projects and reagents you can take with you. It would be disastrous not to have this conversation because you want to have the best possible relationship with your advisor. He/she will write you letters of reference for your application and for any fellowship awards that you WILL apply for as a new faculty member.

The conversation you have with your advisor may surprise you. You may assume that the project you have been working on is yours to take with you, but your advisor may have other plans.

Because of this possibility, it is in your best interest to have this conversation well before you plan to apply for a faculty position. The key items to establish are:

- what are your advisor's plans for your current project?
- if necessary, try to define directions for both of you that will not involve direct competition
- what reagents (i.e. a knockout mouse, a cell line, etc.) can you take with you?
- you may want or need to have similar discussions with collaborators

All of the preceding discussion will help you define a Research Proposal that your advisor will support and that you can discuss comfortably at an interview.

The next thing to do is to decide how you will sell yourself. That is, are you a cell biologist? A cancer researcher? A microscopist? All of the above? This fits in with the idea of you as a commodity. How will you and your research program be sold to grant study sections? While basic research is great (and some faculty ads will specifically seek this), bio**medical** research is often funded because of a relevance to human health and disease. Therefore, if there is any way *(translated: FIND A WAY! It must, however, sound plausible and you definitely need to be able to translate this to a real grant proposal)* to link your research to disease or human health, this is the time to do it. Being a basic cell biologist vs. being a basic cell biologist with a focus on cancer is rarely a contest when members of the search committee read your application. In my research proposal, I emphasized my expertise in imaging and interest in basic problems in endoplasmic reticulum biology. In retrospect, I think this emphasis on very basic biology weakened my application, as the connection to grant applications was less obvious. As an investigator, I emphasized my studies on aging, HIV, stress, and misfolded protein diseases and how my research provided new mechanisms and tools for these problems. In retrospect, if I had done this with my application, I suspect I would have been invited for even more interviews.

On a related note, future research plans should share some of the characteristics of a successful R01 Specific Aims page. Specifically, you should identify the **knowledge gap** that your research will address. If successful, how will your research advance the field? How will your program be innovative (i.e. unique reagents, cutting edge techniques, exciting new questions, etc.)? It is perfectly acceptable to mention the specific aims for your first grant proposal. (Note that this would fall within one of the Research Statement aims- e.g., a research statement aim is equivalent to a whole grant, which itself often contains 3 aims of more limited scope). Some research proposals include several different areas of interest. Limit your focus to an overarching question. You don't actually get points for having lots of ideas (on your Research Statement). It's great to have imagination and lots of ideas, but you want to focus on one main question that will drive your new lab. As with grant reviews, too many topics suggests you are unfocused and cannot prioritize what you will do to get and remain grant funded. If you cannot prioritize, your efforts get diluted and potentially fall short of achieving your goals.

Another important aspect when thinking of yourself as a commodity is your expertise, especially in cutting edge techniques. You are an expert if you: 1) have first-hand experience with the methodology or technology, 2) understand how the method or equipment works and can troubleshoot when something isn't working, 3) have taught classes on the technique or have written reviews on the technique, 4) consult with companies to develop the technique or equipment, 5) have articles using the methodology. Note that I wrote "cutting-edge" techniques. Many schools look to new faculty to bring new expertise to their departments and to share it through collaboration. If you've got it, flaunt it.

The actual proposal is divided into three sections. The first section is 1-2 overview paragraphs. The goal is to help a reviewer know what's exciting about your research program. The second part will be a concise narrative of your research experience and accomplishments to date. Even though this may span up to ten years of your life (!)(grad school and postdoc training), you need to distill this material into less than one page for most applications. See **Appendix C** for examples. The third part (Future

Plans/research proposal) should be a mix of paragraphs and figures (preliminary data, models, etc.), as in a grant progress report. As noted above, you can include specific aims. A key point to convey is how your future research connects to your past training and accomplishments. Is the future research an extension of what you have been doing? Is it an entirely different direction that takes advantage of preliminary data and tools you have developed? How you address this will help convey why you are the right person to be conducting the proposed research.

Additional advice on writing research statements can be found at:

Austin, Jim. "Writing a Research Plan." Science: Careers. 9/26/2002.
http://www.sciencemag.org/careers/2002/07/writing-research-plan

The Career Center, Division of Student Life, University of Washington. "Academic Careers: Research Statements." Accessed 9/30/2016.
http://careers.uw.edu/ifiles/all/files/docs/gradstudents/pdfs/AcademicCareers-Research_Statements_07-08.pdf

Career Services, University of Pennsylvania. "Research Statement." Accessed 9/30/2016.
http://www.vpul.upenn.edu/careerservices/writtenmaterials/researchstatements.php

Avoid including collaborations with your postdoc PI for your future research proposal. The first years of your faculty position need to be geared toward establishing yourself as independent- as in independent from your postdoc advisor. Mentioning that you will continue to collaborate with your current advisor in your research proposal, your cover letter or during your interview is NOT a good idea. In addition, when you are evaluated for grants and promotion, continuing to collaborate with your postdoc advisor generally will be considered unfavorably and as a sign that you are not independent.

Do put yourself into the proposal. If you only talk about research projects as a series of facts and problems, your reviewers will have a difficult time seeing what you have done and what you will do. There should be several references to your findings and specific contributions to the field. While you don't want to portray yourself as having single-handedly dragged your field into the 21st century, you do want to put your research contributions into the context of your field for non-experts.

Your research proposal is very important and should be critiqued by at least two people – one that is grant savvy and one that knows very little about your field. For the latter, a significant other or someone from another unrelated lab is a good choice. The reason for consulting the first person should be obvious. The outsider is the more important person. It is a good bet that the people reading your proposal will not be in your field. If you batter them with acronyms, minutiae or fail to provide sufficient background to explain your questions, you will lose the interest of search committee members. Your research proposal needs to be easy to read, comprehendible by someone with a college degree in biology, and conveys the big ideas without getting bogged down in minutiae. For example, it's more important that your reviewer know that you are developing an anti-cancer therapeutic against protein X in pathway Y, than to go into the details of all of the components of pathway Y, regardless of the relevance of the pathway Y components. You will have opportunities to discuss the finer points of your research in your seminar and your chalk talk. Note that the naïve reader is someone worth employing for your grant proposals in the future when you start your faculty position. Successfully conveying the ideas in a grant proposal is at least as critical as the science itself.

3. Letters of Reference. With your proposal and CV in hand, it is now time to contact your referees. You will want to provide these materials to your referees to help them make your letter as detailed as

possible. Letters that simply say, “I know Bob. He works hard and did a good job in my lab.” will not be very useful. The good letters will explain how you solved problems, that you are innovative, and that you have great potential- all with clear examples. Unfortunately, you aren’t supposed to see your letters of reference. For this reason, it is important to identify people that will write strong and detailed letters. The first two people to ask are your graduate advisor and your postdoctoral advisor. These people know you best and can provide the most detailed assessment of your potential. Even though you must ask these people, you may wish to ask whether they can write you strong letters of reference that assess your abilities and prospects as an academic. Hopefully, you have a good relationship with these people and they will be supportive of your future endeavors. However, it is possible that your advisors may not have a very high opinion of you. Hopefully, this isn’t the case, but if it is, you need to know before you apply. It is possible to survive a weak letter of reference. A negative letter is the kiss of death. If, for some reason, you don’t have a good relationship with one of your advisors and know that you can’t get a good reference or something more sordid has happened- your advisor was convicted of fraud, sexual harassment or something equally problematic- you may wish to ask someone else. If so, you may need to explain why (in an interview) and you should be prepared to do so in a discrete and professional manner.

Most applications require at least three letters of reference. The third letter should come from a mentor, thesis committee member or collaborator that knows you and your research well. Again, confirm that they will be able to write a strong letter of reference. If you have additional collaborators that know you and your work well, then you should consider also requesting letters from them. There are rarely limits on the number of letters of reference you can submit. Still, do not plan to submit more than five letters as it will overwhelm the search committee members.

Once you have identified and contacted your referees, you should arrange for having letters sent. Hopefully, you have given your referees enough warning so that they can have a letter before you start sending out applications. When you begin sending applications, you should try to consolidate letter requests so that you are only contacting your references for letters once a week or once every two weeks. Some people prefer to send out all of the letters at once, though this can get cumbersome with 20-50 applications. In addition, it is generally better to have applications completed as soon as possible. Waiting for letters of reference is usually the last step of the application process. You will want to confirm that letters have been sent. Request that your referee email you whenever a batch of letters have been sent. Letters do need to be sent in sealed envelopes and generally need to be sent directly by the referee to the search committee. Note that it’s rare to send letters of reference or any documents by snail mail anymore. Many job sites even have a portal for sending letters. The portal may still not tell you if all of your materials have been received, so do stay on top of ensuring your applications and all associated materials are complete.

In some cases, your referee will ask you to write your own letter of reference that the referee will plan to sign. While it may sound odd, it is not uncommon to have to write a letter of reference for yourself. *You are not signing someone else's name to the letter. That is forgery and illegal.* Rather, some people assume that you know yourself best and can point out your strengths and accomplishments. In addition, the letter you write may be used as a starting point and will be modified by the referee. Writing your own letter of reference is something I still find a bit surreal.

The key to an outstanding letter is that your <u>abilities</u> are highlighted. Simply stating that you had a project and got papers is meaningless to a search committee. Furthermore, just listing your technical skills is not necessarily appropriate for a faculty candidate. Technical skills are typically listed for technician and, sometimes, postdoc positions. In contrast, indicating that you had to overcome particular hurdles, developed the question and strategy to solve the problem, worked out new techniques or established a new direction for the lab is far more informative and interesting. Your project and its overall success should be apparent from your publications. A good letter will add new insights into what

you did as a postdoc or grad student and what kind of scientist you are. A final suggestion for writing your own letter is to describe how well you work with others and what kind of lab citizen you are. Have you trained people? Do you oversee people working on your projects? Do you contribute to the well-being of the laboratory? These are things that reassure a search committee that you are a potentially compatible future colleague.

4. Cover Letter: This item is the first thing that your search committee will see. The letter lets the committee members know who you are (i.e. a postdoc at School X), which job you are applying for (assistant professor, job # if provided in ad), and where you saw the ad (the Dec. 10 issue of Science). The next paragraph will describe your expertise, what you have worked on and what you propose to work on (in the context of the ad). The proposed work sentences will be much easier, now that you have written your research proposal. State who will be sending letters of reference. Close with your email and phone number and that you look forward to hearing from the committee. If possible, prepare the letter on institutional letterhead to make the letter look more professional. At the very least, use your lab address, not your home address to indicate that you are currently productively employed. **See examples in Appendix D.**

5. Teaching Statement (or Teaching Philosophy): This is not required for all jobs. You will want to have at least one version prepared. Expectations for a teaching statement will depend on the institution and type of faculty position. In general, your philosophy should be brief (one page). It should reflect your teaching experience, groups that you intend to teach (undergrads, grad students, and even postdocs), what courses you would be capable of teaching (emphasis on capable, i.e. don't say Anatomy if you've never taken an Anatomy course), what style of teaching you would promote (interactive, active learning, peer-to-peer, synthesis, etc.), particular items that you would emphasize (i.e. include history of cell biology in your cell biology lectures or the experimental basis behind current theories), and more details regarding how you prefer to evaluate students (testing style, i.e. essays vs. rote memorization, etc.). Furthermore, you'll want to note aspects of mentoring and training as they are also forms of teaching. How do you train a new undergrad in the lab? Can you point to examples? If you mentored someone in the past, are there outcomes you can cite, such as a poster at a conference or middle authorship on a manuscript? If there are no obvious outcomes, that's not the end of the world. Some mentoring is usually better than no mentoring. Finally, it's helpful to describe how you might incorporate your Research Proposal into your mentoring. For example, if you are applying to an undergraduate institution, what kinds of projects might you be able to develop with undergrads? Do you use a technology that you might be able to teach to other trainees at the institution?

A common misconception is that you should plan to create multiple new courses. On the surface, this sounds like you're making yourself more attractive. Yet, this strategy can backfire in two ways. First, you're potentially promising to make new courses. Even one new course can be a tremendous amount of work. Do not underestimate the rough estimate that one hour of lecture requires ten (10!) hours of preparation. Second, you may be signaling a lack of appreciation of how much work teaching can be. You need to focus on getting your lab up and running, not developing multiple new courses, unless you are applying to a teaching intensive institution. In that case, you will not be submitting a philosophy so much as a portfolio of your substantial background in teaching. **See examples in Appendix E.**

6. Commitment to Diversity Statement: This essay is also called a DEI statement and other variations. There has been considerable confusion about what one should write and how this document is used by the search committee. First, let's state what the diversity statement is NOT. It is not an essay to necessarily describe how you, too, have experienced being an outsider. It's not a declaration that you

will not discriminate against others based on protected characteristics. Um…. That's the law. It's also not a declaration that you will only hire members of historically marginalized groups. That's… umm….discrimination and also against the law.

Rather, the statement is mostly an opportunity to describe how you will make your classroom and lab more inclusive and equitable. That's it. You can declare that you are strongly in favor of increasing diversity, but this is a meaningless statement. What I mean is that hopefully everyone wants to attract people from all backgrounds to careers in science. It's what we do in the spaces of equity and inclusion that will make our labs, classes, and institutions more welcoming and attractive to members of historically marginalized populations. Diversity is the outcome, the goal. Therefore, you want to describe in specific terms what you will do to foster equity and inclusion. It's not enough to literally state that you will make your lab inclusive. Tell the committee how. What will this look like for you? Note that what you propose should be a natural extension of you. If you do not currently do outreach activities, why should the committee believe that you are suddenly going to start doing outreach activities when you start your lab? Also, institutions often have already created DEI opportunities. Make yourself aware of them. Do not declare that you are going to create DEI programs at the institution as if you are the first one to consider the idea. It sounds naïve and arrogant. Finally, do not propose a tireless DEI agenda (going to multiple meetings, serving on committees, etc.) that would seriously conflict with building your lab. You only have so many hours in the day and you are being hired to run a lab, not to be the school DEI officer. Do participate in DEI trainings and activities, by all means and consider the implications of what you are proposing in your essay.

How are DEI essays evaluated? It depends. Some institutions first screen DEI essays for shared institutional values and then consider the rest of the application. This is one way to potentially avoid biases based solely on lab reputation and publication impact factors. Also, this screening can help reveal applications with solid science that will not necessarily be part of the select pool of applicants that most institutions are competing to recruit. That is, if the same search journal/grant/pedigree criteria are broadly applied, the same candidates rise to the top of everyone's lists. This helps explain why, even in multiple searches with hundreds of applicants, some applicants end up with several offers.

How else are DEI essays evaluated? Sometimes, there are no obvious criteria. I think most institutions have become more intentional about using DEI essays, but I think everyone needs to be transparent about them so that applicants can prepare the most useful essay for the committee.

Finally, what do DEI essays look like? Fortunately, some institutions have prepared some extremely helpful resources.

https://www.insidehighered.com/advice/2016/06/10/how-write-effective-diversity-statement-essay
https://cft.vanderbilt.edu/guides-sub-pages/developing-and-writing-a-diversity-statement/
https://facultydiversity.ucsd.edu/recruitment/contributions-to-diversity.html
https://facultydiversity.ucsd.edu/_files/c2d-guidelines.pdf
https://ofew.berkeley.edu/recruitment/contributions-diversity

7. Copies of your top publications. You will want to send high quality PDFs of your most representative publications (papers or preprints). Which three publications constitute your "top" publications may not always be clear. In general, prioritize your first and/or corresponding author publications. If you have more than three, choose the highest profile original research articles. If you are co-author on a paper in a top journal, you may wish to select this paper over a first author paper in a low impact factor journal. However, this only makes sense if you have made a substantial intellectual contribution to the study. Reviews and book chapters are generally less interesting as they may not be peer reviewed. Also, these tell committee members little about YOUR research. Meeting abstracts and

papers from meetings proceedings are also often not acceptable, with the exception that this is standard publication practice in computer science/machine learning communities.

Your Online CV (intentional and not)

Now is also a good time to update your LinkedIn (linkedin.com) site. This should include a current high quality photo of you, all of the information in your CV and any additional information that might take too much space in a standard CV. It's also useful (and sometimes sobering) to Google yourself and see what your online presence looks like. Committee members are likely to do this (google-stalk or cyber-stalk). You need to know if your blowout party photos or online rants come up. Also, it is worth reviewing your other social media pages. If needed, you may be able to scrub some of these things yourself or you may need to hire a service to improve your online presence.

The Importance of a Well Organized, Well Written, and Appropriate Application

When I have participated in screenings of applications, a couple of items stood out. First, several applications were truly outstanding, but an absolute mismatch with our department, a cell biology department. Applications that were clearly focused on immunology, neuroscience or development weren't going to be considered. It is like sending a Dear Santa letter to the Easter Bunny. Second, some applications were poorly assembled, sloppy or even nothing more than a CV. The applications that made it past the first round of screening (not necessarily to the interview stage) were relevant to the position announcement and the departmental interests, had quality publications, came from the labs of prominent PIs, had well written and organized applications, and sometimes had successfully been awarded significant grants or fellowships, i.e. an NIH K99 or Burroughs Wellcome career transition award.

The decision to invite candidates for interviews involved careful reading of letters of reference for strong endorsements and warning flags, discussion of the fit of a candidate's research program with the goals of the department, determination of the potential cost of bringing candidates with expensive equipment needs, any personal knowledge that faculty had of the candidates, and unscientific gut feelings by search committee members. *One of the decidedly scary realizations I have had is that success for getting admitted to graduate school, obtaining grants, and getting a faculty position all depend to a degree on intangibles.* Were all of the committee members sufficiently caffeinated and not suffering from low blood glucose levels? Was the application discussed at the beginning or the end of the review process? Did someone on the review committee misunderstand something about the application and have a strong, but not necessarily rational aversion to the applicant's research or PI? All of these things do happen.

While it isn't productive to dwell on these intangibles, it is useful to appreciate that the process is inherently imperfect and there will be circumstances beyond the applicant's control. However, if you make your application:

- Easy to read
- Organized
- Responsive to the job posting

You can put your reviewers in the best possible frame of mind and encourage the reviewer to give your application full consideration.

General Suggestions

USE SPELLCHECK!!!!!!! This is the simplest thing you can do to jazz up your application. Misspellings indicate that you do not pay much attention to detail. You have time to prepare your application materials. They should be perfect.

If English is not your native language, have someone with excellent grammar read and correct your application materials. Unfortunately, spellcheck and even grammar check in writing programs will not always pick up some of the writing problems of nonnative English speakers. Reading several sentences that lack articles or have the wrong pronoun or verb tense will give your committee the impression that you may not be able to write very well. The committee may (unfairly) conclude that your poor grammar reflects poor scientific skills, an inability to teach, and probably difficulty writing grants. Your application MUST look perfect. In 2023, ChatGPT appears to offer an impressive ability to improve the quality of the English in the document. I know several postdocs from China that use ChatGPT to edit their abstracts and fellowship applications.

A Note on Language

I owe a debt to Karen Kelsky for pointing out this problem in her book, The Professor is In (Kelsky, Karen. The Professor is In: The Essential Guide to Turning Your Ph.D. Into a Job. New York: Three Rivers Press, 2015.). The problem I'm referring to is the use of overly deferential language. Examples:

I would be honored to serve in your Department.
I would be thrilled to be granted this opportunity.
I am in awe of the reputation of your Department.
I hope to be fortunate enough to get the opportunity to interview for this position.
I believe that I can make a contribution to...

These aren't the only examples, but they are pretty common in applications. The problem is that you are interviewing to be a colleague, but you are presenting yourself as a postdoc/a trainee/a lesser person. Treat your readers (and your interviewers later at the Interview) as equals. It's easy to feel like an imposter because you do not yet have a faculty position. However, by applying for a faculty position, you ARE declaring that you are [capable of] operating at the level of a junior faculty member. You've trained for this and you should be ready for this. If not, do not bother applying. This is not about being arrogant or pretentious, which are also insufferable. You must present yourself as a colleague, not as a deferential unworthy lesser person.

Planning Ahead

At this point your first possible interview is still weeks to months away. However, you should begin preparing your job talk and your chalk talk so that these will be well polished by the time you get an interview. In fact, **I strongly recommend preparing your chalk talk before writing any of your application documents**, but people rarely listen to me on this point. See Chapter 5 for a discussion of job and chalk talks.

There are a couple of additional items that are worth assembling. First, you absolutely need to know, in rough terms, how much it will cost to start-up your new lab and run it for at least one year. During the interview or negotiations, you will need to talk about start-up needs. You should talk to people that have recently started labs and get lists of all of the lab purchases. You can update the prices with current catalogs. Do not worry about getting the best deals. In fact, overestimation is good at this point. You simply want an idea of the price range for a start-up package. If you use an expensive piece of equipment (generally more than $10,000 and often greater than $50,000), you will want to negotiate this as part of your start-up package. To argue persuasively, you need as much information as possible.

You need to get a quote for the exact instrument you need to do your work. Make extra copies of the quote as you will need to provide a copy to the department chair during negotiations. If it's super expensive (over $100,000), you will need to justify why this is the best form of this equipment. That is, how do competitors' products compare? It is even better if you have used the equipment before. Just saying you want it, without having tried it, makes for a harder sell for the school's purse strings. You will need to do this when you write the equipment section of a grant proposal, so this is good practice. Start-up costs are not limited to reagents and equipment. They also include travel to meetings, publication costs, getting a tech or postdoc's salary for at least one year, and core facility charges. See **Appendix G** for an example from 2004 for a cell biology lab. This will be discussed more extensively in the negotiations.

You will want to do some general homework and learn how much new faculty are making at different kinds of universities. Much of this information can be found for 2 and 4 year colleges at **http://data.chronicle.com**

and for these and additional schools at

https://www.insidehighered.com/aaup-compensation-survey/2015-2016?utm_source=ihe&utm_medium=editorial-site&utm_content=header-link&utm_campaign=aaup

This information will help during your interviews and at negotiation time. If asked your required salary, don't "low ball" yourself with an underestimate and don't ask for an outrageous salary, i.e. $300,000 as an assistant professor at a small liberal arts college in a small town.

Financial Preparation

You should be prepared financially for the job search. It will not be free. However, it should not cost you more than ~$500-1000. You will get reimbursed for most of it, but there is likely to be a delay between when you attend interviews and when you get reimbursed for your travel costs. If, for some reason, you don't have a credit card, get one before you anticipate scheduling interviews. If your credit limit is only $1000, you will probably want to raise it to $5000, simply to cover plane tickets that will eventually be reimbursed.

Finally, you will want to make sure that you have reasonable interview clothes and luggage. Very few institutions will expect you to wear a three-piece suit, but you can certainly wear one if you want. I don't recommend it. You will want clothes that would be considered at least business casual. This might include:

For men: An oxford shirt and slacks (khakis are fine, jeans are unacceptable), a necktie (bow is OK, but no wild or loud patterns), socks (I'm talking to you, California)- specifically dress socks, not athletic socks, and comfortable professional shoes that are in very good condition (no tennis shoes or sandals). Sweaters are fine. Sports coats are fine. No exposed t-shirts (I once saw a candidate unbutton his oxford shirt and expose the chest of his t-shirt for his job talk. Definitely too casual.). Clothes should fit well and be ironed. Check them out long before your interview. Based on personal experience, it's embarrassing to discover a pair of pants or collar is tighter than you remember.

For women: I'll defer to someone with more expertise in this area than I have. Karen Kelsky has extensive advice on dressing for faculty interviews. See Kelsky, Karen. "How to Pack and Dress for Your Campus Visit (Inc. Cold-Weather Tips.)" The Professor is in. 11/15/2011. **http://theprofessorisin.com/2011/11/15/1947/**

For Gender Non-binary Resources, please see suggested guidance at this link: https://uwosh.edu/career/wp-content/uploads/sites/38/2016/05/LGBTQandGenderNon-binaryResources.pdf

In addition:
-A small umbrella. It rained or snowed at several of my interviews, which are often in winter months.
-A clean jacket or coat in good shape. Think business casual. No jean jackets or sweatshirts.
-A briefcase, notecase or backpack in good shape. A ratty backpack is too casual. You're not famous enough to be eccentric, yet.
-Make sure you own or have access to a laptop computer and a memory stick.

Chapter 3. Applying for Faculty Positions

Now that you have your application materials prepared, you are ready to begin applying for faculty positions. The actual process will be time intensive, as you will need to be exhaustive in your search for ads that appear to be a good fit for your research and teaching interests. In addition, your application is not static. You may need to modify your application to fit with a job description.

When to apply?

Ads for faculty positions are posted throughout the year. However, there is a recruitment season in the US. It generally begins in August, when you will notice the number of faculty position ads begins to increase on the *Cell*/*Science*/*Nature* career websites (see below). A large number of ads will continue to be posted through late November/December. At this time, many applications will become due- usually December/January, though some applications are due by mid-October! (hence the importance of having your application materials prepared).

A quick note on application deadlines. As the name implies, these are the latest times that you can submit an application. This does NOT mean that you should wait until the deadline to submit your applications. Why? Because committees often begin scheduling interviews as soon as they receive excellent applications. You want to be in the first round of interviews. Your application will be given more consideration and there is likely to be more enthusiasm for it before search committees start getting burned out. In addition, many search committees plan to interview only 3-6 candidates. If those candidates have been selected before the deadline, then your chances of getting an interview are absolutely dependent on submitting your application as soon as possible.

To finish with the general application process timeline, interviews will begin as early as November and can run through April, though most finish in March. Second interviews usually happen between February and May. Letters of offer will be sent within days or a few weeks of the second interview (or even after the first interview at some schools). You typically have two weeks to a month to negotiate and respond to the letter of offer, though negotiations can go on for several months in some cases. Most positions will begin in August or later depending on when space is available and when (and if) you are expected to do any teaching. Thus, the entire process takes about a year, plus a few extra months during which you will prepare your application materials.

Where to Look for Job Postings?

There are five major sources of information concerning biomedical sciences faculty position openings:

- Journals- *Science*, *Cell*, and *Nature* list the majority of faculty position recruitment ads. The career advertisement websites for each journal are searchable and updated weekly or even daily. Using search terms can help narrow down the number of ads you have to sort through, but you may miss an opportunity because the ad doesn't contain one of your search terms. I used a rather obsessive approach. I searched each website at least once a week. I also subscribed to *Science* and went through all of the faculty recruitment ads. I did find a few ads that I had missed in my online search.

- Specialty journals- ASCB has a website with job listings. It is not as extensive as *Nature*/*Cell*/*Science*, but sometimes posted an ad before some of the other sites.

- Meetings- Check job boards at meetings. There usually aren't very many jobs advertised. However, because you attend meetings in your research areas, the job postings may be particularly relevant to you.

- Job postings in your Department- Many job search announcements are sent to department chairs or colleagues to identify suitable candidates. These letters or announcements are often posted on a job board in your department. While the number of postings is usually small, as with meetings, the job announcements are likely to be highly relevant to you.

- Word of mouth- It is a very good idea to let your colleagues know that you are on the market for a job. Sometimes, jobs are advertised by word of mouth. I found out about two job opportunities in this way. Also, when your advisor is at meetings or seminars, they may hear about an opportunity or can put in a good word for you.

-If you have any inside connections, use them. Let them know you are applying for the position and ask them to contact the chair of the search committee to put in a good word for you. Never underestimate the power of networking.

There are additional resources including *The Chronicle of Higher Education* (http://chronicle.com/jobs/), which has many job listings. However, these positions are primarily teaching positions with less emphasis on research. I have also looked on the websites of departments that interested me and sometimes found job postings. However, the listings were sometimes out of date or were later posted in *Science*. Focusing on *Cell*/*Nature*/*Science* should connect you to most biomedical sciences faculty position openings.

Here are some of the most popular:

- neurorumblr.com
- http://chroniclevitae.com
- http://neurojobs.sfn.org/jobs
- http://www.nature.com/naturejobs/science/
- http://jobs.sciencecareers.org
- http://careers.cell.com
- http://jobboard.ascb.org/jobs/
- http://careers.nationalpostdoc.org
- https://www.alleninstitute.org/what-we-do/brain-science/careers/job-search/
- http://chemjobber.blogspot.com/
- https://www.training.nih.gov/career_services/jobs
- https://startup.jobs/startups

Choosing which ads to respond to

As you review the job ads, you may see over 1000 ads for biomedical sciences faculty positions. Unless you are willing to adapt your application 1000 times and drive your reference letter writers crazy, you need to narrow down the number of ads to which you will respond.

Step 1. Identify the ads for which there is no match with your skills. If the ad clearly states that the department is seeking an NMR specialist and you work on *Drosophila* genetics without an NMR component, there is little point in applying to this ad.

Step 2. Identify places that you and your spouse/partner absolutely would not consider. Be careful here as you may be pleasantly surprised by some places. I grew up in a small town on the south coast of Oregon. Having never been in the Bronx and having only heard the horror stories about the south Bronx (in the 1970s), I had no interest in working there, much less living there. What a difference a visit can make! I became a professor in the Bronx at a Medical School in a safe working class Italian neighborhood. What's more, much as I love Manhattan, my wife and I chose to actually live in the Bronx. Who knew that we could find a single-family house with a yard and driveway in a small quiet seaside community that is part of New York City?

There are other considerations. First, would your significant other be able to find a job in the area? Unless you are wealthy and your spouse plans to be stay-at-home, this is a very important consideration. Though, with remote work options, this may now be less of an issue. In one place that I interviewed, I met a couple of faculty whose spouses could not find jobs in the area. This caused marital and financial strains. Second, how important is it to you to be able to hire postdocs? Schools in metropolitan areas will be able to attract postdocs and you will often have a pool of existing grad students that will become postdocs in the area. Postdocs are often married to postdocs and spouses will often seek jobs once the other spouse has found a job in the area. These individuals can be an important resource for new faculty. Finally, if there are places that you or your spouse absolutely won't live, don't apply to those places.

Step 3. Do your homework. After Steps 1 and 2, you should still have a hundred or more ads that you could potentially apply to. You now need to educate yourself about the institutions and the specific departments. I found viewing the department web page and faculty websites incredibly insightful. First, you can determine which journals faculty are publishing in. If most of the faculty generally publish infrequently or publish in low profile journals, the department is unlikely to be a research intensive department. Publishing metrics and choices are undergoing profound changes as I write this new edition in 2023. Preprints and a backlash against emphasis on journal impact factors (a poor metric inappropriately associated with journal quality) are changing the landscape for how research productivity is evaluated. However, one can still get a sense of how frequently people publish (which in many places can reflect time and resources available to complete studies). There may be heavy teaching requirements or faculty may not be well funded. Incidentally, you can learn about faculty/institution NIH funding by searching the NIH *RePORTER* database. Simply go to https://projectreporter.nih.gov/reporter.cfm, then to the NIH *RePORTER* Query form and type in the name of the institution in the "Institution" box. If only a couple of names/grants are retrieved, then most of the faculty are not NIH funded. Having an NIH grant is certainly not the most important thing in the world for all STEM faculty, but for many biomedical faculty it is a gold standard of research. In other STEM fields, there may be funding from the National Science Foundation (NSF)(https://www.nsf.gov/awardsearch/), Department of Defense (DoD)(https://publicaccess.dtic.mil/search/#/grants/grantHome), Department of Energy (DoE), and various foundations, such as the Howard Hughes Medical Institute (hhmi.org). If the department you are considering has a poor funding record, this may affect your ability to secure your own funding. Many grant application summary sheets include an evaluation of the suitability of the institution where the proposed research will be performed. I met people at schools that told me their grants were rejected because the school was not considered a research institution! Bear in mind that many schools and departments are unabashedly viewing you as a source of future revenue (as well as a future colleague). At most institutions, you will be expected to obtain grants- especially grants that pay overhead. If most people are not NIH funded, this may not be a very realistic expectation for your own biomedical research program. Another point to consider, as my mentors at NIH emphasized, an R01 is portable. If you go through the entire job application process, get a position, get an R01, and then decide that you

want to change institutions, you have options. The R01 will give other institutions reason to consider you if you apply for a new job.

There are other important things that you learn from a department web site. If each faculty member's website includes information about the courses that they teach and office hours, it is likely that there is a significant teaching load in this department.

Look closely at the research interests of the faculty. Do other people have research interests that relate to any of yours? I found one department in which almost everyone worked on aspects of cardiac function. I didn't think this would be a good fit with my research interests in cell biology of the secretory pathway. Alternatively, some departments are general biology and there may only be one or two cell biologists (for example) in the department. Will this be an sufficient peer group for you? Remember that your daily interactions will be in your institution and if you are the only cell biologist (again, for example), you may not have many people to bounce ideas off of or who can give you feedback on a manuscript or grant proposal. In addition, you will need people each with different expertise to collaborate with you on your research or to operate core facilities. Finally, never underestimate the convenience of being able to borrow reagents or equipment from other members of your department. That said, do not constrain your investigation to just the department of interest. Maybe there are potential colleagues or collaborators in other departments. For example, while I'm a cell biologist, I had many collaborations with faculty in Biochemistry.

Now focus on the assistant professor web sites in particular. What kind of publications and how many do they have? Look especially at publications in which they are not the senior author. These are likely to be publications from their postdoctoral research. This is a potential window into what kinds of expectations the search committee will have in terms of publications. If your CV is far outside of the publication records of the assistant professors' postdoc years, the institution may not be a good fit. That is, if the assistant professors have multiple papers in high profile journals, the search committee probably has high expectations. However, as noted in Chapter 1, there are multiple pathways to getting a faculty positions. For example, your expertise in a new technology may trump your relatively few publications. And absolute number of publications is only one component by which one is evaluated.

Many departments post their seminar series. Do many speakers visit the department? Are you likely to be interested in meeting with these speakers? Remember, as a faculty member, you will often meet with visiting seminar speakers for upwards of a whole hour. Also, invited speakers are your chance to hear about the rest of the research world (when you aren't attending meetings).

Look at department/institution facilities. Many departments will have links to core facilities and may highlight special equipment in the department- confocal microscopes, mass spec, supercomputing, etc. If the department/institution lacks resources, this could affect your research program. On the bright side, some departments are seeking to expand their resources and hiring you may be part of that process. I applied to several departments seeking to expand their microscopy expertise. The departments were waiting for a new faculty member to specify the type of microscope before purchasing one.

The last thing to notice is the ratio of assistant to associate and full professors in the department. If there are only full professors, you may be the only young person in the department. This is not necessarily any sort of deal breaker. There are several potential explanations for the imbalance and it is worth inquiring about, should you get an interview.

In the end, imagine yourself in that department. If you have a difficult time imagining yourself fitting into the department, then it may not be right for you. That said, websites are not always frequently updated and this version of the department may be out of date. New hires may not yet have started. Therefore, my suggestions for evaluation should be taken as one way for you to gather data. If this is a place you think you want to be, then dig deeper and talk to someone who can answer your questions.

After viewing department websites, you should have a good idea of where you will apply. You may still have a long list of ads. People often ask me how many places to apply to. I applied to 75 places. This is a large number of applications. My rationale was that I would maximize my chances. In the end, I got eight interviews and six job offers. One of my colleagues sent out fifty applications and got 20 interviews and 12 offers. Remember, the number of people applying for each position can be in the hundreds. Even if you are a good candidate, some of the other applicants will be stellar. Also, some departments are looking for something in particular and it may not be explicit in the ad. Or you could be strong scientifically, but too expensive of a hire for a department. My view is once you have your application materials assembled, with a little additional work to tailor your application, you have another chance to enter the job lottery. However, in this lottery, you probably only want to buy 50-75 chances at most.

Organizing your application files

Keeping track of 50-75 applications requires some organization. It is important to know what you sent, when you sent it, and to remember what job you actually applied for. My low tech system consisted of clipping each ad from Science or printing an internet posted ad, taping or pasting it to a manila folder, and then indicating on the folder dates of actions, such as sending materials, requesting letters of reference, etc. Electronic folders today are fine. You may ask why have a folder?, if all you did was submit materials. The folder is needed because you will receive materials back from the search committee. No, not your rejected application! You will get an email acknowledging receipt of your application and indicating whether you are missing any materials- usually a letter of reference. If everything goes well, you will also fill the folder with correspondence, interview schedules, acceptance letters, etc.

Tailoring your application

Now that you have narrowed down which ads you will respond to, you will need to tailor your application. At the very least, you will need to modify your cover letter to indicate which school and job you are applying for. To make your application more attractive, you will want to respond *specifically* to the ad. For example, in your cover letter you may have chosen to emphasize your work on organelle biology. However, a particular ad is seeking someone with expertise in cell biology and modern imaging techniques. For this ad, you will want to include a few sentences in your cover letter mentioning that you use quantitative imaging, FRET, FRAP, etc., to address your research questions. In addition, you would want to modify your research proposal to add a few sentences mentioning how you have used imaging techniques to address your questions and how you will incorporate imaging into your future research. For another example, an ad is seeking someone with a focus on cancer biology. Your proposal highlighted the basic cell biology of your research and that there is a potential relevance to cancer. If you want to apply to this ad, you will need to develop the relevance to cancer angle. Conversely, if the ad is more focused on basic cell biology, you should consider emphasizing the mechanism in your system and that there is a relevance to cancer. As mentioned in the section on your research statement (Chapter 2, section 2), it is generally a good idea to emphasize expertise with technology and disease relevance no matter what ad you are responding to.

In some cases, you may wish to overhaul your application more extensively. The primary example for this is when one is applying for a position with a high teaching load. You will need to emphasize your teaching experience and abilities. In your CV and Teaching Philosophy, you will want to highlight details including how many students you had per class, how many lectures you presented and how often, what textbooks you used, whether you co-taught courses or you were the course

organizer, any evaluation metrics for your teaching, whether you used particular styles (i.e. Team Based Learning) or technologies (i.e. electronic voting clickers), etc.

Another way to help your application standout is to match your references with the research focus in the ad. That is, you may wish to select referees depending on their expertise and reputation relative to the expertise sought in the ad. For example, say that you find an ad that is seeking an expert in confocal microscopy. If you have a collaborator that is well recognized in live cell imaging and the collaborator can write about your skills as a microscopist, this collaborator would be an excellent choice for that ad. It is more likely that someone on the search committee would recognize your referee and that could enhance your chances of getting invited for an interview.

Sending the applications

Once you have tailored your application, you can now prepare to send the application. First, check the ad very carefully to identify all of the requested materials. I underlined every requested item and checked them off as I assembled the applications.

Second, you submit your application by email or a website portal. Make sure you read carefully what format your application materials need to be in, e.g., PDF, MS Word, etc.

Follow-up

Once you have sent your application materials, check off on your list that you submitted an application to each institution on such and such date. You should receive confirmation of receipt of your materials. Most portals will contact your referees for letters of reference. If not, do follow up with your referees to confirm when letters have been sent. Then you play the waiting game.

You may be surprised, but your application still isn't actually complete. Until you receive a rejection letter from that school, you should update the search committee on any relevant progress. What constitutes noteworthy progress? Getting a manuscript accepted, posting a preprint, winning a prestigious award or getting a grant are the most noteworthy forms of progress. When you can report this progress, it is acceptable to include other, lesser accomplishments and activities- attending a meeting, getting a talk at a meeting, submitting middle author manuscripts, winning travel awards, giving an invited talk (though generally not other job talks), attending workshops, etc. These updates should either be sent by email or via a web portal, if that is an option. The letter should be prepared in a formal format, similar to your cover letter. See **Appendix F**.

Chapter 4. Rejection

Unless you have a stellar CV and are a perfect fit for all of the search committees, you WILL receive rejection letters. This is not necessarily a rejection of you or your science. A rejection means that there were other candidates that better matched the search committee's ideal. The people that weren't rejected may have more publications than you, a specific expertise, may personally know people on the search committee or any other number of possibilities.

Getting a rejection is disheartening and getting a lot of rejections is downright depressing. However, it is a matter of perspective. I applied for 75 jobs and received 67 rejections! Yet, I got eight interviews, six job offers, and a job that I loved. Just as with screening bacterial colonies for a cloned plasmid, it only takes one positive colony for the experiment to succeed. If you're not a molecular biologist, think of it as purchasing 75 lottery tickets and one actually wins the lottery. I suppose you could be disappointed about the 74 losing tickets, but you're going to have a very difficult life as a scientist with that attitude.

Not all rejections will be impersonal form letters. One department chair sent me the nicest rejection I've ever received. The chair was extremely apologetic and praised my credentials. The chair wrote that the school had recently invested in a new facility and needed researchers with a specific expertise appropriate for that facility. Because my research did not fit with the goals of the new facility, the search committee wouldn't be able to further consider my application. Life would be easier for everyone if search committees are more transparent about goals for the hire. Having now served on search committees, I can confirm that we get some excellent applicants that simply don't fit with what the committee is seeking.

What if the worst-case scenario happens and all of your applications are rejected? You can take four courses of action. First, you can curse the charlatans and frauds that failed to recognize your genius and go start a lab on a deserted island and plot the overthrow of the world governments and the destruction of your nemeses. This has a certain appeal, but then you would have to deal with the inevitable James Bond types and the villains (that's you) usually don't fare too well in these struggles. Second, you can just send out more applications. It doesn't cost you more than your time. Third, you can give up on a faculty position and seek a different career path. Fourth, you can get feedback from several people that can help you improve your application. Talk to your advisor about preparing more manuscripts. Talk with people at your current or graduate institutions about what a search committee is seeking and get their critical appraisal of your full application materials. Consider doing a second postdoc to strengthen your credentials or get more preliminary data. Get some teaching experience. Apply for transition awards- good money for you now and great money for when you start your lab. In short, develop a practical strategy that will make you much stronger in the eyes of a search committee the next time you apply for a faculty position.

There is one other scenario that needs to be discussed in the rejection chapter. What if you get interviews, but don't get a job offer? Each case is obviously unique, but there are a couple of ways to view the rejection. If you only get one interview and don't get an offer, you are probably a borderline candidate. You have some excellent qualities, but other candidates can offer a more complete package – more and better publications, transition award funding, greater expertise, more experience, etc. Take the interview invitation as encouragement, apply for more positions and strengthen your application in the ways suggested in the preceding paragraph. Also, more preliminary data might help.

If you get several interviews (three or more) and do not get a job offer, then you have a couple of different concerns. You may be a borderline candidate, but the evidence of multiple interview invitations argues that you ***are*** a desirable candidate on paper. You definitely need to improve your interview skills and need to get some critical feedback on what you aren't doing well enough with your chalk talk, job talk or maybe even interpersonal skills over dinner or during one-on-one meetings. I still

remember a candidate that looked great on paper and then we had our one-on-one meeting. I began trying to tell him about my cell biology work and he cut the conversation short by stating he was NOT a cell biologist. Note, he was not inviting me to explain my system to a non-expert. He was terminating the conversation as irrelevant to his science or interests. In other words, he woefully failed the potential future colleague test. Hopefully, the strategies described in the next section will help you be well prepared to come across strongly in your own interviews.

Chapter 5. Job Talks and Chalk Talks

The Job Talk and Chalk Talk are make-or-break events for you. These are the only opportunities that some faculty may have to see you. These events will tell the search committee several things about you:

1) Can you articulate your plans for your future research?
2) Does your research appear to be fundable?
3) How well do you understand your own research and can you relate it to other fields?
4) Can you answer questions clearly and thoughtfully?
5) Can you teach? Can you explain your research to non-experts?
6) How well do you perform under pressure?
7) Are you interesting and enthusiastic?

How to Prepare and Deliver a Job Talk

The keys to an outstanding job talk are to make sure that everyone understands what you are doing, why you are doing it, and how you plan to advance your research program in the future. Most job candidates get the "what" and "how" parts more or less correct. The biggest downfall of many talks is the "why" part. If you believe it is self-evident that your research is brilliant, a boon to mankind, and so simple a child could understand it, you are probably in for a shock. You will be interviewing in a department of faculty with diverse research interests, as well as much less experienced post-docs and graduate students. Even if everyone in your department also works on immunology, it is still essential that you should not assume that everyone will be familiar with your particular methods, your research focus or even why anyone should care about your research focus.

Equally importantly, you need to engage your audience. Make them interested in your research and make them want to know more. Own your subject. It should be clear that you are an expert in your area and understand how your research relates to other fields (especially the fields of study of the other faculty members). Convince the audience that you would be an asset to the department. Your research, expertise, and future fundable research will make you an outstanding colleague.

The Actual Job Talk

Your seminar should be able to introduce a broad audience to your topic. Remember, members of your audience may be unfamiliar with your research area. In addition, you will be judged on your ability to convey your message and teach. A clear presentation is critical. How to give a clear presentation is something you have hopefully already learned. Below I provide some reminders and suggestions that may be helpful when talking to an audience that is probably more diverse in backgrounds and interests than you may be used to.

1. Introduction: You can make your audience much more comfortable by providing sufficient background for understanding your research. Have at least 2 or 3 introductory slides. Start broad and then focus. This background should include the following:

a. Frame the big picture. If you work on G-proteins and say that you are most interested in members of the X subfamily, that IS NOT the big picture. Let the audience members know why they should care about your research. Are you working on something relevant to disease or fundamental biology? Start at this level and then relate your problem to the big picture.

Start with big questions: Regulation of cellular processes is critical to cellular homeostasis. Understanding the mechanisms responsible for regulation is critical for understanding cancer/disease x/development/etc. Process X is important because.... A key regulatory component of process X is Y, a 7 membrane domain G protein.... This part of a larger family etc.

Job Talk Introduction Example 1.

I work on family members of the X family of G-proteins that are important for cancer.
These proteins are homologous in the P and N regions.
We made mutations, etc. etc. etc.

Job Talk Introduction Example 2

Understanding the biological basis of breast cancer can help in identifying biological markers to detect breast cancer earlier and will hopefully identify new therapeutic targets.

As with all cancers, regulation of the cell cycle is fundamentally altered in breast cancer. [Include slide briefly outlining cell cycle and cancer cell escape from cell cycle.]

Work in our lab and in others has demonstrated that a family of signaling proteins, the X family of G-proteins, are necessary for escape from regulation by the cell cycle in breast cancer.

The general characteristics of G-proteins are A, B, and C.

The X family members share homologous sequences in the regions termed P and N.

To determine how these proteins promote escape from the cell cycle in breast cancer, we made a series of mutations in the P and N regions.

Obviously, Example 2 is much more detailed. More importantly, the average biologist could follow this talk. Example 1 is only going to be relevant to experts in the X family of G-proteins. The point is not to dumb down your talk or to be hyper detailed either, but rather to give all of your audience members, graduate students and faculty alike, the opportunity to understand why you care about your research and why they should, too.

Another way to begin a talk is with a commonly understandable story or analogy. If everyone nods in recognition (they can identify with that situation, they get the point), they'll have a frame of reference for your research problem, they'll be more engaged. It is very important to test stories and analogies with naïve audiences, as the story could be too long, too obscure or missing key information that helps listeners make the connection.

2. The Body of the Presentation: You're going to tell a key story from your postdoctoral studies. I suggest minimizing the urge to tell multiple stories. It can work in some cases, but generally, you want your audience to be able easily follow and remember what you worked on successfully. The things I most often suggest are:

- Set up each experiment. Start with the question. State the anticipated outcome/answer. Then tell the audience how you tested the idea (the actual experiment). First show the control outcome, then show the outcome for the question and compare and contrast. Why? Simply put, if you want to say, "we were surprised by this outcome," you want the audience to be surprised, too. Remember, they did not do the experiment and probably are not in your field. It's not going to be a surprise if they do not know what was expected and why. Finally, state what you concluded from the experiment and this then led you to…. Next slide.

- Minimize text. Make sure everything is big enough to read from the back of a room. Make sure you label axes, provide legends for the different graph components in each slide, and make the point very easy to conclude from the data. Your paper figure may be the most detailed way to explain something, but it could be too complex for a talk.

- You will cover many points in your talk. You should not create a series of paragraphs or have tens of sentences in your summary slide (or ANY slide for that matter). Keep words to a minimum. Think "sound-bites." Memorize any long sentences or paragraphs instead of putting them on your slide. Better yet, instead of a summary slide filled with text, consider showing your findings in a model or some sort of graphic. Graphics and models can convey your point better and you can still say the things you were going to read in the summary slide.

- Future Directions. Your talk will need to include at least five minutes related to future directions for your research and a brief(!) description of what you will do in your first few years as an assistant professor. Some people will not be attending your chalk talk or there may not even be a chalk talk (see below). Make sure your future directions make sense in the context of your talk. If your future aims are a completely different project, then make sure you have enough time to provide a brief introduction to the new project and then explain what the important questions are and how you will address them.

- Acknowledgements. This slide is almost always abused. Clearly there are a number of people that you work with and that contributed to your project. Generally, your audience doesn't know these people and, frankly, doesn't care. You don't need to read off everyone's name. To cut down on your presentation time and to avoid boring your audience, you can abbreviate the acknowledgements by simply displaying the slide and stating, "This work was performed in the laboratory of *your PI* and in collaboration with a key *collaborator's name*." Also, DO thank all of your funding sources.

3. Slide Design

Use a sufficiently large easy to read font- Helvetica, Arial, Times in 16 point or larger.

Restrain your inner-PowerPoint artist and keep your slides simple. Avoid fancy backgrounds. Elaborate slide layouts are distracting. Be careful with color choices. Certain colors are not compatible. Red lines or red letters on blue or black backgrounds are very difficult to see. Black lettering on white backgrounds and yellow or white lettering on blue or black backgrounds work exceptionally well. Other color combinations are certainly possible. Be aware that some of your audience members may be colorblind. For a helpful discussion on use of colors and other tips, see "Tips for Creating and Delivering an Effective Presentation." Microsoft Office (c2007.) https://support.office.com/en-us/article/Tips-for-creating-and-delivering-an-effective-presentation-f43156b0-20d2-4c51-8345-0c337cefb88b Also, see Naegle K. 2021 PLOS Computational Biology. *https://doi.org/10.1371/journal.pcbi.1009554*

Avoid filling slides with more than one big idea. Only include information/data that is needed. Do NOT cram your slide with text or too many pieces of data. Make the effort to tailor your slides. Slides made from a paper figure that includes something you're not going to cover are bad slides. This is a talk, not a journal club. You should make the figure that you need, not just a figure that fills space or sort of addresses your point. The figure should be easy to understand. Your viewer will only get a few seconds to a minute to try and understand your figure. If it's too complicated, you will lose your viewers and you will have a sleeping audience or people reading their emails. I've frequently heard the advice that no one ever complained about slides being too easy to understand. While I do not have space to go into all of the details of slide design, I can think of at least two common examples of slides that are unnecessarily complicated.

i) FACS analysis slides or some other data slide where presenters wallpaper the slide with numerous experiments. Inevitably, speakers will put from six to 20 (!) FACS profiles (or other experiments) on the same slide. Your audience will rarely be full of FACS experts and even the experts like to be able easily see and evaluate the data. The more experiments per slide, the more potential for confusion. Limit the number of profiles so that your audience will know exactly which profile you want them to focus on.

ii) Tables. Tables from your journal articles don't necessarily work well for slides. Usually, there are too many columns, which often are not important to your talk. It is well worth your time to simplify your tables. For example, including n, the actual p value or other details of statistics is rarely necessary. A simple * for statistical significance is usually adequate.

Finally, absolutely, positively, without fail, be sure to **properly reference all materials in your slides**. If it's a figure you did not make, provide a reference. If it's someone else's data, reference it. If it's from your lab mate's lab meeting, reference it. If you pulled it off some place on the web, reference it. Don't be a data thief. Don't let your committee think that you are unclear on the unacceptability of plagiarism.

4. Managing Questions: During your training as a graduate student and a postdoc, you have gained experience handling questions from the audience. Here are some general reminders and pointers.

Anticipate questions. What are the things that are most interesting or most controversial about your work? Does your research conflict with that of another major research lab? If so, be able to discuss what validates your approach and be careful not to be derogatory about the other research groups with a different viewpoint. Your audience may include people that are personal friends with the other research groups.

The most important aspect of answering questions is that you do it gracefully and that you can make the questioner feel like he/she asked a good question, no matter how goofy the question might be. For example:

Good introductions for your responses:

That’s a great question!
You raise a good point!
I hadn’t been thinking along those lines, but that’s an interesting idea.

Sometimes, you’ll get an odd question that you have no idea how to answer. To make you and the questioner look better, try to get at the real question. For example:

Let me rephrase your question to make sure I understand it.
That’s an interesting idea. Could you expand a bit on that?
I have to confess that I’m not familiar with that cell type, protein family, etc…
Could you expand a bit on how you are thinking about this problem?

Silence is not golden during your talk. Frequently (and hopefully), you will get questions during your talk. You should not be phased by this. Remember that anyone asking questions is paying attention. No questions may mean no one cares or no one understands. You need to be comfortable with being interrupted during your talk. Practice, if needed.

Hostile or aggressive questions. Rarely, a questioner will ask questions that are not friendly. The question may be intended to test you or, even more rarely, to even humiliate you. I mention this to simply note that it can happen. Some questioners are simply grumpy people, but others may have ulterior motives. In some cases, the questioner may even be competing with you for the same job. I've seen it happen. The key is not to get upset and not to get drawn into an argument. You need to be professional and mature. Be gracious with a response that thanks the questioner and then just answer the question as best you can in a dispassionate manner. The audience will see that you are calm and the hostile questioner is being a jerk. This happened to me during one of my interviews. I took the aggressive questions in stride and afterwards, the members of the committee apologized profusely to me regarding the rude questioner. Remember that most interviews are a two-way street. The committee is evaluating you, but they are also trying to recruit you. You would be unlikely to accept an offer if you had an exceptionally negative interview experience. Most committees are (or should be) aware of the importance of portraying their institution in a positive light.

Excessive Questions. Sometimes, there are simply too many questions during your talk. Frequent interruptions can cut into your talk time. A few questions are OK and you should anticipate them when planning your talk. This is one reason a 45 minute talk can be a good way to absorb questions without cutting off your story. If you start getting a large number of questions, you could run out of time. Politely ask if you can defer the rest of the questions until the end of the talk because you recognize are short on time.

Job Talk Preparation

Ask your contact during the initial phone or zoom interview (see Chapter 6) if there is any particular aspect of your research or expertise that caught the attention of the search committee. This could be a direct clue as to what the committee will want to hear about in your job and chalk talks. For example, our department held a search for candidates with expertise in imaging and microscope building. Many of the candidates directed their talks almost entirely towards their biological questions and glossed over their ability to develop microscopes, the mechanics of their instruments, and their future plans for microscope development. While the candidate seminars demonstrated strong biology, they failed to discuss what the committee was most interested in learning about the candidates.

Practice your talk until you feel comfortable when giving it. If you are relaxed, almost everyone else will be, too. Practice your talk in front of a naïve audience. It can be helpful to have your PI or your lab mates sit through a practice talk. However, your real audience will be people that are unfamiliar with your research. Therefore, it is critical that you get feedback from people from another department or even some nonscientists. Your talk needs to be clear to an audience that may include both people in your field, as well as people working on radically different areas of science. I gave my cell biology talk at one institution to an audience that included experts on the neurobiology of songbirds, feeding behaviors of snakes, and development in fish.

The feedback you need is whether your talk is interesting for and makes any sense to a naïve audience. Many people want to be encouraging or suggest minor changes that do not get at fundamental problems. You need explicit feedback from people who can be candid and constructively critical. It is not always easy to find such people, but you should make the effort to find them. The same type of people will be valuable for evaluating your grant proposals when you start your faculty position. Ask your test audience to specifically comment on:

- Is your talk interesting?

- Is it clear what you are working on and why this is an important problem? Is your Introduction clear?
- Are your slides easy to understand? Are the images easy to see? Are there too many ideas or words on your slides?
- Does your talk seem rushed?

Note that asking for feedback on these things in a way that one can answer yes or no is not helpful for you. Get detailed responses. Ask your feedback providers to describe what they like, what does not work, *how* something is difficult to understand, etc.

Time your talk. It must be done well before the hour is up. People will leave for other meetings if you go over your hour. Ideal time is 45 minutes to allow for time for questions both during and after your talk. By 45 minutes, I mean a comfortable 45 minutes. Your talk should not feel rushed to cram in 60 or 70 slides. Also, your talk will rarely start on the hour. Rather, the host will wait until 5 minutes after the posted start time. There could be 1-2 minutes of introduction of you. These delays cut into your available talk time. No one cares about giving you a full 60 minutes. They care about getting to their next agenda item by the start (or 5 minutes after the start) of the next hour.

Nobody will complain if your talk is less than 50 minutes. I did attend one job talk that was only about 35 minutes. That was awkward and ultimately bad. Many members of the search committee concluded that the exceptionally short time indicated that the candidate had not accomplished much as a postdoc. After 3-5 years of being a postdoc, hopefully your dilemma is making your talk fit into the allotted time, not trying to figure out how to fill 45-50 minutes of time.

Movies

Movies are a double-edged sword. Including movies in your talk will automatically attract the attention of your audience. Our eyes are naturally drawn towards movement. If you are a microscopist, movies show off your imaging skills and often convey more dynamics that are not always apparent in a static series of images from the movie. If you have a lot of static images, a movie of your model or of a mouse phenotype, can break up the monotony of slides of words, tables or gels. However, deciding to include movies in your presentation comes with a price. The movie will eat up presentation time and more importantly, the movie may not work. Still a problem even in 2023. If the movie file is large or you are running your presentation from the cloud a memory stick, your movie may not be correctly linked to your presentation. Obviously, crashing your presentation or failing to run the movie is not going to impress your audience. Therefore, test your presentation under various computer conditions that you are likely to encounter: on your laptop, transferring your talk to another laptop from the memory stick, and on an alternative operating system. The final test is to run through your slides and movies immediately before your talk. Run the talk in "slide show" presentation mode, not in the "normal view" mode of PowerPoint. Test whether ALL of your movies will play. If not, take them out and improvise. You can also prepare a static series of images slide to use in place of your movie if there are any concerns with a particular movie.

Images and System Compatibility

Test your talk on other computers to make sure that your images and files can be read. Mac PowerPoint presentations can have issues with PC computers. If you use an Apple computer (Mac) or PC, then you may find that certain images in your PowerPoint presentation will not display properly between the two systems. System resolutions can also affect your slides.

For the reasons described above, it may be worth preparing both a PC and Apple version of your talk (if you use Mac, otherwise PC alone should be OK). Test this before traveling to your interview. Your laptop could fail and if you have to put your talk on a PC.

If possible, practice your talk with a remote slide advancer/pointer. You may wish to purchase your own. Knowing how to advance or reverse your slides and start your movies has a significant impact on the impression you make- confident and capable vs. flustered and technologically awkward. Seriously. This little item can be purchased for $35-50 and mastering it before your job talk can help you focus on the content of your science instead of having a bad presentation. Don't forget back-up batteries. Be wary of using the host's slide advancer because it may simply work differently from your own and you could appear awkward with your otherwise well-rehearsed talk.

Don't forget your power cord or video adapter for your computer (especially if you use an Apple notebook). I have attended at least two talks that were delayed for fifteen minutes while hosts frantically tried to find a video adapter for the speaker. You don't get those 15 minutes back.

Bring a 10' power cord. You don't need a heavy industrial cord, just something that will accept your computer power cord. I have given talks in more than a few places where the nearest outlet was beyond the reach of my computer power cord. Not all places will have an extension cord available. While this may sound like overkill, it can be the difference between your computer running out of power and a flawless talk.

Turn off your screen saver and energy saver on your computer. It is distracting when the computer screen goes blank or shows a series of pictures of your trip to the Galapagos, especially if you're answering a long question.

Familiarize yourself with the operation of video projectors. Many departments do not always have an expert available and you may need to set up the projector and connect your computer yourself. In addition, many well meaning hosts do not know how to improve image quality on a projector. If you have movies or dark images, knowing how to properly adjust brightness or contrast is the difference between showing people your research and saying "Um… It looks fine on my computer, but not here on the screen, so you'll have to trust me" during your job talk.

The Chalk Talk

Not all interviews will include a chalk talk. I gave a total of four chalk talks out of eight interviews. Each one of the chalk talks followed a different format. The common theme was that it felt a lot like I was taking my graduate school qualifying exam, again.

A chalk talk typically will consist of you outlining the first 6-10 years of your research program (about the time it takes to get to tenure, in departments that have tenure) in front of the department faculty and often faculty from other departments. You may be permitted to present a short PowerPoint slide presentation (one of my own chalk talks) or you may be expected to only use chalk (or white board markers) (my other three chalk talks).

Preparing for a chalk talk is at least as important as your Job Talk (and often more important).

The Chalk Talk, simple in principle. The first question I usually get about chalk talks is, what is a chalk talk? It is a 30-60 minute session with department members to discuss your research plans for the next 5-10 years. The format is usually simple: you, department faculty, maybe other faculty, dry erase markers, and a white board. You will describe how you will break open your research field with significant progress on the problem you have chosen, how you will overcome technical obstacles, your

alternative approaches, potential for collaborations, critiques of your postdoctoral research, etc. You'll introduce the problem, what you see as significant about solving this problem, your key hypothesis, and the aims for testing the hypothesis and solving your problem. Think of it as an updated version of your graduate qualifier. You must be able to explain why your proposal is significant, why you, why your approach is the best approach, and what your alternative backup strategies/approaches will be.

Sometimes, you may be given the option to give a PowerPoint presentation. I believe PowerPoint slides can suffocate an exciting idea in a swamp of unnecessary distracting details. It is tempting to use slides as a crutch to cover for a thin proposal. If you can avoid using PowerPoint, I strongly recommend it. Chalk or markers force people to be clear and succinct.

You DO NOT need to present a detailed review of your field or the finer points of your techniques. You DO need to know the literature of your field and all of the caveats of a technique and alternatives for an approach, if asked. The key to a chalk talk is to engage your audience. Get them excited about your problem. Then convince them that you have a solution. It's that initial part about engaging the audience that is so vital because it's difficult to get attention back once an audience member loses interest and starts looking at their email.

Key things to think about when developing your Chalk Talk.

These items should be part of the beginning of your chalk talk. These should be plainly stated. I would not recommend putting these into slide format. You want people to focus on you and your ideas. Slides will be distracting.

1. **What is the big question?** This should be something that anyone could relate to, that people would agree is important to understand. These should be high level versions of the problem. You'll get more specific further into your intro, but the initial engagement needs to be understandable by anyone, at best, or someone that has a college undergraduate education at a minimum (1-2 sentences). For example:

Distinguishing correctly folded and misfolded proteins is essential for human health. Failure to do so is implicated in several human diseases.

Proper patterning of cells and tissues is fundamental to development. I'm interested in how cells find their way to the correct positions in tissues.

How does the brain distinguish different human faces?

How does sleep improve memory formation?

What role does our own immune system play in causing tumor cells to metastasize?

2. Why is this a significant problem? This could be related to a disease, but it could also be fundamental research. For example, determining how a process is regulated may not be immediately connected to a disease, but the basic biology could open entirely new lines of inquiry, could turn out to be important for diseases in unexpected ways or could even represent a solution to a long-standing problem. For example, knowing how a neuron circuit in flies regulates a simple fly behavior sounds like a very specialized problem. Yet, this is a big opportunity in neuroscience to determine the mechanism of behavior because we have a map of all of the fly brain neurons, as well as several genetic lines for which individual neurons can be

turned on and off. This would achieve a long-standing goal in neuroscience, describe a solution for this general problem of neurons and behaviors, and lay the groundwork for studying the problem in more complex organisms.

3. **What is the knowledge gap in the field?** What specific problem are you going to solve and what have been/are the barriers to solving it? **(2-3 sentences)** For example, if one was talking about the immune cell example, you might say: We know that communication between immune and tumor cells is critical for tumor cells to leave the main tumor and colonize other parts of the body. Macrophages produce IL4, which regulates tumor metastasis. Due to a need for high resolution microscopy and new tools for distinguishing between different modes of IL4 delivery, it has not been possible to determine how IL4 is delivered and thus how it might be prevented.

4. **Simply stated, what are your aims?** How will your approach resolve this problem? You could fully describe your official aims, but I suggest distilling them into simple goals/outcomes with a note on methods. This isn't the time to go into detail.

5. **State how successfully completing the research will advance the field, create a new field, impact disease treatment, have broader impacts etc., again in clear terms.** e.g., Working out the mechanism and a model of how flies avoid colliding with walls will establish the workings of a complete neural circuit, reveal how flies perform a complex task, and potentially use biology to inform how self driven cars could better navigate around objects.

Note that the previous list is all fairly concrete. Listeners could agree when a task has been successfully completed. In contrast, vague outcomes are problematic. For example, a list of genes or writing *"Implications for human disease"* is practically meaningless. Instead, consider *"Defining the components and steps in this pathway will enable us to identify potential targets for therapeutic interventions."* A problem has been solved. You do need to be able to deliver on a solution that everyone will agree is a meaningful concrete outcome, not just a list of stuff.

6. **It will be a bonus if you can state which institute/study section you will be submitting the proposal to and if you can say that you have spoken to the program officer (state who this is) about your proposal.**

Note that this is only the first 5-10 minutes of the chalk talk. This part is so critical because you want to give an overview so that everyone knows the summary of your proposal. This is because it is rare to make it through all of the details of the aims as you present them later in the chalk talk. You will be interrupted and asked numerous questions. It will be easier to focus on the questions when you're secure in the knowledge that you have given everyone a simple plain language map of where you are going and what you expect. You will spend up to 10 minutes providing the overview, another 20 minutes presenting two of your aims, and will be frequently interrupted with questions (another 30 minutes). For the rest of the chalk talk, as with your job talk, avoid the temptation to provide too many details. Reverse engineer your chalk talk. Identify the key points you want to convey for each section or aim. Make sure those get priority. The fine details for aficionados should be reserved for answering questions.

You will be asked questions about anything related to your research. The audience may be generally friendly or may be very aggressive. The aggressive people may be doing this to try and provoke you to see how you perform under stress. In two of the chalk talks I gave, at least one

questioner was openly hostile and asked pointed and even insulting questions. Defending yourself under these circumstances can be a disconcerting prospect. It is difficult to divine a questioner's intention, so simply assume that all questions are serious and deserve a gracious, intelligent, and serious response- no matter how outrageous the question may be. If the questioner is genuinely hostile and behaving inappropriately, other faculty may chastise the questioner for being unreasonable. Be gracious and give the hostile questioner credit for asking important or insightful questions, regardless. This person may be your future colleague and it is possible that you may win him or her over by not being dismissive of the questions.

It is important to remain calm, admit when you don't know something, admit when you were incorrect, and defend what you know is correct. You will be evaluated on how you develop and defend your ideas, as well as the overall fundability of your proposal.

Typical questions include:

1) How will you compete with others in your field? What makes your research proposal unique? (NOTE: You should know who your competitors are by name and how your research differs from their work or what edge you have to make study sections want to fund your research). How will you avoid competing (or distinguish yourself from) with your advisor?

2) What if your approach doesn't work? What then?

3) Are there any downsides or limitations to your approach/tool?

4) What is your dream experiment and the anticipate result? Or What is the first experiment/aim/thing you will do in your new lab? Why?

5) What do you need from our institution to successfully execute your proposal? This is an important question. You are explaining WHY you think this institution would be a good fit for your program's development. If your research could really be done anywhere, that's nice, but it would still be better for you to have an answer that makes the case that it is in your interest to be at this specific institution.

6) Is there any potential for collaborations within this department or institution? Be careful not to commit yourself or anyone else to collaborations unless you have already discussed this before your chalk talk. No one likes to be roped into something that they did not agree to. Also, you have a research program that you need to get off the ground. You need to focus. Collaborations can be great or they can be a miserable

7) We have undergraduates that are seeking research experiences. Do you have projects that would be suitable for them? How might they participate in your research program?

8) What will you do if everything you propose is completed by another lab by the time you start your new lab? Don't panic! This is not to see what you will do if you can't do what you proposed. Rather this is a chance to see if you have a longer term view of your project, as in "That would be great! Upon verifying the other lab's results, I could now start working on the next stage of my program and …"

9) You said you want to use GFP for your studies. Which GFP and why? Note that I ask this question simply because many fluorescent proteins have serious caveats for certain applications, especially protein fusions. If the candidate is unaware of these issues, this is not a deal breaker, but I am

disappointed that the candidate's project might be derailed by a lack of knowledge of their own tools. Also, a candidate could counteract my perception by doing control experiments to show a fusion is functional or could even replace the untagged endogenous gene.

10) What NIH institutes will you apply to and who is likely to be your program officer? Are there any NIH Program Announcements or RFAs that are relevant to your research? Again, the chalk talk is about your research vision for 6-10 years. It can and often does include a discussion of your planned first big grant, so you should be prepared to discuss these items. Answering this question will set you apart from some of the other candidates. Being able to answer this question suggests that you will be ready to go from Day One as an assistant professor. You have done your homework and know what is expected of you. Even if no one asks, you should probably mention at the beginning of your chalk talk that you have spoken with a program officer and have identified an appropriate Institute and Study Section for your first proposal.

Navigating the grant system at NIH is a topic for a separate book. It is never to early start thinking about your first grant and to familiarize yourself with how the grant system works. Some helpful references include:

Fricker, Lloyd D. *How to Write a Really Bad Grant Application (and Other Helpful Advice for Scientists.)* Bloomington, IN: Authorhouse, 2004.

Friedland, Andrew J., Folt, Carol L. *Writing Successful Science Proposals*. New Haven, CT: Yale University Press, 2000.

Gerin, William. *Writing the NIH Grant Proposal: A Step-by-Step Guide*. Thousand Oaks, CA: Sage Publications, 2006.

Reif-Lehrer, Liane. *Grant Application Writers Handbook*, Fourth Edition. Sudbury, MA: Jones and Bartlett Publishers, 2004.

Yang, Otto O. *Guide to Effective Grant Writing: How to Write a Successful NIH Grant Application*. New York: Springer, 2005.

Some not so typical questions that I personally encountered:

- What will you do when it is discovered that your results are artifactual and your paper is incorrect? (A true test of one's temperament is not to be rude in one's response to such a question).

- Our institution offers access to equipment and our expertise. What will you bring to our department/institution?

- I don't get it. Why are you doing this?

Chapter 6. The Interview

If you send a large number of applications and pre-screen both your qualifications as a future professor and identify good matches for your skills and specific ads, you have a decent chance that you will get at least one invitation for a Zoom screening interview. Congratulations! You are probably in the top 5-15 people being considered for the position. If you pass the screening interview and are invited for an in person interview, you have made the main cut and are typically one of 3-6 people now being considered for the position. Much better odds than being one of 400 competing applicants! You have made the cut because the committee is very excited by your application. They believe you have the appropriate expertise, great recommendations, and are considered a strong candidate. Now you will need to make several preparations. You need to have a constantly updated scheduling calendar that you use regularly. This will be critical for keeping your interview dates separate.

The invitation to the interview and the simultaneous phone interview
Often, the search committee will contact you by phone to let you know that you have been selected for an interview. This call serves two purposes. First, you will simply schedule an appropriate time for an interview. Second, the caller will begin the interview process. Yes, from the first phone call, you ARE being interviewed. If the caller is simply the secretary for the department, you are unlikely to be quizzed and really are just scheduling an interview. Regardless, be polite and respectful. You're always being interviewed for those qualities by everyone. In contrast, anytime a faculty member calls you, you are being interviewed for the advertised position.

What should you expect from a phone interview?
The search committee member will:

1. **Gauge your interest.** YOU WILL BE INTERESTED, even if it is not one of your top choices. This may be the only interview you get. It may be the only job offer you get. Your dream job may be less great than you imagined and this job may be better than you expected. To be completely honest, I was very keen for one position (that would have been a disaster if I had taken it. I know this because of information I got from some people I met a year later) and frankly not initially excited (at least based on the location and the web site) about the job that I ended up taking (which in hindsight was definitely the best place I could have ended up). Finally, it may be very useful to have a second offer to help with negotiations (see Chapter 7 on negotiations).

2. **Answer any questions you might have.** You SHOULD have questions. Useful questions to ask include:

- How should I arrange transportation? You have to get to the interview and it is very useful to know which airport or train station to go to, how you will get to the school, whether the school will make your travel arrangements or you will (often you will make arrangements and get reimbursed.
- Is there a particular aspect of my research that interested the search committee and that the committee would like me to focus on in my seminar? See **Chapter 5** on your job talk.

Ask whether you will get to meet with grad (and undergrad, if relevant) students and what the students are like. If this is not on your schedule, I encourage you to press your hosts to get some students on the schedule. These are what your future lab members could be like and it's helpful to know if they think the department and institution are supportive of their education.

How many days will the interview be?

Will I give a chalk talk at this interview? What are the chalk talk guidelines?

3. **Assess where you are in your job search.** You may already be interviewing elsewhere and you might even have an offer. It is critical that the search committee member know about other interviews and especially any offers that you have. First, offers make you much more desirable. Other schools have concluded you are a strong candidate. Second, the search committee now knows that it will have to compete for you. Third, the search committee will want to schedule you sooner rather than later for an interview.

4. **Schedule an interview.** Have your calendar handy so that you can schedule the interview.

The Online or Zoom interview
Most phone interviews have been replaced with live video interviews, often using Zoom or Teams or a similar program. Online interviews require extra preparation well in advance.

1. The interviewers can see you. Consider the lighting and background, as well as the desk/table and any visible clutter that may show up in your web camera view. Treat the surroundings like you would treat your personal appearance for an interview.

You should wear something better than your usual lab clothes to interview. Dress as you would for an in person interview, even down to pants and shoes to reinforce in your own mind that this is a "real" interview. Mind your posture and adjust your camera/seat so that your eyes are about 1/3 from the top of the screen. It will feel like you are speaking directly to the viewers, at least if your head square is the main viewing square for the audience (no guarantee they'll view you this way, but it's best to act as if they are). Most cameras in laptops are acceptable. You can upgrade to external USB webcams if you desire. Many now are HD 1080p quality. It is important not to have a bright light source coming from behind you that will put you in silhouette or from the top or side that will cast shadows on your face. You don't want your light source shining into the lens of the camera. You want it to be above and behind the camera shining on you.

You can't have messy notes scattered everywhere. You may want to have some notes or reminders, but you don't want to look like you're not paying attention. Consider posting them directly on your monitor so that your eyes never lose contact with the interviewer(s).

Do a mock interview set up with a friend. If possible, Zoom with a buddy and have them critique what he/she/they see. Can you be seen? Is the light casting shadows on your face? Can you be heard clearly from your microphone? Is the laptop positioned so that you have good posture on screen? Is there anything distracting on the wall behind you? Also consider ambient noise and any sounds coming from your surroundings that can be picked up by your microphone.

It is worth noting that you may not be able to see the interviewers. This may be a little disconcerting and you would do well to practice for that possibility. You may also be able to ask interviewers to turn the camera on themselves when each one is asking a question (if the camera only shows one person at a time). This can help you establish a rapport.

2. As you are preparing application materials, make sure you have a reliable internet connection. It's not uncommon for interviewers to have connection glitches on their end, just don't be the person with the problem. Make sure everything works with whatever software the interviewer will be using (i.e. Zoom, Skype, WebX, etc.). You should NOT rely on a wireless connection. Even though it is increasing rare to have an ethernet connection, you should use one.

3. Remember this is a real two-way interview. As with a phone or in person interview, have questions for your interviewers. Do your homework and be ready to discuss the work of the interviewers and what

you want to know about the position. Have questions about the department and any resources you need (i.e. Is there onsite access to equipment or service X?).

4. Be ready for chalk talk type questions. What will your first grant focus on? Do you know what study section you'll submit the grant to? Do you have an alternative approach? What knowledge gap will you resolve?

5. You may be asked to present a short PowerPoint on your teaching or related to your research proposal. You should have a 5-10 min version of your research proposal pitch ready to go before you get any interview requests.

Determine: How will this look without you standing next to a screen? Can you effectively communicate your message when a slide is on the screen, but you are not visible (e.g., you can't move your hands to demonstrate something). Is the material easy to follow or very abstract? Is there a modest amount of material or a lab meeting style data dump (hopefully the former, not the latter)? Be sure to share your PowerPoint/PDF/Keynote file with another computer (try Mac and PC) and see if that displays correctly.

Think about: What are the key take home messages you want to convey and how much detail you really need to go into. The number of slides should be minimal to enable you to get through most if not all slides.

6. You may be asked to teach/lecture during the interview. If so, create a very short lesson and have it ready. What key idea would you like to convey? What story, analogy, data, images, text will be needed to tell this story?

You may be asked some very bare bones questions: "In your classroom, what are you teaching? How? How do/will students respond/interact with you and each other?" Be prepared with thought out (not rehearsed sounding) answers.

Preparing for the in person interview

You already have your job talk and chalk talk prepared (see Chapter 5). DO NOT WAIT UNTIL WHEN YOU ACTUALLY GET AN INTERVIEW OFFER! You may need to tailor your talks based on the job advertisement on your discussions during the phone interview (see above). However, you still have many important preparations to make.

1. Research your interviewers. You will get (and should request) a list of people that you will be meeting. It is essential that you know what your interviewers study. Going the extra mile and reading web pages and even papers of your interviewers can make a huge difference. If you ask just one or two intelligent questions concerning your interviewers' research, they will believe that you are actually interested in them and the job. You should be interested, but my point is that this is a way of showing your interest, instead of just saying you are interested.

As an interviewer, I rarely encounter candidates that know what I do. I'm personally not looking to be flattered. I simply want to know that the candidate has some idea of what people in the department do and whether the research in the department will be interesting to the candidate. In other words, does the candidate care about this particular job or is this just another job interview. Does the candidate want to be MY colleague?

You will not be expected to know the details of each interviewer's research. You won't be quizzed about their papers. However, you need to know the topic, if possible the model system, and the accomplishments of the interviewer (i.e. Is she a leader in the field? a member of the National Academy? Does he regularly publish in top journals? It's pretty embarrassing to meet a Nobel laureate

or Lasker Prize/Fields Medal/McArthur Fellowship/etc. winner and be unaware of his/her/their major achievement). Big bonus points if you can a) relate your research to the interviewer's, b) can ask questions about papers by the interviewer, c) demonstrate knowledge and appreciation of the interviewer's field. Parts a and b should be things you try to do. Part c is not something to try and fake your way through. It is great if you read a review or a paper by the interviewer. However, simply peppering your conversation with jargon will come off as weird and will likely lower the interviewer's impression of you.

To maximize your preparations and to keep your different interviewers straight (very helpful when you have 8-20 interviewers in a visit, seriously), print copies of the salient parts of their web pages, abstracts of any important papers, and reprints of papers or reviews to help you better understand any topics completely outside of your expertise and training. You will want to bring this information with you on your interview trip to study the night before the interview. I did.

2. Request to meet with specific people. As soon as possible, scan through other department websites for the institution. Identify any other individuals that you wish to meet. This can include people in computer science, physics, chemistry or other disciplines of biomedical sciences. This request accomplishes two goals. First, you are demonstrating your interest in the institution and that you are taking this interview seriously. Second, you can meet people that may be future collaborators. For example, if you think you may need to do protein structure at some point in your research, then meet the resident crystallographer or cryo-EM expert and determine if you might want to collaborate with him/her/them.

3. Request to see relevant shared resource facilities. Some core facilities have a director. If you need to know what equipment is available (and how available), fees for use, services, etc., then you will want to ensure the core facility director is on your schedule.

4. Request to meet with graduate students. Many schools will schedule a lunch for you and the students. This is an excellent opportunity to get a sense of the students that might join your lab.

5. **Coordinate any special requests with your contact person as soon as possible.** Do you need audio playback for your talk? Do you have special dietary considerations? Mobility restrictions?

6. **Make sure you know how to get from the train station or airport to your hotel. Make sure you know how to get to your interview.** Many places do provide a host, but some places might just give you an address.

7. **Additional Thoughts.**

- The interview process is a two-way street. You are being considered for a job, but you are also considering taking a job. During the first in person interview, you are still trying to get the job, but you also need to be thinking about whether you want to take this job if it is offered to you. Even if this is the only offer you get, you still need to decide whether to take the job. You are better off not taking a bad job. I appreciate that you've worked very hard to get to this point, not to get just any job, but to get a job that you like and hopefully will love. Do your own detective work and try to ask questions when you can and put together a picture of what it will be like to work at this school. By questions, I specifically mean about the job, not the smaller details. You want to know how faculty are supported by the institution, how new faculty are mentored, teaching expectations, if people collaborate. Things like health insurance, parking, 401K, etc. are generally not negotiable and will be in your letter of offer. I didn’t see a lot of variation in these things between institutions.

- Course ideas. As a future professor, I was interested in creating courses on quantitative microscopy, organelle biology, and a tutorial on landmark papers in cell biology. During meetings with department chairs, administrators, and some faculty and students, I asked about opportunities to create new courses and suggested my course ideas. I found people very receptive to these ideas. Institutions want to have up to date courses and want to offer students new kinds of courses. Discussing this topic during your interview is one way to demonstrate your interest in education and one aspect of value that you can bring to the institution. If you plan to discuss ideas for courses, you should be prepared to briefly outline the course goals and content. That said, you also want to seriously focus on getting your lab up and running. Courses are very time consuming. The can be rewarding (I love teaching). Still, you should be modest about your vision for course development.

- Other research passions. At your interview, you will outline your future grant proposal for your immediate research plans. However, there will be opportunities over meals and during some interviews, when you may wish to describe other research interests. For example, my research focused on endoplasmic reticulum structure and function. I was also thinking about a wild idea to study the "ecology" of organelles. Some interviewers were intrigued and other people thought it was a little bizarre. The reason for bringing up such ideas is that you are letting your interviewers know that you are not a one-trick pony and that you are genuinely passionate about science. There is a fine balance to strike in that you want to ensure everyone knows your main research program IS your focus. Your other ideas should be more casual discussions and something that you appreciate would be a longer term goal.

The Actual Interview
Prepare for a very long day or two days. You will meet with 8-20 people/day.

1. You are in the spotlight from the moment you arrive until you are dropped off at the airport. Everything you say will be taken into account. People will probably be nice to you, but nobody is necessarily your friend. If you tell someone something in confidence or complain about your visit, it *will* get back to the search committee.

Be natural. It is obvious if you are being stiff or insincere and this will make for a poor interview. People are deciding whether they would like to have you as a future colleague.

2. Do speak up if you need to use the restroom. It isn't on your schedule and people often forget to ask you if you need to use the restroom. Do not suffer in silence.

3. Meetings with Faculty. These meetings are critical. The people you meet will be your future colleagues. You want to be courteous, show them respect, express enthusiasm for their research and thoughts, and treat them as you hope to be treated as a colleague. The people you meet will be evaluating you for your intelligence, ability to fit into the culture, and enthusiasm for the department. What should you discuss?

-Focus on science and the institution.
- Ask new faculty about their experiences with their department chairs, the secretaries, Dean, etc. People are usually honest and will tell you what problems they have encountered or support they have received.
- Bring your laptop and printouts relevant to your research. The person you are meeting may not be able to attend your talk. They may want to discuss your research in more detail. Bring extra copies of your papers and your CV.

- If the school does not have a piece of equipment that you need, find out if any of the faculty members would have use for this equipment. This will help later in your meeting with the Chair and/or Dean if you need to negotiate an expensive piece of equipment.
- Identify and *maybe* suggest potential collaborations. These people will be your future colleagues and they might be more excited about hiring you if they can see personal benefits to having you as a colleague. As I noted in the discussion about chalk talks, you want to be very careful about overcommitting to collaborations. You do not know these people and they could be reasonable colleagues and horrific collaborators (I met more than a few as a professor). It's OK to have shared interests and consider potential synergies.

Inappropriate Personal Questions

All kinds of questions will come up during interviews or at dinner, some of which are inappropriate. For example, the search committee is not legally allowed to ask you your marital status, age, religion or whether you have children or plan to have children. I reiterate. **These questions are illegal to ask!** The people asking may be completely unaware of this point and may be asking for completely innocent reasons to make conversation or to get to know you. Realize, though, that these questions have been used in the past to terminate further consideration of a candidate- too old, wrong race or religion, will take time off to raise a family, etc.

You can answer the questions if you want, but are not obligated. I was asked these questions regularly at dinner. The answers were unimportant to me and unlikely to raise any warning flags for the search committee. However, if you have a spouse that needs a job or you are pregnant or planning to have children in the near future, you may feel uncomfortable answering the questions.

In these cases, The Ladders', a recruitment company, website offers some helpful suggestions (The Ladders. Advice. Accessed 9/30/2016. https://www.theladders.com/career-advice/.) The simplest approach is to gently turn the question back at the interviewer. If asked about whether you have children, you could respond, "It sounds like family is important to you, tell me about yours." If an interviewer persists, you can still avoid making the situation too uncomfortable and ask "I'm perplexed by your question because I'm unclear on why my marital/family status/age/nationality (for example) is critical to performing this job. Would you shed some light on why you are asking this question?" Hopefully the interviewer will get the hint and recognize the error. If not, you can state that you prefer not to answer the question.

Alternatively, the interviewer may be awkwardly trying to help you and wants to tell you about the institution's policies to delay the tenure clock for child birth or to let you know that the institution is open to helping find a job for a spouse. In general, assume the best of intentions, try to gently redirect any awkward questions towards more appropriate questions.

If you have Absolutely NOTHING to Talk About

On rare occasions, there really will be nothing scientific to discuss with an interviewer. Your fields may be so different that the interviewer simply doesn't think it is worth his or her time to chat about it. That's unfortunate, but you still have to spend 30-60 minutes with this individual. This can still be a productive interview. Try asking about:

- what the students are like in courses, during presentations, in the lab
- living in the area- where, are there good schools for your children
- equipment and facilities
- institutional support (pilot awards and money during funding emergencies)
- teaching load

Meeting with Students

At most institutions, you will meet with graduate students and sometimes with undergraduates, often over lunch. Hopefully, you requested this meeting (see earlier). You may remember such lunches from when you were in graduate school. You may also remember how boring some of these lunches could be if the speaker simply asked everyone to go around the room and describe what each person was studying. This is an acceptable tactic if the students aren't talkative. There are better and more memorable ways to engage the students. Many of them hope to be where you are in another 3-5 years. They will want to know what it is like to be a postdoc, what is necessary to succeed, and what the job market is like. Students may also want to know what plans you have for them. That's right. The students may expect that you will take an active interest in their professional development. You should think about this before your visit and be prepared for these types of questions.

I had been on graduate council as a student and had been active in organizing and promoting graduate student activities in graduate school. At lunches, I asked the students about what kind of graduate organization existed at school and what kinds of activities were there to get students out of the lab every now and then- ski trips, happy hours, etc. I also asked about how often students got to practice giving seminars to their school or department. At many schools, students only present their research during their thesis defense. I consider this unacceptable and told students that I would work to promote a student seminar series. Other ideas to be discussed include student invited speakers, how is the qualifying exam structured, where students go to do postdocs, alternative career seminar series, grant writing workshops, and quality of course instruction. Most students will have opinions about these topics and will be happy to share them with you. Not only will students get an idea of how much you value their professional development, but you will also get some ideas about the qualities, needs, and ambitions of the students. You will also learn how much regard the department and school has for the students.

Meeting with the Dean

This meeting is often jarring in relation to all of your other meetings. You typically will not be discussing the finer points of your research interests. Rather, you may learn about the institution, how being a faculty member “works”, expectations for your performance and success, institution plans for growth, etc. The useful things you can talk to the Dean about include: 1) core facilities and development of new cores as needed, 2) Dean's vision for molecular biosciences (or your broad area) for the next 10 years at the university including plans for recruitment of additional faculty, 3) The university's support mechanisms for new faculty, and 4) tenure and how to get it.

In addition, this may be a practical discussion with someone that is trying to assess if the institution can afford you. This is not something you should overthink, but it does matter. What do you REALLY need to do your proposed research? Do you need a whole floor of a building? Do you need $2 million worth of equipment just to start your lab? Do you need one or more expensive instruments solely for your lab’s use? Maybe you do. Maybe you think you need all of this, but your usage will be more modest (20 hours/week) or you can do the first few years of your proposal without that very expensive instrument. Your plans to need to be a balance of reality and practicality. Also, remember that if you have a very expensive instrument all to yourself, your lab is probably going to be responsible for the usually not inexpensive service contract ($10-30k, annually). That could be 10% of a grant.

I did my postdoc in a lab that was fortunate to have three dedicated confocal microscopes. ($500k+ each). I assumed that I needed a confocal microscope just for my future lab’s use. Other colleagues negotiated a confocal as part of their startup packages. I even had two institutions offer to buy me one. In the end, I went to the institution that did not buy me a confocal. I got funds to upgrade the instrument in the core facility, buy a widefield fluorescence microscope for my lab’s personal use, and funds to put towards a new confocal if I could get grant funding for one. I was able to use the instrument in the core

facility, especially after the upgrades. I ultimately got a microscope with new capabilities a few years after I started by writing a special grant, a Shared Instrumentation Grant. Part of the purchase involved the grant and my startup funds dedicated to a new instrument. By that time, my lab was larger, we needed more time on a microscope and needed some new features. Even then, we housed the new instrument in the core facility, which provided maintenance and covered the service contract. Obviously, each situation is different. I cannot tell you what you do or do not need for your startup package. My point is to be open to shared instruments, getting an instrument that is sufficient for now, but has upgrade potential or even realizing that something might be nice to have, but is not required for your research program. I now know that I was an expensive hire. One institution made me an offer, knowing that they could not provide the minimum needed microscope access for my program. The department was very nice to me, but in the end, I simply could not do any of my proposed research without access to a confocal microscope. You need to decide what kind of research program is reasonable for you. If you can explain what your lab ideally needs, what would be sufficient for your lab/what you would be open to (e.g., a shared instrument), and what's going to be a deal breaker, then you are not being greedy. You are articulating what is needed to conduct your research program.

The Dean may or may not still be doing research. If possible, read up on the Dean's research and be able to chat about it.

You should also find out the expertise of any administrators you will meet. Many of them were once faculty and some even still conduct scientific research, especially at medical schools. This latter point is important for your future. That is, it is useful to know whether the Dean understands and appreciates your research. Your Dean can be very important when you are applying for fellowships and shared instrumentation grants. Fellowships often require a letter of support from your Dean. Shared instrumentation grants often fare better if you can secure an institutional commitment (i.e. $$$) to guarantee space and either help purchase the equipment or pay for the service contract. Thus, even if you don't meet with the Dean on a regular basis, the Dean plays an important role in your career development and supporting your research infrastructure needs. This interview is more than a formality. You need to make a good impression and begin cultivating a relationship that will help your career.

What will you discuss with the Dean?

- Promotion and tenure. The Dean is very knowledgeable about statistics for promotion and what are the typical expectations for promotion. The expectations are always: papers, grants, teaching, and service, with extra emphasis on the first two.

- Your expertise and what you will bring to the institution

- The expectation that you will bring in grants

Preparing for the meeting with the Department Chair

This meeting is critical. All of your interview meetings are important, but the chair is the one who has a substantial say in hiring you. The chair is also supposed to be your advocate when seeking funds and space from the Dean to hire you. You NEED the chair to persuasively advocate for you and your research program requirements. The meeting begins the negotiation process. It is critical that you be prepared to tell the chair what you will need to start your new lab. You <u>must</u> do several items of research before you go to this meeting.

1. Try to find out how much other faculty make at the institution, especially new faculty. This will give you a realistic idea of how much salary to request, if asked. This information may either be in the actual job listing or you can ask other faculty at the interviews. Junior faculty are the ones most relevant to ask. Do note whether the individual is PhD or MD/PhD (which tend to get higher salaries). The number that you will be told is part of a range. The number is useful so that you won't say that you expect $100k at a school that will offer $50K or vice versa.

2. Find out how much space junior faculty typically have in new labs at the institution. During the interview process, ask to see the space intended for your new lab, if possible. Note that this should not be a deal breaker. Some places make plans to hire someone without knowing how much space will be needed. Obviously, if you have a large piece of equipment with special infrastructure requirements, your space needs will be different from someone else. Also, at many institutions, space availability is a game of chess. It's not uncommon to see faculty for the same department housed in different buildings or floors on campus. It's just reality. Some departments are more successful at getting grants and outgrow their floor or building. Other spaces that were intended for recruitment may be occupied by a retiring faculty member that is taking a really long time to wind down his/her lab. Based on conversations with faculty at many different institutions, you can be fairly confident that your promised new lab space will NOT be ready on the day you are scheduled to start. There are exceptions and I hope you are one of them. Just make plans for things you can do (papers to write, things to order, etc.) during potential downtime or talk to the chair about some bench space to conduct some experiments while you wait for your own lab. This can be a good time to try out core facilities and find out how available they are for use, how quick turnaround is, and (I recommend this) whether they give you the expected outcomes for some controls or standards that are known only to you.

3. Determine how much you will need to start up your lab. This should include equipment, salary for at least one grad student/postdoc/tech for at least one year, and other operational costs such as publications, funds to attend conferences, service contracts, core facility costs, and email accounts. Ask people who have started labs at similar institutions in the past three years what their costs were. Note that numbers for salary will vary between institutions. What you want to know is whether you'll have enough in the salary bin to cover 2 grad students? Postdocs? Techs? for x years.

4. What are the teaching expectations? At a research institution, you should try to get protected from teaching and committees for at least one term and preferably one year. If you are asked to give one or two lectures in a team taught course, that should be OK and can even be a great thing, esp. if you're teaching in fall term. When you teach, you are advertising what kind of scientist and mentor that you are. If you explain things well, engage students, and can highlight your exciting research, you may well attract a rotating student or interested undergrads. On the other hand, teaching an entire course is a huge time commitment (e.g., plan on 10 hours prep for each new lecture that you deliver).

5. Do you need any special (expensive) pieces of equipment? How much does it cost? You should get a quote for the equipment before going to this meeting and bring the quote with you. The Chair will know you are serious and will be able to tell you whether this is realistic. Maybe it's difficult to justify one big expense for a single department member. An option to think about in advance is what if the school will get the equipment with you being the primary user, but sharing the equipment with the rest of the department or even institution. This can be a good solution if few people are likely to use the equipment or you could get stuck with operating a core facility. Be careful. Some institutions will simply say they can't afford the equipment and might help you with partial funding if you bring in a shared instrumentation

grant or some such thing. You need to evaluate whether you can do your research under such conditions or if the equipment you need exists in another department and if you could access it. Don't shortchange yourself. If you need the equipment and the school can't provide it, your research will suffer! And the tenure committee will still evaluate your portfolio for publications and grants regardless of any notes saying you couldn't get a key piece of equipment.

The actual meeting with the Chair:

1. Don't start by asking for anything. Let the chair ask you what you need. Start all discussions as questions, not demands. For example, compare the two approaches: 1) I must have a Zeiss confocal microscope, in my new lab, for my lab's exclusive use. 2) Is there a confocal microscope available in the department? If not, is there one available on campus? If so, how much will it cost for me to use? If not, would the school be able to provide a confocal for the department with my lab as the primary user? Be prepared to explain exactly why this item is critical for your research. If the chair is determined to consider your equipment for the larger department (and you can live with this), identify other department members that would benefit from this equipment. This will make for a much stronger case.
2. Do ask the chair what is expected of you (i.e. teaching, percent salary from grants, etc.), how the tenure system works, and about available resources (such as cores), when would you be expected to start?
3. If the chair asks, do say whether you have scheduled interviews at other institutions. This is very important. Some institutes will try and make you an offer very quickly. You need to give yourself time to explore your options. In addition, other institutions may make you offers and these can be used to negotiate a better package.
4. Ask if the university have any pilot awards, student support or other kinds of awards? These can help stretch your startup package.

Seminar

Your seminar must be perfect. You have practiced this talk in front of others. You have a backup on a flash drive and the Cloud. If your file is small enough, you can email it to yourself. It is critical that you have your talk in some usable form! The Seminar is discussed extensively in the previous chapter.

Chalk Talk

The Chalk Talk is discussed in the previous chapter. Note that there may not be a Chalk Talk. There may be a Chalk Talk only if you are invited to a second interview. The Chalk Talk may be an extended discussion after your seminar. Ask your host before you travel if you do not see Chalk Talk on your agenda.

Dinner

Now is the time that your hosts hope that you will feel relaxed. They will often encourage you to drink alcohol and the evening can last up to three or four hours. This is after your very long day of interviews. This is not the time to relax. **You are still being interviewed.** Continue to say nice things about people, don't get drunk, and have several questions to ask. This is your chance to find out more about the institution: where do people live? How much do houses/condos/apartments cost? Schools for kids? Parking/public transportation? Activities in the area? Ease of recruiting grad students and postdocs? How to manage teaching loads? How good is the grant support office (helpful? chaotic? note this is important because your grants will depend on the people in the office doing things correctly and in a timely fashion), what kind of experiences did your hosts have starting up their labs and what advice would they offer? Does the department/school have a good seminar series? Has there been much turnover of faculty in the past few years? How does the department mentor junior faculty?

Weird things get said at dinner. You may think nothing of something you say and have it come back to you in a very bad way. For example, I met with some faculty for dinner the night before my actual interview. We discussed the equipment in the department, including a new confocal microscope. One professor asked me if I wanted one for my own lab. Of course, I wouldn't object, but knew that this was a half million dollar piece of equipment. I said as much and indicated that if the current microscope wasn't oversubscribed that I could work with it. The professor was persistent and claimed the department chair would be enthusiastic about supporting the purchase of another microscope for my personal lab. I said I'd ask about it. The next day, immediately after introducing himself, the Chairperson said "I'm NOT buying you your own microscope." I relate this story not to make the reader paranoid, but to emphasize that EVERYTHING you say or do will be remembered and related to everyone on the search committee.

Another odd dinner happened when I was on the search committee. The candidate had given an excellent talk and a very strong CV. The department chair described some directions for the candidate's research, when the candidate blurted out, "That's great....If I don't get this job, would you hire me as a postdoc." I think everyone at the table, except the candidate, was stunned. There was no further consideration of the candidate after that statement.

Speaking ill of your current postdoc lab is a very bad idea. At one dinner, the committee asked about the candidate's interactions with the candidate's PI. The person didn't want to talk about it. Upon further prodding, the candidate voiced resentment over the PI's "failure" to support the candidate's career development. Given the good letter of recommendation written by the PI, it wasn't clear what the candidate meant. After dinner, the candidate had a few drinks and began describing a list of perceived insults and injuries. Even if your PI is not your favorite person, it is important to remember two things. First, you would not have gotten an interview if your PI wrote a terrible reference letter. Second, if you speak ill of people, the search committee members can easily imagine you saying the same kinds of things about them when they become your colleagues. Finally, the scientific community is relatively small and people talk. Whatever you say about people will get back to them. A general rule in science should be "Make no enemies. Do not speak ill of people." You never know when you will need a reagent, a letter of reference, a manuscript review, etc.

After the Interview

After you return home, this will sound old fashioned, but be sure to write a thank you to your host, preferably on a card. It is also respectful to email a thank you to anyone that interviewed you. If you are still interested in the school, say so. If you aren't interested, still say you are interested- an offer could be used for negotiations with other schools. You may not get any other offers. If you really really are not interested (and this was true for some the places where I interviewed), then definitely tell the host that you are pursuing another offer and thank them for considering you.

The Second Interview

Many schools schedule a second in person interview. You've already given your seminar and talked to many of the faculty. You'd think the search committee would know by now whether they want you. Actually, the search committee does want you. If you get invited back for a second interview, you are on a shortlist of one or possibly two people. There are often 2-3 goals at the second interview. The first goal is to seek approval of the entire departmental faculty. You may not have met with everyone during your first interview and this is the time for you to meet other people that may be outside of your area of research, but are in the department you may join. For example, if you are a cell biologist and the other person is a chemist or an ecologist, that person would be unlikely to be on the search committee for your position. In addition to department members, you will probably meet the Dean (if you did not during the first visit) and possibly other administrators. Joining a department is usually a something that the entire department votes on.

How might the department members decide on hiring you? They will want to be confident that you are intellectually rigorous, that you are collegial, and that you will help finance the department through the grants you bring in. This the second goal and this takes the form of the Chalk talk, which you either gave during your first interview or might give now.

The final goal of the second interview is to sell YOU on the institution. It is highly likely that if you have made it this far, you will have other offers that you are considering. The search committee may try to show off the institution and the town by having a real estate agent show you the local neighborhoods, and some houses in your price range. Your spouse or significant other may be invited to the second interview. The goal is to help sell your significant other on living in the area. I am aware of at least a few cases in which schools also assisted spouses in finding a job in the area by introducing them to relevant employers or even scheduling interviews with graduate school admissions officers. (Yes, receiving consideration for admission to law school, medical school or graduate school for your spouse is a potential perk of becoming a faculty member).

By now, you should know the drill for interviewing with faculty. Be as prepared in the first round of interviews. Bring your computer, your printouts, and read up on the research of the people you will be interviewing.

After your meetings, you may be told immediately by the Chairperson or search committee chair that you will be offered the position. You may be told that other candidates are being considered. You may be told that the search committee needs to meet to vote on your candidacy. Regardless of what you are told, nothing will be settled. **Do NOT accept a position on the spot.** Whatever happens, a position can and should be negotiated. You need to ensure you get what you need to successfully conduct your research. Therefore, you want to express enthusiasm for the position and then wait for the Letter of Offer.

I have a friend that was too excited to get a job offer at dinner during the interview. The host gave her an envelope that contained a letter of offer. My friend signed it right there, much to the shock of her host. I'm disappointed the host did not stop this or tear the letter up and tell my friend to negotiate. Still, I think it is a teachable moment to remember that this is a job and a business. Ignorance of the process does not mean that you'll get a do over or that people (even well-meaning people) will keep you from making rookie mistakes. Use your scientific training and always ask questions if you do not understand something. Do not be afraid to seek more information before committing to anything. Without trying to be overly dramatic, this IS a big decision.

Chapter 7. The Letter of Offer and Negotiations

If you impressed the search committee, you will receive a letter of offer. The letter will often be preceded by a phone call from the search committee informing you that you have been selected. The call is rarely superficial. This is the beginning of the negotiation period for what you will need to start your position and what it will take to persuade you to take the job. It sounds odd that after everything you've gone through that the tables would be turned and the school needs to persuade you to accept their offer. This is also in stark contrast to almost every job you have probably taken to date. Usually, you have simply received a job offer and you must take it as is. Now, you get a chance to define some of your own terms. Most candidates I meet tend to be surprised or confused by the negotiation process. I counted myself among this group.

The phone call you receive may include a request for your requirements. You can tell the caller exactly what you need, you can tell them that you will provide a written list or you can ask them what they plan to offer you and wait for the letter of offer to arrive. I prefer the latter two options because everything is in writing. The caller may outline the letter that will be sent. Simply tell the person that you look forward to receiving the letter. You should ask about any special equipment that you will need for your research. If you need a $500,000 microscope or at least access to one, you should ask about the intended solution. You will have already mentioned this to the Chairperson during your interview (Chapter 6) and now you need to know what kind of commitment the institution is willing to make.

This is also the time to let the committee member know whether you have additional offers. This will let the committee member know that the institution now has to compete for you. Do not volunteer the terms of your other offers. This is a bargaining chip for you. As in cards, don't tip your hand just yet.

First, decide whether there is any possibility that you would accept an offer from the institution. If not, politely thank the caller and inform them that you have taken another offer. If there is even a remote possibility that you would take this job, then you can move onto negotiations.

Surprisingly, this was the most stressful part of the job search for me. I had multiple offers and wanted to take the job that would make me happiest. I also had very little idea of what I could negotiate. Everything will depend on what other offers you have. If you have no other offers, you can ask for whatever you want, but are not assured of receiving anything beyond the initial offer. If you have other offers, the institutions must compete for you and must be prepared to sweeten the deal. If you do not have any other offers, your ability to negotiate isn't very strong. This is one reason for applying for several positions, *to increase your negotiating power.* You can still make reasonable requests, but don't have much recourse if the school refuses, other than not taking the position.

Upon deciding to enter negotiations, you will receive the first letter of offer. It is in your best interest not to immediately accept this offer. It isn't time to get greedy, but it is the last time you will have maximum bargaining power with your new employer - at least until you get offers from other schools to hire you away from your faculty position, but that's a topic for another book. You should think of this as your opportunity to get what you need to start your lab and maybe even some perks.

Strategies for negotiating

1. Get everything in writing!!!!! Everyone will tell you this and it is excellent advice. When you start the job, the institution is only legally obligated to provide you what is listed in your letter of offer. This is basically the contract for your job. No matter what anyone promises, don't believe it until it is in writing. This is also a good reason to carry out most negotiations by email. Then everyone has a written document of the negotiations and you can be assured that you have not been misunderstood.

2. The letter of offer will have a deadline for responding. The deadline usually ranges from two weeks to a month. This deadline is to place pressure on you to decide. Consider the process from the perspective of the institution. Time is of the essence. The search committee will rank the candidates after the interview process. You are probably the top choice, but may be number two or even three. If you don't take the position, then the committee can contact the next person on the list. If you take two months to decide, then the other candidates on the list may have already taken other jobs and the search committee will not have anyone to hire. The institution is trying to fill a position and the sooner the position is filled, the sooner the search committee members can breathe a collective sigh of relief that they were successful in the search and won't have to go through another round of interviews. From personal experience, interviewing can be a tremendous time drain. Your research and other obligations don't disappear. If you have to meet with and go out to dinner with six or more candidates, you can burn out quickly.

Now that you know why there is a deadline, you need to decide whether you need to extend it. Do you have any other interviews scheduled? Do you have any other offers to negotiate? If so, request, in writing, to have the deadline extended and for how long. Any reasonable school will give you an extension. A couple of months is possible, but is a long time for the school. Don't be pressured to take the first offer that comes along, but don't keep the school waiting forever either. Remember the school wants to complete the faculty search. It is a courtesy to state why you need the extra time, but it is not essential that you explain why.

3. With a letter in hand, it is time to move towards your endgame. You can contact any other schools that are still considering your application and inform them that you are very interested in their institution and that you have some time constraints because you already have a letter of offer from another institution. Do indicate the name of the institution that has made an offer. Be aware that not all letters of offer are created equal. An Ivy League Institution is unlikely to suddenly decide to interview you because you have a letter of offer from Bob's College of Biology and Appliance Repair. Also, you need to be clear on why you wish to be considered by the other institution(s) when you contact them. I don't recommend that you simply try to draw out the process and contact all of the remaining institutions, just the ones that you would seriously consider as an alternative.

4. Going forward, you need to compare each iteration of the letter of offer for details. Most people will negotiate in an honest transparent manner. However, someone could give you what you requested and then take away something else. If you notice, you could be told this was an honest mistake. Maybe it was. Do not sign the letter until it is corrected, the change is satisfactorily explained or the final letter is acceptable. Get every correction/change IN WRITING!

What to ask for:

1. Higher salary. You will likely be offered a moderate salary for the position. Do your homework and determine the typical salaries at each type of institution and variations for locations. A salary at one school may sound low, but the cost of living in the area may also be low. Also, be aware of how much of the salary is money being paid to you versus money you must earn from grants. That is, many medical schools only pay a fraction of your salary, often 10-50%. If you ask for a higher salary, you are placing higher expectations on your potential to bring in grants. Don't sell yourself short, but be aware of how much of the requested salary is actually coming from the institution.

A colleague described how several of his letters of offer did *not* spell out what percent of the salary would be covered by the school. It is unclear how common this practice is, but it is information

that you must find out. At the very least, you need to know what is expected of you. Speak directly with your department chair or the head of the search committee until you get a satisfactory answer and, as always, *get it in writing*.

2. Protection from teaching and committees. It will take you time to set up your lab, hire people, and train them. Teaching a full course is tremendously time consuming. Also, committees, such as graduate student admissions or faculty search committees, can eat up your time. When you start your new lab, you will need time to write grants and to get preliminary data. You need to be protected for at least the first semester and preferably for the first whole year. This isn't always possible, but you can often find a compromise. It's not too bad if you have teach one or two weeks of lectures total. It's also not unreasonable to serve on a committee that meets infrequently and does not carry many responsibilities. That said, ask for protection for a year and negotiate from there.

3. Bigger start-up package. Packages will vary significantly between institutions. State schools will typically offer smaller packages than private schools and medical schools will typically offer the largest package. Realize that if a medical school offers you a $400,000 package, a small state school or liberal arts college will not necessarily be able to match it. Consider what the package includes. For example, two years of salary for a technician/postdoc/graduate student is extremely valuable. Lots of lab space is nice, but you need people and equipment to populate the space and make use of it.

I received several different startup package offers:

Salary ($60-86k), number of years (1-3), summer salary (up to two years)
Technician/postdoc/grad student (1-3 years) (1 or 2 people)
Laboratory supplies and Equipment ($90-300k)
$500,000 microscope or promised funds to help purchase a microscope or funds to pay for time on a facility microscope.

As an absolute minimum, you need to know what you need to start your lab for the first year. If the institution's offer isn't in that range and the institution is unable to increase the offer, then you should seriously consider walking away from the job offer. This may sound especially difficult if this is the only offer you get, but you did not just do 5-12 years of post-college training to get a job that is underfunded and underresourced. Note that the story is different for many European institutions, positions are basically offered on the condition that you get external funding for startup. No funding, no job.

Remember that getting grants takes time. Unless you have a transition award, it will take at least six months and probably up to a year from the time that you apply for a grant and actually receive the money. So, unless you are exceptionally confident of your ability to bring in funding, your start-up is all the money that you will have to run your lab. With that timeline in mind, you would be better off with funding necessary to run your lab for 1.5 years. Many medical and private schools will have packages that cover your lab for two to five years. Additional funding can be negotiated, especially if you can make a compelling case that your success depends on a minimum detailed and justified budget. Remember that the school wants you to succeed. The school is investing in you. It's a terrible bet to underfund a new hire's research.

What should a startup package include?

- Costs of equipment and reagents to start your lab and keep it running for at least 1 year and preferably 2-3 years.
- Funds for travel to meetings ($1000-2000/year) and for at least one publication a year (~$1-3000/year).
- Funds for core facilities (i.e. time on a microscope or sequencing facilities).
- Funds for lab personnel for at least 1 year and preferably 2-3.
- Funds for operations (i.e. computer hook-ups, email accounts, copier charges, etc.)
- Funds for all renovations or remodeling of your lab space. This is usually not money for your lab account, but this is a promise that the school will pay for the relevant renovations.
- Space in a -80°C freezer, cold room, etc.
- Animal housing and care.
- whatever else your research absolutely requires for success

4. Tenure and tenure-track positions. There are some faculty searches for non-tenure track positions. If you apply for and get an offer for a non-tenure track position, find out exactly what this entails. Sometimes, this means that your contract will be renewed annually (serve at will) or every few years and that you will not be offered a permanent position. There are various forms of these positions- 1 year visiting professor positions that usually involve heavy teaching loads, Instructor positions usually affiliated with a tenure-track faculty member mentor, Adjunct faculty which typically provides no lab or funds, but can provide access to departmental resources or even graduate students. However, non-tenure track can also mean that you can write for grants, but cannot have department graduate students in your lab. The job may not be so attractive if you do not have the full benefits enjoyed by tenure-track faculty.

For tenure-track jobs, the nature of tenure differs significantly between schools. Many schools consider you for tenure after a 5-7 year period. Typically, a package of your accomplishments and contributions related to funding, publications, teaching, committees, and other service will be assembled, often in conjunction with your department chair. Your materials will be reviewed by a tenure committee, which will make a recommendation that the Dean, school President, and Board of Overseers must then approve.

What you get with tenure also varies between institutions. You may have a guaranteed minimal salary or a permanent job or near absolute academic freedom to pursue risky or even pseudoscientific research topics. Or you may only get the distinction of being able to say you have tenure without any obvious material benefits. You could still lose your salary or lab if you lose grant funding. Tenure may mean that maintaining your job will entail a heavier teaching and committee load. The importance of tenure varies between institutions. For example, even though tenure was distinct from promotion at my institution, there was also no "up-and-out" policy. Failure to get tenure did not automatically mean that a faculty member must leave. At other institutions, not getting promoted to associate professor is the end of the line at those institutions and you will have to find another job. Finally, it should be mentioned that "tenure-track" doesn't always mean you really have a chance at tenure. At some institutions, tenure is only granted to individuals considered the top members in their fields. Without three R01 grants, frequent *Science*/*Nature*/*Cell* papers, etc., you wouldn't have a hope of being seriously considered for tenure at such places. Given this spectrum of tenure, you should request a copy of the school's tenure policy and be very clear on what you are or are not getting with a tenure-track offer.

5. Perks. These are items that are unlikely to be included in your initial letter of offer, but that you can ask for, especially if you have other letters of offer. Before you start requesting these items, rank them and decide which are most crucial and which are most likely to be granted. You want and need to be a shrewd negotiator.

- a parking space (paid for the first year or two, if you are feeling bold).
- reduced cost or free tuition for your significant other at one of the institution's graduate schools, assuming your significant other has sufficient grades and test scores to be admitted to the program.
- a job for your significant other or at least help finding a job
- more lab space (you'll appreciate this when your lab begins to expand).
- your own -80°C freezer and sufficient space
- funds to attend additional meetings
- Moving costs for both your house and any lab equipment you may have.
- Funds for house hunting trips for both you and your significant other.
- a dishwasher/glass cleaner
- relief from teaching duties or a TA for your courses
- a later start date
- a service contract for a piece of equipment (extremely valuable!)

After the phone conversations and emails, you will receive a draft letter of offer. It will state the terms of the offer. Look the letter over carefully and determine whether anything is missing and whether you can ask for more. This is your last chance to increase your package. Remember that the school has interviewed several people and you are the top choice. They want you! You can make requests and it is not unexpected.

If you do have multiple offers, you can ask the school to match or beat your best offer. Medical schools and undergraduate universities have different sets of resources and expectations. Undergraduate schools will typically offer lower salaries with smaller startup packages and larger teaching requirements. Be careful about comparing salaries with medical schools, as the undergrad school may simply not be able to match such an offer. At the same time, a smaller startup package may have lower grant funding requirements, while a generous package might expect 50-100% salary support through grants within five years. Bear in mind that the undergraduate salary is usually 9 months and you can get an additional 1/4 (or "summer salary") with grants. You might ask for one or two years of "summer salary" as part of your startup package.

If you have multiple offers and you can rule out interest in some of the offers, immediately let those schools know that you appreciate the offer, but are respectfully declining to pursue another offer. It is important to maintain good relations with everyone you meet. You never know whether you may get a future offer from that school or someone from that school could become your new department chair or dean or could review your grants and manuscripts. One of my general rules in life is: *Make no enemies in Science.* I can't overstate this one.

Do ask to have your teaching load reduced for at least the first term and preferably for one year. That said, once you arrive, see if you can give one or two guest lectures in a fall semester graduate course. This is a great way to attract rotating graduate students to your lab.

Make sure the letter includes: salary, benefits, start date, teaching load, start-up amount (find out if this includes your salary or is separate), amount of lab space, if you were told you would be in a new building when it is finished, the title of the position, whether it is tenure-track, and how long your initial contract will be (usually three years). Also, determine whether your startup package has a “sunset date.” That is, do you have to spend all of your funds by a specific date or surrender them back to the university? Sunset dates have become common and are often not negotiable. Still, I encourage you to try and extend a sunset date as long as possible, because startup funds are often unrestricted funds. These are extremely useful for things like a new school mandated raise for students (not included in grant funds) or a service repair for a piece of equipment.

Once you have received a letter that satisfactorily addresses your concerns, sign the letter and you now have a faculty position. **Congratulations!!!!!!!**

To Take or not to Take a Job

Surprisingly, the most stressful part of the application process can be choosing between job offers or even whether to take the one offer you get. The two major questions to ask are:

1. Will you continue to develop in the new environment? Can you identify individuals that will mentor you? It is very helpful for young investigators to have a more senior investigator read manuscripts and grant proposals and then provide constructive feedback. Think of your new faculty position as an advanced postdoc position. You will be much more independent, but still have a lot to learn- how to manage a lab, mentor students, write grants, serve on committees, etc. A good institution will help you make this transition and prepare you for the next stages of your scientific development. You hopefully learned during your interviews how well the department supports new faculty and how happy the associate professors are, esp. the recently promoted ones.

2.Will you be able to do your research? Are teaching expectations high (i.e. one or more whole course per term)? Does the department or school have the necessary resources and potential collaborators you will need? One measure of the biomedical research environment is how many people are NIH funded. You can go to the NIH Reporter database and search for your institution. If very few people are funded, you are not likely to receive much grant mentoring and your institution may not be considered competitive for research funding. That could affect your ability to conduct your proposed research. You might still have a job, but not necessarily the one you thought you were applying for.

That said, I've written this assuming your goal is to do biomedical research. If you are doing traditional evolution/ecology biology or enjoy teaching (I do, too), then your criteria may be different and that's fine. You just need to determine if your expectations align with the job you are being offered.

If you cannot answer yes to both of these two questions, you need to seriously consider whether it is worth taking the job.

During my faculty search, I received multiple job offers (six). I immediately declined two job offers. I was flattered by the offers, but did not see myself thriving at those institutions. The other four offers were very seriously considered. I thought about where I wanted to live, where my wife wanted to live, affordability, quality of the research environment, teaching load, the start-up package, and various intangibles. As someone raised in a small town on the Oregon Coast, I had never seriously thought about living in the Bronx, much less New York City. However, during my interviews, I saw parts of the Bronx that I found very attractive. I ended up living in the Bronx and loved it.

For me, the crucial deciding factors were a little odd. I chose my faculty job for two reasons. First, it was the one interview that I found truly challenging. Some of my interviewers at Einstein, while very pleasant, left me feeling intimidated both by their intellect and their scientific accomplishments. I felt that I needed this environment to push me to be a better scientist. The second reason was because of some great advice I received from some mentors at the NIH. In a nutshell, my mentors emphasized the importance of getting one's first R01 grant funded from the NIH and how this grant would make it possible to advance at my institution or to move to another institution, if I wanted.

During some of my interviews at other institutions, it became apparent that faculty felt trapped in their environment, unable to leave due to lack of grant support and inadequate time for developing a body of scholarly achievement (papers), due to heavy teaching loads. I wanted to ensure I had the best chance for succeeding. I got the flexibility and support I needed and it provided peace of mind. In hindsight, I know that I made the right decision.

Chapter 8. Acceptance and Preparing for Your New Job

Once the school has met your requests to the best of its ability, you have everything the school has promised IN WRITING, you are satisfied that you have access to everything you will need to succeed in your research, and you are convinced that this will be a good, if not great, job, you are ready to sign the letter of offer and accept the job. **CONGRATULATIONS!**

The Job that Wasn't

I have one note of caution. Despite the apparent happy resolution of the exhausting job search process, there are rare instances when things can still go horribly awry. It's not my intent to scare readers, but even when everything is done right, it can still go wrong. True story. A friend, Dr. W, interviewed for a position and was offered the job. Dr. W left his postdoc position after a going away party and arrived at his new institution, except… there was no new job. The person that offered the position was no longer Chair and had left. The new Chair claimed that the position had not been negotiated in good faith by the former Chair and the position had never been approved by the Dean. It was unclear whether a lawsuit would have been fruitful, but the bottom line was that there was no job! Dr. W was able to resume his position at his postdoctoral institution and worked a few more years until he found a new faculty position and went onto a highly successful career. My only suggestion in this bizarre situation is to make additional visits to your new institution between the time the letter is signed and before quitting your postdoc and moving. It's helpful to at least see that your future lab space is being prepared for you and that your future department is really expecting you. Keep in frequent contact with your chair and future colleagues.

As soon as you accept job, you will be at least as busy as you were applying for the job. You will have a long to do list that will help you transition to your new job. I have divided this list into things to do immediately and things to do at least a month before you leave your current position and begin your new job

To do immediately after accepting your new job

-Thank your significant other/spouse for all of their support during this long process.

-Be gracious and notify and thank everyone that wrote you a letter of reference that you have taken the job. A thank you note is obligatory. These people said good things about you and sent tens of letters for you. A thank you note is the least you can do for them.

-Begin hunting for an apartment or house. I encourage you to get an apartment, as spending time in a place will reveal things like traffic/commuting, shopping, schools, etc.

-Begin making arrangements for special research needs (i.e. housing mice, zebrafish, etc.)

-Inquire about requirements for hiring postdocs/techs and begin hunting for your first employee.

-Identify all foundation fellowships for which you will be eligible and submission dates (usually in Fall or early winter). If you are preparing application materials before you arrive, you'll be ready to submit in your first year.

-Find out how soon you can begin ordering and if there is a place to send everything. You will want to have big ticket items like incubators and tissue culture hoods ordered to arrive by the time you begin.

-If you couldn't get out of teaching your first term, find out what will be expected, what lesson plans you may need to design and get started.

At least one month before you go

-Collect aliquots of all plasmids and antibodies you plan to bring with you

-Frozen perms of cell lines

-Make arrangements to have emails forwarded to new school email

-Set up email account at your new institution

-Make arrangements with movers and/or reserve moving truck

-Notify post office of forwarding address

-Start packing all of your stuff for the big move

-Make final push on data collection and writing of manuscripts as it may be a long time before anyone does anything with your postdoc projects again. Note that it is not uncommon for new faculty to return to their postdoc lab to collect data to wrap up a project during the first year.

-Savor your last day as a postdoc.

APPENDICES

In the following pages, I have included examples of both my own application materials, as well as generously shared materials from other individuals that obtained faculty positions at graduate research institutions. While there is no single uniform format, the following examples were all considered sufficiently acceptable by search committees to earn invitations for interviews (during the period of 2003-2010).

Today, I would write a better Research Statement. My original document spent too much space on my postdoc work and was too open ended in my future directions. I needed at least one or two candidate proteins to make the second aim more concrete and persuasive. It was something that I today would criticize as a "screen." A good research proposal articulates a question with defined anticipated outcomes. It's difficult to predict what one will get with a screen. The information in my postdoc work was not useless to include. Rather, I would have tried to incorporate more of it as preliminary data in the future directions. Same information, but more strategically leveraged as being well prepared to launch my new lab.

A. Sample Faculty Position Advertisements

FACULTY POSITIONS IN IMAGING AND CELL BIOLOGY IN
THE GRUSS-LIPPER BIOPHOTONICS CENTER

Innovative and creative scientists are invited to apply for faculty positions at any level in the Biophotonics Center of the Albert Einstein College of Medicine. New space is being constructed to expand the Biophotonics Center into the Price Center for Genetic and Translational Medicine, a new building on campus to open by the end of 2007. Members will be tenured, or tenure-track faculty in the Department of Anatomy and Structural Biology. Candidates are expected to have a background in any of the following: Biophysics, Physics, Electrical Engineering, Biology or Chemistry, but with a research focus in microscopy and imaging as related to the cell biology of human disease. The facilities in the Price Center for Genetic and Translational Medicine will include chemical genomics, bioinformatics and computational biology, human genetics, microarray and sequencing, protein chemistry and proteomics, gene therapy and transgenic mice. The Biophotonics Center will also be expanding an Innovation Laboratory into the Price Center including a microscope fabrication facility, laser workshop, a multiphoton microscope, rapid live cell imaging microscope, single molecule detection, and optical and software engineering support. The Biophotonics Center also maintains a service component, the Analytical Imaging Facility, which includes comprehensive light, electron and cryo-electron microscopy services.

Please send letter of introduction, curriculum vitae, research plan and three letters of recommendation to:

Biophotonics Search Committee
c/o Lillian Molina, Administrator
Albert Einstein College of Medicine
1300 Morris Park Avenue
Forchheimer 620
Bronx, NY 10461

TENURED/TENURE-TRACK FACULTY POSITIONS (open rank)
The newly expanded **Center for Membrane and Cell Physiology** at the University of Virginia invites applications for tenured/tenure-track positions in High-Resolution Live-Cell and Tissue Imaging. Live-cell and super-resolution imaging are undergoing a revolution and the University of Virginia seeks to position itself at the forefront of these developments by building a team of creative and highly collaborative scientists developing and employing such methods to solve important biomedical problems. Tenure status and rank of the positions will be dependent on qualifications. Incumbents will be resident members of the Center for Membrane and Cell Physiology and will also have an appointment in a basic science or clinical department of the UVa School of Medicine. Outstanding opportunities exist to collaborate with structural, computational, cardiovascular, cancer, developmental, cell, and chemical biologists and neuroscientists in a highly interactive research environment at the University of Virginia. Competitive start-up packages will be offered.

The Department of Biochemistry and Molecular Biology at the Louisiana State University Health Sciences Center in New Orleans, LA (**http://www.medschool.lsuhsc.edu/biochemistry/**) seeks candidates with successful ongoing research programs to apply for a tenure track faculty position at the associate or full professor level. Candidates should have a strong record of research accomplishments, lead an active nationally-funded research program, and have a vision, as well as a commitment to establish collaborative research ventures. Expertise in all areas of biochemistry or molecular biology will be considered, but special consideration will be given to those that complement the existing research strengths of the department which include cell regulation, cancer biology, and structural biology.

B1. Example of the author's postdoctoral CV

Erik Lee Snapp, Ph.D.
Building 18T Room 101
Cell Biology and Metabolism Branch
National Institutes of Child Health and Human Development
National Institutes of Health
Bethesda, MD 20892
(301)-496-5189
(301)-402-0078 FAX
snappe@mail.nih.gov

EDUCATION

1993-1999 **Ph.D., laboratory of Dr. Scott Landfear**
Dept. of Molecular Microbiology and Immunology
Oregon Health Sciences University Portland, OR 97201
Thesis: Differential Targeting of Glucose Transporter Isoforms in *Leishmania enriettii*.

1985-1989 **B.A. (Biology)**
Harvard University, Cambridge, MA

EMPLOYMENT

1999-2003 **Postdoctoral Fellow, laboratory of Dr. Jennifer Lippincott-Schwartz**
Cell Biology and Metabolism Branch, NICHD, NIH, Bethesda, MD
Research interests: 1) Dynamics, organization, and maintenance of the endoplasmic reticulum, 2) Retention of misfolded proteins in the ER, 3) Organization of the translocon, 4) Fluorescence microscopy methods

HONORS AND AWARDS

- FARE Travel Awards 2001-2002 and 2002-2003.
- PRAT Fellowship (Pharmacology Research Associate Training)(1999-2002)
- Henry Sears Fellowship 1996
- NRSA Training Grant (Interactions at the Microbe/Host Interface)(1995-1998)
- Tartar Fellowship 1995

TEACHING

- Faculty at Practical Course in GFP and Advanced Microscopy at the Max Planck Institute for Biophysical Chemistry at Gottingen, Germany, Sept. 18-27, 2000.
- Teaching Assistant for Medical Microbiology laboratory for medical students, Spring 1995, 1996, and 1997 at Oregon Health Sciences University.

OTHER PROFESSIONAL ACTIVITIES

- Regular reviewer for Journal of Cell Science (2000-present)
- Graduate Student Research Forum Funding Coordinator (1996-1997)
- Graduate Student Council (Sept. 1994 to Sept. 1996)

- Graduate Student Research Forum Co-chair (1995-1996)
- Graduate Student Organization Representative (Sept. 1993-Sept. 1994).
- NERDS/Kids Science Outreach Volunteer 1994

PUBLICATIONS

Snapp, E. and Hegde, R. S. Application of antibody-based FRET to probe oligomeric complex organization. in: Bonafacino, J., Dasso, M., Harford, J., Lippincott-Schwartz, J., Yamada, K. editors. Morgan, K. S. series editor. In Current Protocols in Cell Biology. John Wiley & Sons, Inc. New York. in preparation.

Snapp, E., Iida, T., Frescas, D., Lippincott-Schwartz, J., and Lilly, M. The *Drosophila* fusome contains highly interconnected endoplasmic reticulum. In preparation.

Snapp, E., Reinhart, G., Bogert, B., Lippincott-Schwartz, J., and Hegde, R. Structural dynamics of the protein translocon in the endoplasmic reticulum of mammalian cells. under review.

Snapp, E., Hegde, R., Colombo, S., Borgese, N., Francolini, M., and Lippincott-Schwartz, J. Self-organization of stacked cisternae from branching endoplasmic reticulum in living cells. J. Cell Biol. accepted.

Snapp, E. 2002. ER biogenesis: proliferation and differentiation. *The Biogenesis of Cellular Organelles*. ed. Mullins, C. Landes Bioscience. Georgetown, TX. In press.

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Nikonov, A., **Snapp, E.**, Lippincott-Schwartz, J., and Kreibich, G. 2002. Active translocon complexes labeled with GFP-Dad1 diffuse slowly as large polysome arrays in the endoplasmic reticulum. *J. Cell Biol.* 158:497-506.

Brandizzi, F., **Snapp, E.**, Roberts, A., Lippincott-Schwartz, J., and Hawes, C. 2002. Membrane protein transport between the endoplasmic reticulum and the Golgi in tobacco leaves is energy dependent but cytoskeleton independent: evidence from selective photobleaching. *Plant Cell*. 14:1293-1309.

Lippincott-Schwartz, J., **Snapp, E.**, and Kenworthy, A. 2001. Studying protein dynamics in living cells. *Nat. Rev. Mol. Cell Biol.* 2:444-456.

Nehls, S., **Snapp, E. L.**, Cole, N. B., Zaal, K. J .M., Kenworthy, A. K., Roberts, T. H., Ellenberg, J., Presley, J. F., Siggia, E., and J. Lippincott-Schwartz. 2000. Dynamics and retention of misfolded proteins in native ER membranes. *Nat. Cell Biol.* 2:288-295.

Snapp, E. L. and S. M. Landfear. 1999. Characterization of a targeting motif for a flagellar membrane protein in *Leishmania enriettii*. *J. Biol. Chem.* 274: 29543-29548.

Snapp, E. L. and S. M. Landfear. 1997. Cytoskeletal association is important for differential targeting of glucose transporter isoforms in *Leishmania enriettii*. *J. Cell Biol.* 139:1775-1783.

RECENT ABSTRACTS

Self-organization of stacked cisternae from branching endoplasmic reticulum in living cells. Cellular Dynamics Keystone Meeting. Talk and poster. Feb. 2003.

Self-organization of stacked cisternae from branching endoplasmic reticulum in living cells. ASCB Meeting. Poster. Dec. 2002.

Ribosomes organize and maintain fully assembled translocons at the mammalian endoplasmic reticulum. Poster. ASCB Meeting. Dec. 2002.

The *Drosophila* fusome contains highly interconnected endoplasmic reticulum. Germ Cells meeting Cold Spring Harbor. Poster. Oct. 2002.

Remodeling of the endoplasmic reticulum in living cells. Poster. ASCB Dec. 2001.

Mobility and retention of misfolded proteins in the endoplasmic reticulum of living cells. ASCB Meeting (poster) Dec. 2000.

Quality control of misfolded proteins in the ER of living cells. Protein Folding FASEB meeting at Saxtons River, VT. (talk) July 2000.

INVITED TALKS

Studying Protein and Organelle Dynamics with Photobleaching Technology. Society of Developmental Biology Annual Meeting. July, 2003.

Using FRET to probe organization of the translocon in cells. LIMB Seminar series. May 2003.

Remodeling and Differentiation of the Endoplasmic Reticulum in Living Cells. Laboratory of Cell Biology Thursday Seminar Series. NHLBI, NIH. March 2003.

REFERENCES

List names, addresses, telephone, FAX, and emails of at least three references.

B2. Example of a CV
Generously provided by Samara Reck-Peterson

Samara L. Reck-Peterson, Ph.D.

x Street, San Francisco, CA 94158
555-555-5555 (lab) 555-555-5555 (cell)
xxx@ucsf.edu

EDUCATION

Ph.D. Cell Biology — 2000
Yale University, New Haven, CT

B.A. Biology — 1993
Honors in Independent Study
Carleton College, Northfield, MN

HONORS AND AWARDS

National Institutes of Health Postdoctoral Fellowship — 2002 - 2005
(Ruth L. Kirschstein National Research Service Award)

Teaching Assistant of the Year, Department of Molecular Cellular and Developmental Biology, Yale University — 1999

Prize Teaching Fellow, Yale College and the Graduate School of Arts and Sciences, Yale University — 1998

Physiology Course Student, Marine Biological Laboratories, Woods Hole, MA — 1994

RESEARCH EXPERIENCE

Postdoctoral Fellow, University of California San Francisco — 2001 - present
Department of Cellular and Molecular Pharmacology, San Francisco, CA
Laboratory of **Ronald Vale**
"*Cytoplasmic Dynein: Molecular Mechanism of Motility"*

Postdoctoral Fellow, **Stanford University** — 2001
Department of Pathology, Stanford, CA
Laboratory of **Gerald Crabtree**
"Artificial Dimerization to Create Novel Ubiquitination Substrates"

Graduate Student, **Yale University** — 1995 - 2000
Department of Cell Biology, New Haven, CT
Laboratories of **Mark Mooseker** and **Peter Novick**
"Functional, Biochemical and Biophysical Characterization of Myo2p, a Class V Myosin of the Yeast Saccharomyces cerevisiae"

Undergraduate Research, Carleton College — 1989 - 1993
Department of Biology, Northfield, MN
Laboratory of **Susan Singer**

"*Floral Determination in Nicotiana tabacum"*

UNIVERSITY SERVICE

Director of Postdoctoral Education, Dean's Office 2005 – present
UCSF School of Medicine, San Francisco, CA

- Developed programming with the Executive Dean of the Medical School, Keith Yamamoto
- Applied for and received funding from the Sandler Family Foundation and the Burroughs Wellcome Fund
- Began a new postdoctoral fellowship program funded by the Sandler Family Foundation to give 9 postdoctoral fellows seed money to develop independent research directions
- Co-organized and developed the first UCSF course on "Scientific Leadership and Laboratory Management"
- Created an award to recognize the creative and independent research contributions of UCSF postdoctoral fellows "The Dean's Postdoctoral Prize Lecture"
- Developed a website for the office: http://www.medschool.ucsf.edu/postdocs/
- Participated in the Science and Society Institute's workshop (sponsored by the Pew Charitable Trusts) "Media and Public Policy Training", Washington DC, September 18-21, 2005
- Participated in the Howard Hughes Medical Institute and Burroughs Welcome Fund "Course in Scientific Management", Bethesda, MD, June 6-10, 2005

UCSF Postdoctoral Fellow 2001 - present
UCSF School of Medicine, San Francisco, CA

- Founder and director of a seminar series "Genentech Hall Research in Progress Seminars" for postdocs and graduate students, now in its 4th year

TEACHING EXPERIENCE

Physiology Course 2006
Teaching Assistant for Ronald Vale
Marine Biological Laboratories, Woods Hole, MA

Cancer (First year medical school curriculum) 2003
UCSF Postdoctoral Teaching Fellow
UCSF School of Medicine, San Francisco, CA

Rotation student mentor (1 graduate student rotation project) 2002
UCSF School of Medicine, San Francisco, CA

Cell Biology and Pharmacology (First year medical school curriculum) 2002
UCSF Postdoctoral Teaching Fellow
UCSF School of Medicine, San Francisco, CA

Cell Biology of the Nucleus and Cytoplasm 1997 - 2000
Teaching Assistant, Molecular Cellular and Developmental Biology Dept.
Yale University, New Haven, CT

Rotation student mentor (5 graduate student rotation projects) 1997 - 2000
Yale University, New Haven, CT

Molecular Mechanisms of Disease 1999
Teaching Assistant, Cell Biology Dept.
Yale University, New Haven, CT

Advanced Seminars in Cell Biology 1998
Teaching Assistant, Cell Biology Dept.
Yale University, New Haven, CT

Physiology Course 1996 - 1998
Teaching Assistant for Mark Mooseker
Marine Biological Laboratories, Woods Hole, MA

Principles of Molecular, Cellular and Developmental Biology 1997
Teaching Assistant, Molecular Cellular and Developmental Biology Dept.
Yale University, New Haven, CT

Experimental Strategies in Cellular Biology 1996
Teaching Assistant, Molecular Cellular and Developmental Biology Dept.
Yale University, New Haven, CT

PUBLICATIONS

Reck-Peterson, S.L., Yildiz, Y., Carter, A.P., Gennerich, A., Zhang, N., and Vale, R.D. 2006. Single molecule analysis of dynein processivity and stepping behavior. *Cell, 126*: 335-348.
[Commentaries on this research appeared in: *Cell, 126:* 335-348*, Nat. Rev. Mol. Cell Biol. 7*: 625, and *J. Cell Biol. 172:* 486-92, *Chemical and Engineering News 84(47): 70-73***]**

Shih JL, **Reck-Peterson SL**, Newitt R, Mooseker MS, Aebersold R, Herskowitz I. 2005. Cell polarity protein Spa2p associates with proteins involved in actin function in *Saccharomyces cerevisiae. Mol Biol Cell., 16:* 4595-4608.

Gibbons IR, Garbarino JE, Tan CE, **Reck-Peterson SL**, Vale RD, Carter AP. 2005. The affinity of the dynein microtubule-binding domain is modulated by the conformation of its coiled-coil stalk. *J. Biol. Chem., 280:* 23960-23965.

Reck-Peterson, SL, and Vale, RD. 2004. Molecular Dissection of the Roles of Nucleotide binding and hydrolysis in dynein AAA domains in *S. cerevisiae*. *Proc. Natl. Acad. Sci,* 101: 1491-1495.

Olave, I, **Reck-Peterson, SL**, Crabtree, GR. 2002. Nuclear actin and the regulation of chromatin and chromosomes. *Ann. Rev. Biochem.*, *71*: 755-781.

Reck-Peterson, SL, Tyska, MJ, Novick, PJ, and Mooseker, MS. 2001. The yeast class V myosins, Myo2p and Myo4p, are non-processive actin-based motors. *J. Cell Biol*., *153*, 1121-1126.

Reck-Peterson, SL, Provance, DW, Jr., Mooseker, MS, and Mercer, JA. 2000. Class V Myosins. *Biochem. Biophys. Acta*. *1496*, 36-51.

Karpova, TS, **Reck-Peterson, SL**, Elkind, NB, Mooseker, MS, Novick, PJ, and Cooper, JA. 2000. Role of actin and Myo2p in polarized secretion and growth of *Saccharomyces cerevisiae*. *Mol. Biol. Cell 11*, 1727-1737.

Reck-Peterson, SL, Novick, PJ, and Mooseker, MS. 1999. The tail of a yeast class V myosin, Myo2p, functions as a localization domain. *Mol. Biol. Cell 10*, 1001-1017.

INVITED SEMINARS

University of Idaho, Microbiology Molecular Biology and Biochemistry 2006
Dept., Moscow, ID

National Postdoctoral Association Annual Meeting	2006
American Society of Cell Biology Annual Meeting	2005
Dynein Workshop, Kobe, Japan	2005
UCSF Genentech Hall Research in Progress Seminars	2005
Motile and Contractile Systems Gordon Research Conference	2005
UCSF Cell Biology Retreat	2003
Carleton College, Biology Dept., Northfield MN	2003

SELECTED MEETINGS

Biophysical Society Discussions. Molecular Motors: Point Counterpoint	2006
Cellular and Molecular Fungal Biology Gordon Research Conference	2006
Biophysical Society Annual Meeting	2005
Plant and Fungal Cytoskeleton Gordon Research Conference	2002, 2004
American Society of Cell Biology Annual Meeting	1997, 2000, 2003
Motile and Contractile Systems Gordon Research Conference	2003

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REFERENCES

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Yale University
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Professor and Chair, Cellular and Molecular Pharmacology Dept.
HHMI Investigator
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San Francisco, CA 94158
555-555-5555
xxx@cmp.ucsf.edu

xxx
Professor, xxx Dept.
Executive Vice Dean
address
555-555-5555
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B3. CV Example 3
Generously provided by Dr. D. Thomas Rutkowski

CURRICULUM VITAE

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Education

09/1993- 05/1997	B.S. in Biological Sciences with a concentration in Biotechnology Minor in Chemistry University of Delaware, Newark, DE, USA Thesis Advisor: David Francis, Ph.D. Senior Thesis Project: *Regulation of gene expression by inter-element promoter spacing in D. discoideum*
09/1997- 06/2002	Ph.D. in Cell Biology, Department of Biochemistry and Biophysics University of California San Francisco, San Francisco, CA, USA Thesis Advisor: Vishwanath Lingappa, M.D., Ph.D. Thesis: *A New Role for Signal Sequences: Regulation of Protein Biogenesis at the Endoplasmic Reticulum*

Postgraduate Training

07/2002-06/2007	Associate, Howard Hughes Medical Institute University of Michigan Medical Center Ann Arbor, MI, USA Laboratory of Randal Kaufman, Ph.D. Area of study: *Regulation of adaptation to chronic protein misfolding stress in development and disease*
07/2007-present	Senior Research Specialist, Department of Biological Chemistry University of Michigan Medical Center Ann Arbor, MI, USA Laboratory of Randal Kaufman, Ph.D. Area of study: *Regulation of adaptation to chronic protein misfolding stress in development and disease*

Teaching and Mentoring

Spring 1996	Undergraduate Teaching Assistant, Genetics lab, University of Delaware
Spring 1997	Undergraduate Teaching Assistant, Molecular and Cellular Biology lab, University of Delaware
Fall 1998	Teaching Assistant, Biochemistry for first year graduate students, University of California San Francisco
Fall 2003-present	Graduate and Undergraduate Mentoring:
(10/03-6/04)	Corey N. Miller, undergraduate student (Honors Thesis student) (now in M.D./Ph.D. program, UCSF)
(5/04-5/06)	Jack Li, undergraduate student (now in M.D. program, Univ. Michigan)
(1/05-5/07)	Kathryn M. Gunnison, graduate student (now in M.D. program, Rosalind Franklin Medical College)
(6/06-present)	Grace D.-Y. Yau, undergraduate student (ongoing)

Awards and Honors

09/1997-06/2002	Howard Hughes Medical Institute Predoctoral Fellowship in Biological Sciences

Scientific Memberships and Activities

09/1998-present	Howard Hughes Medical Institute "Ask-a-Scientist"
09/2001-present	American Society for Cell Biology
07/2002-present	Review or pre-review of more than two dozen manuscripts

Bibliography (most recent listed first)

Present work

Rutkowski, D. T. et al. Crosstalk between ER stress signaling and gluconeogenic and lipogenic pathways connects ER function to liver metabolism.

Publications

1. Wu, J.†, **Rutkowski, D. T.†,** Dubois, M., Swathirajan, J., Saunders, T., Wang, J., Song, B., Yau, G. D., and Kaufman, R. J. (2007) ATF6α optimizes long-term endoplasmic reticulum function to protect cells from chronic stress. ***Developmental Cell*** 13, 351-364
   †D.T.R. and J.W. contributed equally

2. **Rutkowski, D.T.,** and Kaufman, R. J. (2007) That which does not kill me makes me stronger: adapting to chronic ER Stress. ***Trends in Biochemical Sciences*** 32, 469-476.

3. **Rutkowski, D. T.†,** Kang, S.-W.†, Goodman, A. G., Garrison, J. L., Taunton, J., Katze, M. G., Kaufman, R. J., and Hegde, R. S. (2007) The role of $p58^{IPK}$ in protecting the stressed endoplasmic reticulum. ***Molecular Biology of the Cell*** 18, 3681-3691.
   †D.T.R. and S.-W.K. contributed equally

4. **Rutkowski, D.T.**, Arnold, S. M., Miller, C. N., Wu, J., Li, J., Gunnison, K. M., Mori, K., Sadighi Akha, A. A., Raden, D., and Kaufman, R. J. (2006) Adaptation to ER stress is mediated by differential stabilities of pro-survival and pro-apoptotic mRNAs and proteins. ***PLoS Biology*** 4, e374.

5. Zhang, K., Shen, X., Wu, J., Sakaki, K., Saunders, T., **Rutkowski, D. T.**, Back, S. H., and Kaufman, R. J. (2006) Endoplasmic reticulum stress activates cleavage of CREBH to induce a systemic inflammatory response. ***Cell*** 124, 587-599.

6. **Rutkowski, D. T.**, and Lingappa, V. R. (2006) Membrane targeting of proteins. In ***Cells***, First Edition. Jones and Bartlett Publishers, Sudbury, MA (Benjamin Lewin, et al. eds.)

7. **Rutkowski, D. T.**, and Kaufman, R. J. (2004) A trip to the ER: coping with stress. ***Trends in Cell Biology*** 14, 20-28.

8. **Rutkowski, D. T.**, and Kaufman, R. J. (2003) All roads lead to ATF4. ***Developmental Cell***. 4, 442-444.

9. **Rutkowski, D. T.**, Ott, C. M., and Lingappa, V. R. (2003) Signal sequences initiate the pathway of maturation in the endoplasmic reticulum lumen. ***Journal of Biological Chemistry*** 278, 30365-30372.

10. Lingappa, V. R., **Rutkowski, D. T.**, Hegde, R. S., and Andersen, O. S. (2002) Conformational control through translocational regulation: a new view of secretory and membrane protein folding. ***Bioessays***. 24, 741-748.

11. **Rutkowski, D. T.**, Lingappa, V. R., and Hegde, R. S. (2001) Substrate-specific regulation of the ribosome-translocon junction by N-terminal signal sequences. ***Proc. Natl. Acad. Sci., USA***. 98, 7823-7828 (Track II).

Oral Presentations at International Meetings

1. **Rutkowski, D. T.**, Wu, J., and Kaufman, R. J. (2007) ATF6α optimizes endoplasmic reticulum function to mediate adaptation to chronic stress. *FASEB Summer Research Conference: From Unfolded Proteins in the Endoplasmic Reticulum to Disease*, Indian Wells, CA.

2. **Rutkowski, D. T.**, Miller, C. N., Arnold, S. M., Li, J., Wu, J., Gunnison, K. M., and Kaufman, R. J. (2006) Posttranscriptional and posttranslational attenuation of gene expression produces adaptation to ER stress. *Cold Spring Harbor Symposium: Molecular Chaperones and the Heat Shock Response*, Cold Spring Harbor, NY.

Other Presentations

1. Albert Einstein College of Medicine, Liver Center Seminar Series (2007) (invited speaker).

2. Keystone Symposium: Protein Misfolding Diseases, Breckenridge, CO (2006) (poster).

3. University of Michigan Medical School Department of Biological Chemistry Retreat, Kalamazoo, MI (2004 [poster], 2005 [poster], 2006 [talk], 2007 [talk])

4. Keystone Symposium: Conformational Diseases of the Secretory Pathway, Taos, NM (2003) (poster).

B4. CV Example 4
Generously provided by Dr. Anne Kenworthy

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EDUCATION

1999-present	**NRC Fellow, laboratory of Dr. xxx** Cell Biology and Metabolism Branch, NICHD, NIH, Bethesda, MD *Research interests:* intracellular trafficking and membrane dynamics of lipid- modified proteins
1994-1999	**Postdoctoral fellow, laboratory of Dr. xxx** Department of Biology, xxx University, city, state *Research interests:* structure of lipid raft microdomains in cell membranes
1989-1994	**Ph.D. (Cell Biology), laboratory of Dr. xxx** Department of Cell Biology, xxx University, city, state Certificate in xxx *Research interests*: membrane biophysics and intersurface forces
1985-1989	**B.A. (Biology, with Honors)** Summa Cum Laude xxx College, city, state
TEACHING	Instructor, "Biomembrane Structure," Spring 1997 Johns Hopkins Masters Program in Biotechnology
HONORS	National Research Council Fellow (1999-2000) Maxwell Elliot Power Prize in Biology (1988) Kenyon College Honor Scholar (1985-1989) National Merit Scholarship winner (1985)
SOCIETIES	American Society for Cell Biology; Biophysical Society; Sigma Xi; Phi Beta Kappa

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Publications

Kenworthy, A. K., Philips, M., and Lippincott-Schwartz, J. In preparation. Dynamics of GFP Ras in living cells reveal N-Ras cycles between the cell surface to the Golgi complex.

Kenworthy, A. K., and Lippincott-Schwartz, J. In preparation. Large-scale diffusion of lipid raft components in the plasma membrane provides evidence that raft proteins are not associated in common, stable membrane domains.

Kenworthy, A. K., Petranova, N., Hubbard, A. L., and Edidin, M. In preparation. Membrane organization of GPI-anchored proteins in polarized hepatocytes: do lipid rafts mediate transcytosis?

Kenworthy, A. K. and Robinson, J. M. In preparation. Caveolin-1 at the apical recycling compartment of MDCK cells displays unique epitopes recognized by N-terminally directed antibodies.

Nichols, B. J., **Kenworthy, A. K.**, Roberts, T. H., Hirschberg, K., Lodge, R., Phair, R. D., and Lippincott-Schwartz, J. Submitted. Rapid cycling of lipid raft markers between the cell surface and Golgi complex through a pathway that is cholesterol-sensitive and bypasses transferrin labelled endosomes.

Nehls, S., Snapp, E. L., Cole, N. B., Zaal, K. J. M., **Kenworthy, A. K.**, Roberts, T. H., Ellenberg, J., Presley, J. F., Siggia, E. and Lippincott-Schwartz, J. 2000. Dynamics and retention of misfolded proteins in native ER membranes. *Nat. Cell Biol.* **2**:288-295

Kenworthy, A. K., Petranova, N., and Edidin, M. 2000. High resolution FRET microscopy of cholera toxin B-subunit and GPI-anchored proteins in cell plasma membranes. *Mol. Biol. Cell.* **11**: 1645-1655

Kenworthy, A. K., and Edidin, M. 1998. Distribution of a GPI-anchored protein at the apical surface of MDCK cells examined at a resolution of < 100 Å using imaging fluorescence resonance energy transfer. *J. Cell Biol.* **142**: 69-84.

Hristova, K., **Kenworthy, A. K.**, and McIntosh, T. J. 1995. Effect of bilayer composition on the phase behavior of liposomal suspensions containing PEG-lipids. *Macromolecules* **28**: 7693 7699.

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Kenworthy, A. K., Magid, A. D., Oliver, T. N., and McIntosh, T. J. 1994. Colloid osmotic pressure of steer ⟨- and ß-crystallins: possible functional roles for lens crystallin distribution and structural diversity. *Exp. Eye Res*. **59**: 11-30.

Koenig, S. H., Brown, R. D. III, **Kenworthy, A. K.**, Magid, A. D., and Ugolini, R. 1993. Intermolecular protein interactions in solutions of bovine lens ßL-crystallin. *Biophys. J.* **64**: 1178-1186.

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Invited papers

Kenworthy, A. K. In press. Imaging protein-protein interactions using fluorescence resonance energy transfer microscopy. *Methods: A Companion to Methods in Enzymology*.

Kenworthy, A. K. and Edidin, M. 1999. Imaging fluorescence resonance energy transfer as a probe of the membrane organization and molecular associations of GPI-anchored proteins. *In* Methods in Molecular Biology Vol 116: Protein Lipidation Protocols. M. H. Gelb (Ed.) Humana Press Inc, Totowa, NJ. pp. 37-49

Kenworthy, A. K., McIntosh, T. J. and Hristova, K. 1997. Phase behavior and intersurface forces of self assembling polymer-lipid systems. *Current Topics in Colloid and Interface Science.* **2**: 83-93.

McIntosh, T. J., **Kenworthy, A. K.**, and Needham, D. 1995. Measurements of the range and magnitude of the repulsive pressure between PEG-coated liposomes. *In* Stealth Liposomes. D.D. Lasic and F. Martin (Eds.) CRC Press, Boca Raton. pp 63-71.

Invited talks

Kenworthy, A. K. 1999. Lipid raft structure visualized with sub-micron resolution. American Society for Cell Biology Subgroup Meeting, Raftology: lipid microdomains and membrane function.

Kenworthy, A. K. and M. Edidin. 1999. Searching for lipid rafts using imaging fluorescence resonance energy transfer. Third Annual Membrane Research Forum, Nagoya, Japan.

Kenworthy, A. K. and M. Edidin. 1998. Imaging FRET detects clustering of ganglioside GM1 molecules with one another, but not with a GPI-anchored protein, 5' NT, on the apical surface of MDCK cells. FASEB Summer Conference, Lipid Modification of Proteins.

Kenworthy, A. K. and M. Edidin. 1998. Searching for "lipid rafts" in cell membranes using fluorescence resonance energy transfer (FRET) microscopy. Biophysical Society Meeting Workshop, Applications of Fluorescence Imaging in Cell Membrane Biophysics.

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Edidin, M., **Kenworthy, A. K.**, and Gheber, L. 1998. Light microscopy beyond the wavelength limit: methods for characterizing cell surface membranes. *Microsc. Microanal*. **4** (Suppl 2: Proceedings) pp. 1018-1019.

Recent Abstracts

Kenworthy, A. K. and Lippincott-Schwartz, J. 2000. Protein and lipid diffusion in Golgi membranes. *Biophys. J.* **78**:408A

Kenworthy, A. K. and Lippincott-Schwartz, J. 1999. Protein and lipid diffusional mobility in the secretory pathway: measurements in Golgi membranes. *Mol. Biol. Cell* **10**:114a

Nichols, B. **Kenworthy, A. K.** and Lippincott-Schwartz, J. 1999. Membrane traffic between the TGN and cell surface. *Mol. Biol. Cell* **10**:301a

Kenworthy, A. K., Hubbard, A. L. and Edidin, M. 1999. Membrane organization of a GPI anchored protein during transcytosis revealed by imaging fluorescence resonance energy transfer (FRET) measurements. *Biophys. J.* **76**: A232

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C1. Example of a Research Proposal

Generously provided by Dr. D. Thomas Rutkowski

Statement of Research Interests

My work focuses on the mechanisms by which cells adapt to chronic stress. My area of study is the unfolded protein response (UPR), which senses and responds to protein misfolding stress in the endoplasmic reticulum (ER). The ultimate goals of this work are to understand how stress responses shape the development and functionality of secretory organs, and how these responses can be therapeutically manipulated to treat human diseases of protein misfolding stress.

Previous Work

A core interest at all stages of my research career has been to understand how biological processes are regulated according to cellular need. As a graduate student, this motivation led to my discovery that the N-terminal signal sequences of secretory and membrane proteins encode information not just for the targeting of these proteins to the ER, but also for regulating their faithful topology[1] and maturation[2] once targeted. These and related newly-defined roles for signal sequences have been subsequently shown to impact processes as disparate as hormone responsiveness, pharmacological sensitivity, and global secretory pathway influx during stress[3].

My postdoctoral work has been focused on addressing the question of how cells adapt to physiological and pathological protein misfolding stresses rather than succumbing to them. My model system is ER stress, which defines any perturbation that compromises the ability of the ER to properly fold and process proteins. The UPR, like all stress response pathways, is marked by the simultaneous activation of both adaptive signaling cascades that help alleviate stress and apoptotic (i.e., death-promoting) cascades. How a cell can selectively initiate and perpetuate the adaptive components of a stress response without bringing about its own execution is not understood.

> The mechanisms that underlie adaptation are critical to both pathology and normal development and organ function[4]. For example: Type II diabetes is associated with ER stress in pancreatic β cells, and ER stress-induced apoptosis likely contributes to β cell failure in this disease. Yet Type II diabetes is a chronic condition, manifesting over many years. Thus, most β cells must adapt to the stress of increased insulin production. As a counterpoint, UPR activation is also implicated in both viral infections and cancer, circumstances in which the adaptive components of the response have likely been hijacked without initiation of cell death. Even normal physiology requires cells to adapt to stress: an intact UPR is necessary for the development of secretory cells such as B-lymphocytes, hepatocytes, and pancreatic acinar cells. Despite the physiological importance of adaptation, no framework previously existed for understanding how an activated UPR can lead to survival and adaptation over death because an adaptive UPR had not been experimentally reconstituted. My postdoctoral work has led to important mechanistic insights into this process that will drive my research as an independent investigator.

The UPR senses ER stress by the action of three ER-resident transmembrane proteins—ATF6α, PERK, and IRE1α. These molecules are activated by ER stress, and each initiates signaling cascades that result in transcriptional upregulation of genes that facilitate ER protein processing. I was able to successfully reconstitute an adaptive response in a simple and tractable in vitro system. From this system, I found that an adaptive response is qualitatively distinct from the much-better characterized response to severe stress[5]. Specifically, the ATF6α, PERK, and IRE1α pathways are all activated by stresses of both types. However, the upregulation of downstream apoptotic cascades

is suppressed when adaptation occurs, yet the upregulation of genes that improve protein folding persists. The mechanism for this selectivity is the rapid degradation of pro-apoptotic mRNAs and proteins. If the UPR-dependent enhancement of protein folding in the ER[6] is able to correct the protein folding problem, further UPR signaling is attenuated and apoptosis is not executed. Thus, the UPR is structured to make apoptotic cascades directly responsive to stress, while improvements in protein folding are longer-lasting and protect the cell from long-term insult. I found this general mechanism of adaptation to apply to both pharmacological and genetic ER stress, and so it is likely to be of broad importance in understanding how cells adapt.

Previous work had suggested that the upregulation of chaperones during ER stress is controlled by ATF6α [7], and so we predicted an important role for this protein in adaptation. To test this idea, we deleted ATF6α□□□□□□□□□. We found that ATF6 α coregulates chaperone expression during ER stress, along with the IRE1α and PERK pathways. Because of this overlap, *Atf6*α-/- cells and animals tolerate brief exposure to stress, but not persistent insult[8]. These results suggest that ATF6α evolved at least in part to protect cells from chronic stress. These studies have laid the conceptual foundation for how the UPR is structured to allow for adaptation and have provided genetic tools to identify the mechanisms of adaptation. As an independent investigator, I will extend this work to the study of physiological and developmental stresses, with an emphasis on the mechanisms whereby professional secretory cells use an adaptive UPR to expand and maintain their secretory capacity.

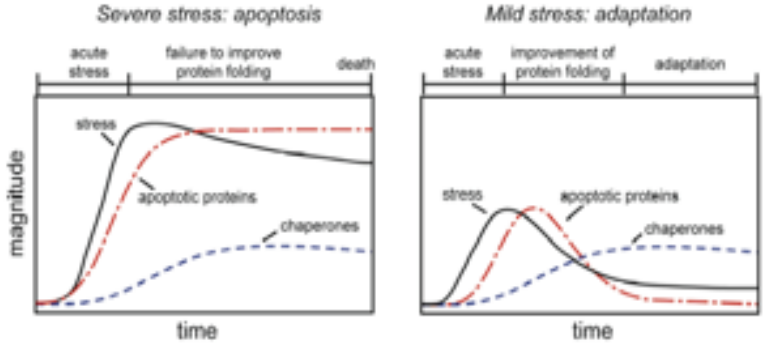


Figure 1. Improved protein processing is impossible when stress is severe (left panel). Thus, continued UPR signaling leads to prolonged upregulation of apoptotic proteins. During mild stress, upregulation of pro-adaptive proteins, such as ER chaperones, reduces the load on the ER folding machinery and attenuates further UPR signaling. The rapid degradation of pro-apoptotic proteins ensures that death pathways are not executed as cells adapt.

Future Work

To address the question of how cells adapt to chronic ER stress, my lab will pursue three areas of investigation over the next five years.

1. I hypothesize that the fundamental aspects of adaptation suggested by our earlier work will underlie adaptation to chronic ER stresses of different types, including genetic and developmental stresses. These aspects include: (a) quasi-permanent upregulation of adaptive UPR targets; (b) suppression of apoptotic cascades; and (c) net improvement in the ER protein processing capacity in adapted cells compared to naïve cells. This hypothesis is based on our preliminary data that suggest that various models of chronic ER stress lead to persistent upregulation of ER chaperones but not apoptotic cascades. These models include increases in ER protein load, genetic compromise of ER quality control, and differentiation of B-lymphocytes into antibody secreting plasma cells. Therefore, **my first specific aim will be to define the commonalities underlying the UPR as it induced by these stresses, to identify the consequences of these programs on ER function, and to describe the mechanisms by which these adjustments are maintained.** This work will take

advantage of our ability to reconstitute stresses of various types in experimentally tractable cell culture systems. In each of these systems, we will monitor the status of the UPR at multiple points, from its activation state to expression of downstream targets, at both RNA and protein levels. Using both endogenous and exogenous substrates, we will also monitor the ER protein folding and processing environment. This analysis will involve biochemical probing of ER chaperone-substrate interactions and the kinetics of protein maturation and secretion. In addition, in collaboration with Erik Snapp (Department of Anatomy and Structural Biology, Einstein University), we will use fluorescent substrates that require proper folding for their trafficking through the secretory pathway to monitor ER functionality in living cells. Finally, we will determine how the adapted state is maintained by comparing adapted cells to naïve cells. We will focus in particular on changes in gene and protein expression, and also on epigenetic modifications, that persist even when adapted cells are removed from stress. Together, these studies will reveal the underlying mechanisms by which the UPR allows for adaptation to stresses of various types.

2. I hypothesize that the ATF6α pathway is needed to establish and maintain the optimal functionality of professional secretory cells. This hypothesis is based in part on our preliminary data showing that secretory cell types in *Atf6*α-/- mice, including liver, pancreas and B-lymphocytes, show reduced expression of ER chaperones. Therefore, **my second specific aim will be to characterize the consequences of ATF6α deletion on the differentiation and functionality of professional secretory cells, using B-lymphocytes as my primary model system.** B-lymphocytes will be analyzed from wild-type and *Atf6*α-/- mice by both in vitro stimulation of differentiation into antibody-secreting plasma cells and by in vivo challenge with antigen. In addition to monitoring the antibody response in vitro and in vivo, we will determine whether the ER expansion that accompanies B-lymphocyte differentiation requires ATF6α, and whether *Atf6*α-/- B-lymphocytes are more prone to cell death during differentiation. The development of secretory cells as a model system for adaptation will provide a springboard for future work examining adaptation to other physiological and pathological stresses.

3. I hypothesize that continued signaling by an adaptive UPR maintains a functional secretory apparatus in fully differentiated professional secretory cells and therefore maintains organ physiology during both normal and stress conditions. This hypothesis is based in part on our observation that specific secretory tissues such as liver, pancreas, and spleen show suppressed expression of ER chaperones in *Atf6*α-/- mice in the absence of exogenous stress. **My third specific aim will be to elucidate the contribution of the UPR signaling pathways to the maintenance secretory organ function, with an emphasis on the liver.** This work will take advantage of my access to primary cell lines and mice genetically deficient in, or with readily deletable alleles of, many of the key UPR signaling molecules besides ATF6α, including ATF6β (a protein related to ATF6α of unknown function) and IRE1α. In mice, we will characterize liver function using biochemical and histological methods, and secretory pathway functionality by biochemical, proteomic, and genomic methods (for example, comparing the protein composition of the hepatic ER in normal animals or mice lacking ATF6α). Similar analysis will also be carried out in primary hepatocytes, wherein overexpression and knockdown experiments can be used to test specific predictions about the role of these proteins in maintaining liver function. Once the contributions of the ER signaling molecules to liver function is better understood, we will be able to explore how normal liver function is subverted by pathological challenges that lead to ER stress, such as chronic alcohol consumption, exposure to environmental toxins, and infection by hepatitis viruses.

The long-term aim of this work is to identify the key control points in cellular life-and-death decisions, and to find therapeutic means for manipulating these decisions to treat conditions in which dysregulation of the adaptive response has been implicated.

While the adaptive and apoptotic signaling pathways of the UPR have been in some cases well defined, this has occurred in largely non-overlapping studies that leave the question of how cells actually choose between these alternate fates undefined. Thus, this work is particularly timely, and fills an important but currently underrepresented area of study within the field of stress biology.

[1]Rutkowski et al. (2001) *PNAS* 98, 7823; [2]Rutkowski et al. (2003) *JBC* 278, 30365; [3]Hegde and Bernstein (2006) *TiBS* 31, 563; [4]Rutkowski and Kaufman (2007), *TiBS*, (in press); [5]Rutkowski et al. (2006) *PLoS Biol*. 4, e374; [6]Rutkowski et al. (2007) *MBoC* (in press); [7]Okada et al. (2002) *Biochem. J*. 366, 585; [8]Wu, Rutkowski, et al. (2007) *Dev. Cell* (in press)

C2. Example of author's research proposal

CURRENT RESEARCH For the past four years, I have been investigating the broad questions of 1) How are endoplasmic reticulum (ER) activities and functions organized and coordinated? and 2) How does the ER form, differentiate, and maintain distinct subdomains? The ER performs essential cellular functions, including biogenesis of secretory proteins, calcium regulation, lipid synthesis, and the trafficking of proteins and lipids. Morphologically, the ER displays a variety of forms including branching tubules, cisternae, and closely apposed lamellar stacks. Furthermore, the ER is divided into ribosome-studded (rough ER-the site of translocation of lumenal and membrane proteins) and ribosome-free (smooth ER) subdomains. Despite the importance of ER functions, little is known as to how ER activities are organized in cells or how ER morphology is determined. As a postdoctoral fellow, I have initiated studies of these fundamental questions.

Analysis of data from the human genome project suggests that up to one fourth of all genes encode secretory and membrane proteins. Almost all such proteins are co-translationally inserted into the ER through a multicomponent protein channel, the translocon. The same channel has been implicated in the retrotranslocation of proteins out of the ER into the cytoplasm for degradation by the proteasome. While several proteins involved in forward translocation have been identified and characterized biochemically, little is known about how these proteins are organized within individual channels. Whether or how their organization changes with the functional state of the translocon (i.e. absence of nascent peptide chain, forward translocation of a peptide chain or retrotranslocation) are not clear.

To elucidate the mechanisms that organize translocons, I have begun developing tools to distinguish the different functional states of translocons. My initial studies have focused on characterizing actively translocating versus inactive translocons in cells. Using antibody-based acceptor photobleaching fluorescence resonance energy transfer (FRET) and confocal microscopy, protein-protein interactions between translocon components have been probed. Discrete changes in the organization of components of active and inactive translocons were detected[1].

To probe ER functionality and protein mobility, I have studied different forms of ER in a variety of organisms. I have used photobleaching (FRAP and FLIP)[2,3] of GFP-tagged proteins to help investigate retention of misfolded membrane proteins in mammalian ER[4] and protein trafficking between the ER and the Golgi in plants[5]. In collaboration with Dr. Mary Lilly, I identified the ER as the membranous component of the *Drosophila* ovary fusome, a cytoskeletal-membranous structure that connects cystocytes in the syncitial cyst that forms during oogenesis. Photobleaching experiments revealed the continuity of the ER between all of the cystocytes within a cyst and changes in continuity during oogenesis[6].

To study the biogenesis of smooth ER structures, I have integrated photobleaching and molecular biology techniques. These studies revealed that geometric structures including sinusoidal ER, crystalloid ER, karmellae, and whorls all can arise from the overexpression of specific resident ER membrane proteins with weakly interacting cytoplasmic domains that dimerize in an anti-parallel manner[7]. The dynamic interactions of these proteins bind ER membranes together, initially stacking on the nuclear envelope, and later reorganizing into Organized Smooth ER (OSER) structures. OSER may be pathogenic, as they are observed in cells expressing mutant proteins that cause Charcot-Marie-Tooth syndrome and early onset torsion dystonia. In collaboration with Dr. Gert Kreibich, I helped characterize a potential mechanism for the maintenance of rough ER organization. Photobleaching studies revealed that polysome assemblies of ribosomes and translocons diffuse extremely slowly, effectively immobilizing the large complexes and excluding them from other ER domains[8]. All of these projects have contributed to the development of a foundation for dissecting the mechanisms of ER organization and differentiation in my continuing studies.

FUTURE RESEARCH OBJECTIVES I will be building upon my postdoctoral studies to address the mechanisms of 1) translocon organization and function in cells and 2) ER differentiation.

1. Structural and spatial organization of the translocon- Using standard immunofluorescence techniques, translocon components display a homogeneous distribution throughout the ER. In contrast, FRET analysis of translocon components has revealed significant spatial heterogeneity in translocon organization throughout the ER, consistent with the possibility that spatial segregation of distinct translocon activities or functions exists. In addition, translocon activities are not restricted to forward translocation. The retrotranslocation of proteins out of the ER for ER associated degradation (ERAD) involves core translocon proteins. Whether translocons involved in forward translocation also participate in retrotranslocation is unknown.

To further investigate these ideas, FRET between translocon components will be used to correlate the spatial organization, composition, and distribution of translocons (and potentially other protein complexes) with their functional states and activities. Specialized cell types that may be enriched in distinct translocon activities will be probed. For example, antigen-presenting cells might have higher numbers of retrotranslocating translocons. FRET experiments will permit a direct visualization of the functional organization of the ER during normal development and disease states.

To knock down native translocon components and, in some cases, to functionally replace them with GFP-tagged wild type or mutated components, I have begun utilizing RNAi methods. Currently, stable RNAi cell lines are being generated for quantitative biochemical analyses of changes in protein processing in cells missing translocon components or containing functionally incorporated mutated components. In addition, these cells will be important for probing changes in translocon organization using the FRET methods I have developed as a postdoctoral fellow. Changes in translocon function will be qualitatively assessed by probing for changes in cell organization and the distributions of translocation-dependent proteins. Using these complementary approaches, exciting new insights into the cell biology of translocon function and organization will be gained.

2. Rough and smooth ER differentiation- The mechanisms that govern differentiation and partitioning of rough and smooth ER within a continuous organelle are poorly understood. To investigate the *regulation* and *components* of rough and smooth ER differentiation, pancreatic acinar cells (in which rough ER proliferates in response to glucocorticoid hormones) and lutein cells (in which smooth ER proliferates as estrogen levels fluctuate), will be used as model systems. Both cDNA microarray analysis and proteomics will be employed to identify candidate proteins involved in ER differentiation and to characterize their temporal regulation. Properties of candidate proteins will be investigated by expressing the proteins with fluorescent tags and imaging the proteins in undifferentiated cells and also by modulating expression of the native proteins in differentiated cells by using RNAi. How rough and smooth ER subdomains are *physically* formed and maintained is an equally important problem. Whether subdomains represent dynamic steady-state assemblies of proteins and membranes or whether subdomains form on scaffolds or matrices is unknown. Live cell imaging and photobleaching of rough and smooth ER marker proteins will be used to probe the accessibility and mobility of rough and smooth ER proteins within and between distinct ER subdomains. These approaches will yield valuable information about the molecular, spatial, and temporal regulation of ER differentiation.

SELECTED REFERENCES **1.Snapp** et al. (submitted). **2.Snapp** et al. Curr. Prot. Cell Biol. 2003. **3.**Lippincott-Schwartz et al. 2001. *Nat. Rev. Mol. Cell Biol.* 2:444-456. **4.**Nehls, et al. 2000. *Nat. Cell Biol.* 2:288-295. **5.**Brandizzi et al. 2002. *Plant Cell.* 14:1293-1309. **6.Snapp** et al. (in preparation). **7.Snapp** et al. 2003. *J Cell Biol.* 163:257-269. **8.**Nikonov et al. 2002 *J Cell Biol.* 158:497-506.

C3. Research Statement Example 3

Generously provided by Dr. Anne Kenworthy

Research accomplishments and current research

Structure of lipid raft microdomains— In the so-called "lipid raft" model, glycosphingolipids and cholesterol are proposed to self-assemble into microdomains which organize other proteins and lipids. These domains form functional complexes that can participate in a variety of membrane trafficking and cell signaling events [1]. Lipid rafts have been principally characterized biochemically by their insolubility in cold non-ionic detergent. Despite the wide-ranging implications of this model, the structure of lipid rafts in cell membranes is controversial. To visualize these domains in intact cells, I used a novel form of fluorescence microscopy with extremely high resolution (<100 Å), imaging fluorescence resonance energy transfer (FRET). My FRET measurements suggested that glycosylphosphatidylinositol (GPI)-anchored proteins, a biochemical marker for lipid raft domains, are not present in clusters as predicted by the lipid raft model but instead appear to be randomly distributed across the cell surface [2, 3]. This implies that either rafts are small and dynamic structures, or the entire outer leaflet of the plasma membrane is a single raft-like domain. How raft domains organize lipid-modified proteins on the inner leaflet of the plasma membrane remains an open question, which I plan to return to in future experiments.

Intracellular trafficking of Ras—Ras GTPases are key players in signal transduction pathways regulating cell growth and differentiation. Ras, a farnesylated protein, has long been known to localize to, and function at, the inner leaflet of the plasma membrane. It is now known that palmitoylated N- and H-Ras isoforms are also associated with the Golgi complex, and reach the cell surface as part of the classical secretory pathway [4]. The presence on N- and H-Ras on the Golgi could have additional implications for Ras trafficking and signaling. In collaboration with Dr. Mark Philips (New York University), I have addressed this issue using time lapse confocal microscopy and photobleaching techniques in living cells expressing Green Fluorescent Protein (GFP) chimeras of N-, H- and K-Ras. My studies have revealed a previously unidentified pathway that recycles N- and H-Ras from the cell surface to the Golgi complex. Preliminary experiments indicate that this pathway may be utilized by other cytoplasmic lipid-modified proteins and therefore could provide a general mechanism for regulating the trafficking and signaling of these molecules, possibilities I propose to explore in future experiments.

Membrane dynamics of lipid raft components at the cell surface—My previous FRET experiments suggested that most GPI-anchored proteins are not constitutively clustered in raft domains. The dynamics of the association of these molecules and other proteins with lipid rafts remains an open question. Recent high-resolution measurements of the dynamics of individual proteins in plasma membranes imply that molecules remain stably associated with lipid rafts for minutes [5]. To test this, I am measuring the diffusional mobility of GFP-tagged raft and non-raft markers, including both transmembrane and peripheral lipid-modified proteins, using confocal FRAP. I have also begun to use confocal fluorescence correlation microscopy (FCS), another technique that can resolve the diffusion of individual molecules from that of lipid raft domains, as a complementary approach to this question. Our FRAP data suggest that only a small fraction of molecules is associated with these microdomains at any given time. Since the lateral diffusion of cytoplasmic lipid-modified proteins has been largely unexplored, these experiments also provide fundamental insight into the environment of the inner leaflet of the plasma membrane.

Future research plans

Lipid-modified proteins localized at the inner leaflet of the plasma membrane play key roles in relaying signals from cell surface receptors to intracellular effectors [6]. This family of peripheral membrane

proteins includes Ras, heterotrimeric G-proteins and Src family kinases, proteins intimately linked to cancer biology. A goal of my future research is to understand how the lipid modifications of these proteins (myristoylation, palmitoylation, and prenylation) impact their function. My initial studies will address the following specific questions using live-cell confocal microscopy of GFP-tagged proteins [7] coupled with FRET, FRAP, and FCS techniques [8-10]:

1. Intracellular trafficking of lipid-modified signaling proteins— While some lipid-modified proteins such as K-Ras are almost exclusively localized to the plasma membrane, others such as nitric oxide synthase, Gα subunits, and palmitoylated forms of Ras (N- and H-Ras) are also associated with the Golgi complex. I will explore the role of this Golgi pool in the intracellular trafficking of these molecules by asking:

A. Do multiple lipid-modified proteins share a common cycling pathway between the plasma membrane and the Golgi complex?— I will test whether the cycling pathway utilized by N- and H-Ras is a common pathway shared by other lipid-modified proteins, visualize the intermediates involved in this process, and characterize the signals that sort proteins into this pathway.

*B. How are lipid-modified proteins trafficked to and from the cell surface in polarized cells?—*I will determine which proteins undergo vesicular transport from the Golgi complex to the cell surface in polarized epithelial cells, evaluate whether trafficking occurs directly or by transcytosis, and determine if sorting signals target these proteins to either the apical or basolateral membranes.

2. Molecular associations of lipid-modified proteins in signaling complexes— Current models suggest that these peripheral proteins are not randomly distributed across the inner leaflet of the plasma membrane but instead are organized in complexes that could serve to compartmentalize and regulate cell signaling events. To test this I will ask:

A. How are lipid-modified proteins organized on the inner leaflet of the plasma membrane? I will test if lipid raft domains [1] organize lipid-modified proteins in pre-assembled complexes and/or if such domains assemble transiently during cell signaling. How the size, composition, and dynamics of these complexes change over time will also be characterized. I will also evaluate the effects raft-disrupting conditions such as cholesterol depletion and raft-enhancing conditions such as antibody-induced crosslinking.

B. Does caveolin regulate signaling by organizing lipid-modified proteins into complexes? *I will probe for direct binding of various proteins to caveolin, a transmembrane protein thought to act as a "scaffold" for regulating signaling [11]. I will also look for indirect effects of caveolin arising from its cholesterol-binding activity [12].*

***References**: [1] Simons and Ikonen (1997)* Nature ***387**:569; [2] Kenworthy and Edidin (1998)* J. Cell Biol. ***142**:69; [3] Kenworthy* et al. *(2000)* Mol. Biol. Cell ***11**:1645; [4] Choy et al. (1999)* Cell ***98**:69; [5] Pralle* et al. *(2000)* J. Cell Biol. ***148**:997; [6] Casey (1995)* Science ***268**:221; [7] Lippincott-Schwartz* et al. *(1998)* Trends Cell Biol. ***8**:16; [8] Pollok and Heim (1999)* Trends Cell Biol. ***9**:57; [9] Nehls* et al. *(2000)* Nat. Cell Biol. ***2**:288; [10] Brock* et al. *(1999)* Proc. Natl. Acad. Sci. USA ***96**:10123; [11] Okamoto* et al. *(1998)* J. Biol. Chem. ***273**:5419; [12] Roy* et al. *(1999)* Nat. Cell Biol. ***1**:98.*

C4. The opening paragraph

Tumor cells pose the greatest threat to patients when the cells detach from the tumor and form metastases at distant sites. Healthy immune cells play a key role by communicating with the tumor cells with Epidermal Growth Factor (EGF). Blocking EGF signaling significantly inhibits metastasis. How EGF interacts with the EGF receptor on tumor cells is unknown. The leading hypothesis is that the immune cell (macrophage) secretes a gradient of EGF that finds the tumor cell. However, macrophages are often several cell lengths away from tumor cells, which will result in EGF dilution and possibly insufficient signal density. Also, I have preliminary data revealing that macrophages do not secrete detectable amounts of EGF into cell culture media. An alternative hypothesis is that a novel membrane structure, nanotubes, extend from macrophages directly to tumor cells, touching the tumor cell and delivering EGF in a highly concentrated manner. An additional hypothesis is that EGF may be concentrated in vesicles or exosomes that find the tumor cell. Whether diffusion, exosomes or nanotubes communicate with the tumor will determine what types of therapeutic strategies could be developed to block the process of metastasis. As a postdoc, I have developed reagents and fluorescence microscopy methods to visualize delivery of molecules by all three pathways. My future lab will resolve the long-standing problem of how immune cells communicate with and influence tumor cells in live animals.

The important ideas in this paragraph include what the high level problem is (metastasis/cancer), the question I'm going to focus on (how immune cells communicate with tumor cells to induce metastasis), why this is a significant question (not just that it's cancer, but rather that the mechanism of communication is going to determine what kind of therapy will be able to disrupt communication), why me (my preliminary data and the tools I have developed), plus a clear idea of what the answer could be. This last point is very important. You do not want to say your research will "increase understanding" or something equally vague. You don't really want to say the thing you are working on is "understudied" because lots of things are not studied. That's not a justification to start studying something. There needs to be a clear value to choosing to study your problem vs. all of the other things out there that could be studied. Or put more bluntly, why is YOUR problem a better bet for the department to invest in than the problems the other candidates are studying? Remember, you are being hired for future your research program. Your track record as a postdoc speaks to your potential to be successful. You are now trying to convince the search committee that you've got a problem that the search committee will want to see successfully solved.

D1. Example of Cover Letter
Generously provided by Dr. D. Thomas Rutkowski

Date

Name
Department
Institution
Address
City, State, Zip

Dear Committee Members:

I am a postdoctoral fellow in the lab of Dr. xxx at the University of Michigan. I am applying for the position of Assistant Professor in the Department of Cell Biology and Neuroscience at Rutgers, the State University of New Jersey. This application is in response to an advertisement in the September 7 issue of Science.

My postdoctoral work has been devoted to understanding the mechanisms by which cells adapt to chronic stress in the endoplasmic reticulum. The endoplasmic reticulum stress response is necessary for protection against a wide spectrum of chronic diseases and also for the proper development of secretory tissues. Ultimately, if we are to understand the normal development of secretory cells, and to therapeutically intervene when stress-mediated cell death is implicated, we must understand how cells commit to adaptation over death.

My work to date has led to important fundamental insights into the mechanisms of adaptation. As a principal investigator, I will extend this work to understanding how cells sense and adapt to physiological and developmental endoplasmic reticulum stress. My expertise in cell biology and molecular biology, signal transduction, development, and genetics, and active collaborations in other areas, give me a broad experimental base. I am confident that I will maintain a vigorous and internationally competitive research program that will complement the existing strengths of the Department of Cell Biology and Neuroscience.

Letters of reference in support of this application will be provided by:

- x, Ph.D., postdoctoral advisor, Howard Hughes Medical Institute / University of Michigan
- x, M.D., Ph.D., graduate advisor, University of California San Francisco/ Prosetta Corporation
- x, M.D., Ph.D., collaborator, National Institute of Child Health and Human Development / National Institutes of Health
- x, Ph.D., collaborator, University of Texas Southwestern Medical Center

I can be contacted at (555) 555-5555 (work): (555) 555-5555 (cell); or xxx@gmail.com (email)

I look forward to hearing from the committee.

Sincerely,

D2. Example of Author's Cover Letter

DEPARTMENT OF HEALTH & HUMAN SERVICES

Erik Lee Snapp, Ph.D.
National Institutes of Health

National Institutes of Child Health
And Human Development
Cell Biology and Metabolism Branch
Building 18T, Room 101
Bethesda, MD 20892
Phone: 301-496-5189
Fax: 301-402-0078

March 11, 2004

Search Chair
UCSF Box X
San Francisco, CA

Dear Dr. X,

I wish to apply for the tenure-track faculty position of Assistant Professor in cell/developmental biology advertised on Science Jobs online. Attached are a copy of my curriculum vitae, recent reprints, and statements of research and teaching interests.

A fundamental issue in cell biology is to understand the molecular mechanisms governing the biogenesis and functional organization of cellular organelles. I have concentrated my efforts on the endoplasmic reticulum (ER). My postdoctoral research in the laboratory of Dr. Jennifer Lippincott-Schwartz at the National Institutes of Health has focused on using live cell fluorescence imaging and biophysical techniques including photobleaching and FRET to visualize the organization and dynamics of ER proteins and membranes. In the future, I plan to expand my studies of ER biogenesis in three areas: structural organization of the ER protein translocation channel in cells, characterization of the spatial distribution of functional activities of protein complexes in cells, and the mechanisms and regulation underlying the proliferation of rough and smooth ER in differentiated cells. In addition to imaging and biophysical techniques, my future studies will incorporate additional tools including RNAi, gene replacement, and proteomics. These studies will provide fundamental and novel insights into 1) the cell biology of the ER protein translocation channel and 2) the functional organization and architecture of the ER.

I am committed to pursuing a career in academia and research, and look forward to hearing from you regarding my application. If you wish to discuss my educational and research background in further detail, please contact me at (301)-496-5189. Thank you for your consideration of my application.

Sincerely,

Erik Lee Snapp, Ph.D.

D3. Cover Letter Example 3
Generously provided by Dr. Anne Kenworthy

X, Ph.D.
address
city, state zip

November 24, 2000 **Cell Biology**

School of XXX
University of XXX
address
street address
city, state zip code

Dear Search Committee,

Enclosed please find my application for one of the tenure-track faculty positions in the area of Cell Biology in the School of X recently advertised in *Science* Online. My research interests are the intracellular trafficking, molecular associations and membrane dynamics of lipid-modified proteins. In my postdoctoral research with Dr. X at X University, I studied the organization of GPI-anchored proteins in lipid raft microdomains using fluorescence resonance energy transfer (FRET) microscopy. My current postdoctoral research in the laboratory of Dr. X at the National Institutes of Health has focused on visualizing the intracellular trafficking and membrane dynamics of Ras. My studies of Ras-GFP chimeras have revealed a pathway by which Ras cycles between the cell surface to the Golgi complex. This pathway could represent a general mechanism for regulating the trafficking and signaling of cytoplasmic lipid-modified proteins.

In the future, I plan to expand my studies of Ras to investigate how lipid modifications such as prenylation, palmitoylation, and myristoylation regulate the function of lipid-modified signaling proteins localized to the inner leaflet of the plasma membrane. My initial studies will focus on the intracellular trafficking of GFP chimeras of a variety of these proteins between the cell surface and Golgi complex as well as the association of these proteins with lipid raft domains to form signaling complexes. I will study these processes in living cells using cutting-edge confocal imaging methods and biophysical techniques such as FRET, fluorescence recovery after photobleaching (FRAP), and fluorescence correlation spectroscopy (FCS). These studies will provide fundamental insights into the links between the cell biology and signal transduction of these proteins.

Thank you for your consideration of my application.

Sincerely,
applicant signature
applicant, Ph.D.

E1. Author's Teaching Philosophy example 1

TEACHING INTERESTS

My greatest teaching challenge has been to convey my love of science and ideas to a broad audience of varied backgrounds. Whether tutoring an Adult Basic Education course, speaking to fourth grade students on career day at NIH or teaching graduate students how to photobleach cells with a confocal microscope, I have always sought to engage all of the students. My favorite response from a student came from a fifth grade girl when I visited her school as part of the NERDS science outreach program. I organized and taught a parasite focused microbiology workstation. Afterwards, the girl said to me, "Thanks to you, I'm never traveling anywhere or eating anything again!" It was the best compliment I've received for my teaching.

To succeed in biology, I think students must be taught how to learn. I started in biology in the late 1980's before PCR, green fluorescent protein, gene chips or bioinformatics had been discovered or created. Today, biologists take advantage of all of these tools and must be prepared for tomorrow's tools, such as proteomics or RNAi. To this end, I would convey to students that science is a dynamic process and not a set of static facts to be memorized. I believe this can be accomplished by integrating a combination of science history, modern day research problems, and an appreciation of cutting-edge techniques with standard course topics. Lecture materials would be supplemented with problem sets and hands-on laboratory experience, whenever possible.

Learning extends well beyond the classroom. My work in laboratories during my undergraduate education was an essential aspect of my training as a scientist. Providing students with such an opportunity is a critical factor in the education process at this level. Both laboratory-based courses and programs that enable interested students to participate in mentored research can provide such opportunities. At the graduate level, helping students to become scientists by working with them on a daily basis is one of the most critical roles of the faculty. I benefited from having a graduate advisor that still worked at the bench and was able to address both questions about the direction of a research project and the intricate details of a troublesome experiment. Mentoring from other professors helped broaden my perspective of approaches to scientific questions and career paths. Finally, I think it is important to prepare postdoctoral fellows for their future careers. Career development workshops on topics such as grant proposal writing and alternative careers have been popular at my graduate institute and at my postdoctoral institution. I would be interested in developing and participating in such a program as a faculty member.

My teaching experience includes serving as a microbiology teaching assistant for medical students and as an instructor for an advanced microscopy course for graduate students, postdoctoral fellows, and professors. As a teaching assistant, I set up the labs, lectured on the methods, provided technical guidance, and led class discussions of problem sets. For the microscopy course, I wrote an extensive handout (that became the basis of my Current Protocols chapter), lectured, and instructed students in hands-on use of the confocal microscope and the interpretation of experimental results. In both cases, I was teaching students from broad backgrounds and with varied interests. It was a challenge that I enjoyed and look forward to in the future.

Based on my background, I would be able to teach in either undergraduate or graduate-level cell biology or parasitology courses. I could also teach a specialized course such as

organelle biogenesis or microbial pathogenesis at the graduate level. In addition, I could contribute selected lectures on light microscopy, fluorescence microscopy methods, protein translocation, and glucose transporters.

E2. Teaching philosophy example 2

Generously provided by Dr. D. Thomas Rutkowski

Before I knew that I wanted to be a scientist, I knew that I wanted to teach. When I was first exposed to the career arc of the academic research scientist, I realized that I could do both. I view teaching at all levels as an opportunity to present science as a dynamic process of discovery, and to introduce the scientific way of thinking to students and trainees.

As a graduate student, I co-authored a chapter with my advisor on protein targeting in the textbook *Cells*, which is the new cell biology companion to the *Genes* series. In composing that work, I made a conscious effort to emphasize throughout the chapter the topics that are important but poorly understood. The feedback I have received on this effort suggests that this approach has been well received by both students and teachers. I remember from my own time as a student that biology presented as a series of facts, with little supporting information on how problems were addressed and what remained to be discovered, was dull. While a more contextual presentation of science is routine (or at least should be) in graduate school, I believe it can be successfully applied to undergraduates and to non-scientist postgraduates. I also believe that such classes would benefit from the presentation of topics under a unifying theme that runs throughout a teaching period. For example, essentially all of cell biology can be taught around the biology of HIV, which can be used to integrate lectures on DNA replication, transcription, translation, protein folding and transport, cell cycle control, immunity, etc. In classes with a relatively small number of students, this approach can be further augmented by incorporation into a problem-based learning format. The goal of these approaches is to not only make science more interesting, but also to illustrate how science is ultimately detective work and discovery.

The research scientist also has a responsibility to teach through mentoring of lab personnel. I benefited at all levels of my research training—even as an undergraduate—from advisors who gave me a great deal of leeway. I was free to pursue questions that I found interesting and to learn from my own success and failures. In my mentoring of undergraduate and graduate students, I have applied a similar approach. My philosophy has been to give trainees projects on which they could have some ownership, rather than using them as technicians. I have found that even the undergraduates who come to the lab seeking to bolster a C.V. for medical school applications are more likely to develop their critical thinking faculties in this way. For graduate students in particular, I will tend to err on the side of independence rather than regimented oversight. Early intellectual freedom, even thought it might be more frustrating for trainees in the short term (as it was for me), will better prepare them for scientific independence.

With that consideration in mind, though, I recognize the importance of striking the proper balance between a hands-off approach and more direct supervision. I have come to appreciate first-hand that every person comes to a lab with a unique motivation and a unique set of strengths and weaknesses. I believe that mentoring young scientists should always encompass critical data interpretation (especially of one's own data), development of experimental plans, scientific writing, presentation, and career development. However, these lessons cannot all fit into a "one-size-fits-all" style of mentoring. Some students will thrive with independence, but others will flounder. My goal as a mentor is to be flexible to each person's motivations and talents, to maximize his or her potential.

My formal teaching assistantship experiences encompassed giving brief lectures, assisting in labs, conducting question and answer sessions, holding office hours, and individual meetings as necessary. Thus, in addition to fundamentally enjoying teaching, I have enough experience to feel

comfortable with it. Based on my specific background and expertise, I would be most qualified to teach undergraduate or graduate level cell biology courses, or specialized topics courses in the secretory pathway, stress responses, or protein biogenesis. I could also contribute lectures on protein translocation, ER quality control, or secretory cell development.

E3. Teaching Philosophy Example 3
generously provided by Dr. Anne Kenworthy

Teaching philosophy and interests

I approach science education from the perspective of someone who attended a small liberal arts college as an undergraduate and research-oriented universities as a graduate student and postdoctoral fellow. Being able to actively participate in laboratory research was an important aspect of my undergraduate training, and I think that providing students with such an opportunity is a key aspect of the education process at this level. Both laboratory-based courses as well as programs that enable interested students to participate in supervised research can provide such opportunities. At the graduate level, helping graduate students to become scientists by working with them on a day-by-day basis is clearly one of the most critical roles of the faculty. But, I also think an important challenge in science education today is to recognize the needs of the growing number of students and postdoctoral fellows who will not continue to work in a traditional academic settings but instead will pursue "non-traditional" scientific careers. While I do not necessarily believe that the current format of Ph.D. programs should be changed, I do think this is issue needs to be given serious consideration by those training the next generation of scientists.

My current philosophy of teaching is based on my experience as the instructor of a semester-long course on "Biomembrane Structure" in the Masters program in Biotechnology at The Johns Hopkins University. The program was a part-time one, most of the students having day jobs as technicians and taking one or two courses per week at night. I was singularly responsible for the course, and the syllabus and format of the class were entirely of my design. Since the course was in a biotechnology program, I discussed both the biophysical and biochemical properties of lipids and model membrane systems and selected topics in the cell biology of membranes. In retrospect, I probably had overly ambitious expectations of the students: I assigned weekly problem sets based on readings from the primary literature, in addition to background reading from several textbooks. In class each week, I devoted two hours to a lecture based on the material from the textbook and one hour to discussions of the assigned papers and problem sets. There were also two exams, and a student project consisting of a research paper and a presentation based on the paper. In the students' evaluations of the course, several commented on the fact that although they had to work extremely hard, they got a lot out of it. Given that I was a full-time postdoctoral fellow at the time, I felt much the same way.

In the future, in addition to teaching a specialized course such as biological membranes at the graduate level, based on my background I would also be able to teach in either an undergraduate or graduate-level cell biology course. My experience in fluorescence techniques and biophysical chemistry would enable me to contribute selected lectures in courses in these areas as well.

F. Examples of an application update

Dear Search Committee,

I am writing to update you on my activities since I submitted my application. On January 10, my manuscript Snapp EL, other authors. Title. was accepted at the Journal of Cell Biology. In addition, I gave an invited 20 minute presentation at the American Society of Cell Biology Annual Meeting on Dec. 9. I continue to be highly enthusiastic about the position in your department and look forward to hearing from you. Thank you for your time.
sincerely,
Erik Lee Snapp

Dear Search Committee,

I am writing to update you on my activities since I submitted my application. Importantly, I received a letter of offer from the Department of Biology at Big Name School on February 1. While I am interested in the Big Name School position, your institution is my top choice. I share a number of research interests with several of your faculty and would like the opportunity to be considered for your department. I have been asked to make a decision for Big Name School by March 1. I would welcome the opportunity to discuss my status with you. Thank you for your time and I look forward to hearing from you.
sincerely,
Erik Lee Snapp

G. Example of typical start-up costs for a cell biology lab in 2004

Date	Item	Supplier	Cat. No.	Price	Qty	Total Price
10/12/04	2005 at a glance calendar	staples	558433	$9.15	1	$9.15
10/12/04	acme keen earth scissors	staples	711770	$6.69	2	$13.38
10/12/04	acco 350 paper punch	staples	893844	$42.89	1	$42.89
10/12/04	scotch deluxe tape dispenser	staples	463940	$13.99	2	$27.98
10/12/04	office star chair	staples	500281	$79.99	1	$79.99
10/12/04	tensor brushed steel lamp	staples	382362	$29.99	1	$29.99
10/12/04	staple remover	staples	211862	$0.65	1	$0.65
10/12/04	imac	applestore		$2,001.00	1	$2,001.00
10/12/04	HP 2300N bw laser printer	applestore		$949.00	1	$949.00
10/22/04	stir bar kit	fisher sci	14-513-82	$47.38	1	$47.38
10/22/04	red spirit thermometers	fisher sci	14-983-19b	$20.93	2	$41.86
10/22/04	portable pipete aid 110v	fisher sci	13-681-19	$183.11	1	$183.11
10/22/04	combitip 10ml	fisher sci	21-381-340	$87.36	1	$87.36
10/22/04	combitip 2.5 ml	fisher sci	21-381-338	$87.36	1	$87.36
10/22/04	pipet eppendorf repeater plus	fisher sci	21-380-338	$331.50	1	$331.50
10/22/04	stirrer scholar pc-171	fisher sci	11-497-22	$109.20	1	$109.20
10/22/04	vortex genie mixer 120 v	fisher sci	12-812	$207.00	1	$207.00
10/22/04	Ub-5 ph meter	fisher sci	02-226-211	$339.70	1	$339.70
10/22/04	buffer pack ph standards	fisher sci	sb105	$19.58	1	$19.58
10/22/04	hydrion double roll ph paper	fisher sci	14-850-11b	$3.70	1	$3.70
10/22/04	microcentrifuge tube rack 5/pack	fisher sci	05-541-4	$26.13	1	$26.13
10/22/04	scoopula	fisher sci	14-357	$10.96	1	$10.96
10/22/04	micro spatula tapered 12/pk	fisher sci	21-401-10	$31.44	1	$31.44
10/22/04	syringe gas tight 50ul	fisher sci	14-824-30	$30.37	2	$60.74
10/22/04	carboy w/spigot 9l	fisher sci	02-963-5A	$83.27	3	$249.81
10/22/04	hooded gas lighter	fisher sci	12-007	$1.95	2	$3.90
10/22/04	renewal flints 5/pk	fisher sci	12-007-5	$2.72	1	$2.72
10/22/04	burner natural gas model	fisher sci	03-902	$51.94	1	$51.94
10/22/04	burner for natural gas	fisher sci	03-917	$21.92	1	$21.92
10/22/04	wash bottle 500 ml 4 pk	fisher sci	03-409-10E	$15.13	1	$15.13
10/22/04	ice bucket w/lid purple	fisher sci	11-675-120	$51.16	2	$102.32
10/22/04	incubator co2 tc sensor 115 v	fisher sci	11-689-4	$3,337.00	1	$3,337.00
10/22/04	biological safety cabinet 4 ft	fisher sci	11-686 8	$5,374.00	1	$5,374.00
10/22/04	cabinet stand napflow 1200	fisher sci	11 686-71	$290.00	1	$290.00
10/22/04	sash panel uv napflow 1200	fisher sci	11-686-11	$549.00	1	$549.00
10/22/04	variable speed tile rocker	fisher sci	05-450-34	$423.42	1	$423.42
10/22/04	polaroid gelcam kit w/ 7" hood	fisher sci	04-441-122	$1,661.37	1	$1,661.37
10/22/04	8"x8" variable intensity spectroline UV transilluminator	fisher sci	11-992-80	$1,385.31	1	$1,385.31

10/26/04	mettler 150GX 0.1g balance	fisher sci		1913460	$568.00	1	$568.00
10/26/04	label pal label printer	fisher sci		11877175	$249.00	1	$249.00
10/26/04	printer labels	fisher sci		11877178	$18.15	3	$54.45
10/26/04	bath isotemp	fisher sci		1546210	$956.86	2	$1,913.72
10/26/04	eppendorf centrifuge	fisher sci		540061	$6,424.00	1	$6,424.00
10/26/04	rotor swing bucket	fisher sci		540064	$1,320.00	1	$1,320.00
10/26/04	adapter 50 ml tubes	fisher sci		540073	$169.60	2	$339.20
10/26/04	adapter 15 ml	fisher sci		540070	$169.60	1	$169.60
10/26/04	mp3 cell/mtb module/pp basic	biorad	165-3323		$908.10	2	$1,816.20
10/26/04	minisub cell GT system w/7x10 caster	biorad	170-4467		$231.20	2	$462.40
10/29/04	Gilson PR1000 pipetman	Rainin	PR1000		$256.00	1	$256.00
10/26/04	Gilson p10	tte laboratories	gp10		$109.00	2	$218.00
10/26/04	Gilson p100	tte laboratories	gp100		$109.00	2	$218.00
10/26/04	Gilson p200	tte laboratories	gp200		$109.00	1	$109.00
10/26/04	Mycycler thermocycler	Biorad			$4,245.75	1	$4,245.75
10/29/04	Mirra chair	Tobron			$640.00	1	$640.00
11/2/04	1 ml pipettes	fisher sci	07-200-571		$92.34	1	$92.34
11/2/04	2 ml pipettes	fisher sci	07-200-572		$107.11	1	$107.11
11/2/04	5 ml pipettes	fisher sci	07-200-573		$30.21	1	$30.21
11/2/04	10 ml pipettes	fisher sci	07-200-574		$32.55	1	$32.55
11/2/04	25 ml pipettes	fisher sci	07-200-575		$87.17	1	$87.17
11/2/04	200 ul pipette tips sterile	fisher sci	07-200-583		$19.00	3	$57.00
11/2/04	1000 ul pipette tips sterile	fisher sci	07-200-304		$23.59	3	$70.77
11/2/04	0.65 ml eppendorf tubes	fisher sci	07-200-186		$27.85	1	$27.85
11/2/04	1.7 ml eppendorf tubes	fisher sci	07-200-535		$106.10	1	$106.10
11/2/04	50 ml centrifuge tubes	fisher sci	05-526B		$98.84	2	$197.68
11/2/04	15 ml centrifuge tubes	fisher sci	05-538-59A		$75.58	2	$151.16
11/2/04	14 ml pp snapcap tubes	fisher sci	14-956-1J		$63.60	1	$63.60
11/2/04	forceps, jewlers	fisher sci	08-953E		$23.60	2	$47.20
11/2/04	bench liner	fisher sci	14-127-47		$79.46	1	$79.46
11/2/04	tripod, iron 8"	fisher sci	15-300C		$25.51	1	$25.51
11/2/04	pan, stainless 10x6x1/2x2	fisher sci	13-361A		$27.13	1	$27.13
11/2/04	marking pen black 10/pk	fisher sci	13-379-1		$25.33	1	$25.33
11/2/04	tube vaccum 1/4" ID, 10ft		14-176-6b		$42.85	0	$0.00
11/19/04	multi-stage CO2 regulator	fisher sci	10-572E		$281.00	1	$281.00
11/19/04	microvolume pipette tips 0.5-10 ul	fisher sci	07-200-251		$28.53	2	$57.06
11/19/04	plate 6 well	fisher sci	07-200-83		$44.13	1	$44.13
11/19/04	plate 12 well	fisher sci	07-200-82		$48.92	1	$48.92
11/19/04	24 well tc clstr sterile	fisher sci	09-761-146		$48.39	1	$48.39
11/19/04	96 well plates	fisher sci	07-200-89		$57.17	1	$57.17
11/19/04	flask 25 cm2 canted next 500/cs	fisher sci	10-126-30		$201.50	1	$201.50
11/19/04	filter system 150 ml 0.22um	fisher sci	09-761-118		$43.39	1	$43.39

11/19/04	vl round bottom org cap 2ml 250 cs	fisher sci	09-200-198		$65.19	2	$130.38
11/19/04	beaker starter kit Kimax	fisher sci	02-555-2		$17.15	2	$34.30
11/19/04	HD utility funnel 12/pk	fisher sci	10-500-7		$23.10	1	$23.10
11/19/04	1000 ml erlenmeyer flasks 6/pk	fisher sci	10-040K		$34.80	1	$34.80
11/19/04	250 ml erlenmeyer flasks 12/pk	fisher sci	10-040F		$34.80	1	$34.80
11/19/04	cylinder grad 2000 ml	fisher sci	08-572-10H		$25.86	2	$51.72
11/19/04	100ml pmp cyl grad 1ml	fisher sci	08-572-10D		$9.02	5	$45.10
11/19/04	beaker pp grad 500 ml	fisher sci	02-591-33		$12.07	2	$24.14
11/19/04	beaker pp prtd grad 500 ml 10/pk	fisher sci	02-591-30		$33.62	1	$33.62
11/19/04	bottle media grad 500 ml	fisher sci	06-404D		$4.63	10	$46.30
11/19/04	bottle media grad 125 ml	fisher sci	06-404A		$2.35	20	$47.00
11/19/04	bottle 1000 ml non grad 24/cs	fisher sci	06-451-279		$150.89	1	$150.89
11/19/04	parafilm 4"x250 ft	fisher sci	13-374-12		$30.93	1	$30.93
11/19/04	weighboat large 500/cs	fisher sci	02-204C		$99.86	1	$99.86
11/19/04	weighboat medium 500/cs	fisher sci	02-204B		$50.50	1	$50.50
11/19/04	weighboat small 500/pk	fisher sci	02-204A		$41.46	1	$41.46
11/19/04	weigh paper 4x4 inches	fisher sci	09-898-12B		$14.22	1	$14.22
11/19/04	tris/glycine/sds 10X 1l	fisher sci	bp1341-1		$36.66	1	$36.66
11/19/04	brilliant blue r-250 coomassie	fisher sci	bp101-50		$70.55	1	$70.55
11/19/04	EDTA 0.5 DEPC treated 1 l	fisher sci	bp24831		$54.19	1	$54.19
11/19/04	glycerol 1l	fisher sci	bp2291-1		$49.20	1	$49.20
11/19/04	hepes 1M 500 ml	fisher sci	bp299500		$90.12	1	$90.12
11/19/04	tween20 500 ml	fisher sci	bp337-500		$15.04	1	$15.04
11/19/04	triton x-100	fisher sci	bp151-500		$21.31	1	$21.31
11/19/04	axiovert200 microscope	zeiss			$19,827.10	1	$19,827.10
11/18/04	epson perfection photoscanner 4870		t9297ll/A		$391.43	1	$391.43
11/17/04	whirlpool 21 cu ft refrigerator	pc richard	et-1mhkxmq		$444.00	1	$444.00
11/17/04	fridigaire upright freezer 21 cu ft	pc richard	ffu2124dw		$365.00	1	$365.00
11/17/04	frigidaire refrigerator 18.2 cu ft.	pc richard	frt18b4aw		$349.00	1	$349.00
12/3/04	PFUultra high fidelity DNA polymerase	Stratagene		600380	$107.91	1	$107.91
12/3/04	Qiafilter plasmid midi kit(25)	Qiagen		12243	$224.00	2	$448.00
12/3/04	Qiaquick PCR purification kit(50)	Qiagen		28104	$79.00	2	$158.00
12/3/04	Qiaquick gel extraction kit(50)	Qiagen		28704	$79.00	2	$158.00
12/3/04	alkaline phosphatase	fisher sci	PRM1821		$41.80	1	$41.80
12/3/04	DNA markers,1kb DNA ladder	fisher sci	bp2578-100		$80.50	2	$161.00
12/3/04	PCR nucleotide mix(40MM)	fisher sci	bp25651		$166.10	1	$166.10
12/3/04	wizard plus DNA miniprep	fisher sci	PRA7510		$266.20	1	$266.20
12/3/04	DTT	fisher sci	bp172-5		$36.85	1	$36.85
12/3/04	glycine	fisher sci	bp381-500		$27.90	1	$27.90

12/3/04	tris base	fisher sci	bp152-1	$55.77	1	$55.77
12/3/04	vac man lab vacuum manifold	fisher sci	PR-A7231	$108.00	1	$108.00
12/3/04	potassium acetate 500G	fisher sci	bp364-500	$20.07	1	$20.07
12/3/04	SDS 100G	fisher sci	bp166-100	$25.63	1	$25.63
12/3/04	tris-glycine 10x,4L	fisher sci	bp13064	$53.78	1	$53.78
12/3/04	hydrochloric acid reag ACS 500ML	fisher sci	A144-500	$12.94	1	$12.94
12/3/04	sodium hydroxide cert ACS 500G	fisher sci	S318-500	$17.54	1	$17.54
12/3/04	DMSO 100ML	fisher sci	bp231-100	$14.59	2	$29.18
12/3/04	formaldehyde 37% 500ML	fisher sci	bp531-500	$17.52	1	$17.52
12/3/04	PBS 10x 2x1L/pk	fisher sci	bp665-1	$24.47	5	$122.35
12/3/04	LB broth Miller 500G	fisher sci	bp1426-500	$27.81	1	$27.81
12/3/04	kanamycin mono sulphate 5G	fisher sci	bp906-5	$32.19	1	$32.19
12/3/04	ampicillin Na salt 25G	fisher sci	bp1760-25	$41.97	1	$41.97
12/3/04	funnel Buchner PP/PA 110MM	fisher sci	10-362E	$15.68	2	$31.36
12/3/04	filter paper WH3 11cm 100/pk	fisher sci	09-820B	$12.48	1	$12.48
12/3/04	flask filtering PP 3/8" 2L	fisher sci	10-182-51	$20.37	2	$40.74
12/3/04	rub stpr 1 hole#10 8/pk	fisher sci	14-135P	$22.16	1	$22.16
12/3/04	methanol cert ACS 4L poly	fisher sci	A412P-4	$24.59	2	$49.18
12/10/04	timer portable keychain w/alarm	fisher sci	06-662-25	$13.61	1	$13.61
12/10/04	autoclv tape strat-ln 3/4" 60 yd	fisher sci	11-889-11	$4.01	3	$12.03
12/10/04	flask filtering PP 3/8" 2L	fisher sci	10-182-51	$20.37	3	$61.11
12/10/04	flask filtering pp 1000ML 1/CS	fisher sci	10-182-50B	$16.57	3	$49.71
12/10/04	rub stpr 1 hole#8 appx 12/pk	fisher sci	14-135M	$21.52	1	$21.52
12/13/04	natural powder free latex gloves w.aloe,S	fisher sci	19-050-548A	$5.95	1	$5.95
12/13/04	natural powder free latex gloves w.aloe,M	fisher sci	19-050-548B	$5.95	1	$5.95
12/13/04	natural powder free latex gloves w.aloe,L	fisher sci	19-050-548C	$5.95	1	$5.95
12/13/04	natural powder free latex gloves w.aloe,XL	fisher sci	19-050-548D	$5.95	1	$5.95
12/15/04	LB lubert agar Miller	fisher sci	bp1425-500	$61.14	1	$61.14
12/15/04	Culture dish 100x20mm	fisher sci	08-772-32	$80.00	2	$160.00
12/16/04	Kit 1st aid 16 unit	fisher sci	17-987-97B	$46.77	1	$46.77
12/16/04	Compact first aid kit	fisher sci	19-027-409	$6.53	1	$6.53
12/16/04	Astrospec patriot CL XTREM	fisher sci	19-025-334	$6.59	3	$19.77
12/16/04	Compak storage cabinet	fisher sci	17-153A	$369.93	1	$369.93
12/16/04	4 gal acid cabinet	fisher sci	19-033-718	$406.89	1	$406.89
12/16/04	Respirator main free BBI	fisher sci	18-999-3262	$15.52	2	$31.04
12/16/04	Carboy WM w/handle LDPE 20L	fisher sci	02-961-60E	$42.56	2	$85.12
12/16/04	Jar w/m PP 32oz	fisher sci	11-815-10F	$25.90	1	$25.90
12/21/04	Ethanol 200 proof 1gal	stores		$7.50	1	$7.50
12/21/04	Ammonium persulfate 100g	fisher sci	bp179-100	$18.49	1	$18.49

12/21/04	Tricine 100g	fisher sci	bp315-100		$31.18	4	$124.72
12/21/04	Tris hydrochloride 1kg	fisher sci	bp153-1		$106.89	1	$106.89
12/21/04	10x TAE (Tris-acetate-EDTA) 4l	fisher sci	bp13354		$53.15	1	$53.15
12/21/04	glacial acetic acid seq 500ml	fisher sci	bp1185-500		$20.44	2	$40.88
12/21/04	ethidium bromide 5g	fisher sci	bp102-5		$70.55	1	$70.55
12/21/04	syringe filter 26mm,0.2,50/case	fisher sci	09-754-29		$42.54	1	$42.54
12/21/04	syringe 10ml,LL,100/pk	fisher sci	14-817-31		$27.19	1	$27.19
12/21/04	sodium azide,50g	Sigma	71289-50G		$41.61	1	$41.61
12/21/04	TEMED, 50ml	Biorad	161-0801		$35.89	1	$35.89
12/21/04	40%Acryl/Bis sol,29:1,500ml	Biorad	161-0146		$49.47	1	$49.47
12/21/04	30%Acryl/Bis sol,37.5:1,500ml	Biorad	161-0158		$42.68	1	$42.68
12/21/04	E-quote E005404649-dimension 2400 series				$458.10	1	$458.10
12/22/04	Tris base 1kg	fisher sci	bp152-1		$55.62	1	$55.62
12/22/04	PBS 10x solution	fisher sci	bp3991		$30.33	1	$30.33
1/4/05	polyfect transfection reagent	Qiagen		1015530	$19.00	1	$19.00
1/4/05	electrode pH glass	fisher sci	02-226-3		$79.79	1	$79.79
1/4/05	autoclave gloves orange	fisher sci	11-394-299		$15.96	1	$15.96
1/5/05	pipes free acid biotechnology	Sigma	P1851-25G		$30.33	1	$30.33
1/5/05	calcium chloride dihydrate sigmaultra	Sigma	C5080-500G		$34.28	1	$34.28
1/5/05	potassium chloride ACS reagent	Sigma	P3911-500G		$23.13	1	$23.13
1/5/05	manganese chloride tetrahydrate USP	Sigma	M8054-100G		$24.81	1	$24.81
1/5/05	magnesium sulfate heptahydrate molecular	Sigma	M2773-500G		$32.94	1	$32.94
1/5/05	cylinder carbon dioxide 65#	tech-air	CD-65		$18.74	2	$37.48
1/11/05	incubator 1.0cuft	fisher sci	11-695-1		$285.76	1	$285.76
1/11/05	agarose 1ooG	fisher sci	bp1356-100		$144.50	1	$144.50
1/11/05	four-wy MCRTB	fisher sci	03-448-17		$25.10	1	$25.10
1/11/05	gasinlet filter for CO2 incubator	fisher sci	11-688-82		$14.99	1	$14.99
1/11/05	kimwipes	fisher sci	06-666A		$95.79	1	$95.79
1/11/05	NPT female pipe adapter	fisher sci	NC9239338		$11.00	1	$11.00
1/13/05	END Note 7 Mac	CDW Government inc		513943	$179.19	1	$179.19
1/13/05	1 kb DNA ladder	stores	bp-2578-100		$80.50	1	$80.50
1/14/05	Adobe acrobat pro 7 CD Windows	gov connection		5558775	$22.83	1	$22.83
1/14/05	Adobe acrobat pro 7 licence Windows	gov connection		5555849	$45.65	1	$45.65
1/14/05	Adobe acrobat pro 7 CD Mac	gov connection		5558791	$22.83	1	$22.83
1/14/05	Adobe acrobat pro 7 licence Mac	gov connection		5559268	$45.65	1	$45.65
1/14/05	Adobe photoshop CS CD Windows	gov connection		469872	$22.83	1	$22.83
1/14/05	Adobe photoshop CS licence Windows	gov connection		5412549	$126.41	1	$126.41
1/14/05	Adobe illustrator CS CD Mac	gov connection		469851	$22.83	1	$22.83
1/14/05	Adobe illustrator Cs licence Mac	gov connection		5207158	$42.14	1	$42.14

1/20/05	Protein standards kaleidoscope prestained	Biorad	161-0324		$100.00	1	$100.00
1/20/05	goat anti-mouse rabbit igg hrp	Jackson immunoresearch	115-035-146		$105.00	1	$105.00
1/20/05	goat anti-rabbit IgG hrp	Jackson immunoresearch	11-035-144		$105.00	1	$105.00
1/20/05	filtr sheet 10 ft	fisher sci	HAH00010		$193.20	1	$193.20
1/20/05	isopropanol HPLC	fisher sci	bp26324		$48.88	1	$48.88
1/20/05	supersignal west pico 100 ml	fisher sci	PI34077		$61.75	1	$61.75
1/20/05	autorad cassette 8x10"	fisher sci	FB-XC-810		$87.81	1	$87.81
1/20/05	Ponceau S 10g	fisher sci	bp103-10		$19.07	1	$19.07
1/20/05	Fuji RX film 8x10" 100/pk	fisher sci	04-441-115		$108.10	1	$108.10
1/20/05	pan HDPE 10 QT	fisher sci	13-359-25		$17.38	1	$17.38
1/21/05	Microsoft office pro 2003 CD	Dell	A0169281		$19.38	1	$19.38
1/21/05	Microsoft office pro 2003 licence	Dell	A0154983		$47.20	1	$47.20
1/24/05	test tube support full view	fisher sci	14-781-15		$9.46	2	$18.92
1/24/05	microcentrifuge tube rack pick 5/pack	fisher sci	05-541-5		$27.43	2	$54.86
1/24/05	sodium acetate	fisher sci	bp333-500		$29.69	1	$29.69
2/1/05	MP3 comb,15 well,0.75mm	Biorad		1653355	$21.56	6	$129.36
2/4/05	restriction enzyme BamHI	fisher sci	prr6021		$29.41	1	$29.41
2/4/05	restriction enzyme Bgl II	fisher sci	prr6081		$26.90	1	$26.90
2/4/05	restriction enzyme Eco RI	fisher sci	prr6011				$0.00
2/4/05	restriction enzyme Kpn I	fisher sci	prr6341		$44.44	1	$44.44
2/4/05	restriction enzyme Not I	fisher sci	prr6431		$42.00	1	$42.00
2/4/05	restriction enzyme Xho I	fisher sci	prr6161		$29.40	1	$29.40
2/4/05	alkaline phosphatase	fisher sci	prm1821		$41.80	1	$41.80
2/4/05	T4 DNA ligase	fisher sci	prm1801		$27.73	1	$27.73
2/4/05	pen-strep	biosurce int	P303-100		$9.00	2	$18.00
2/4/05	glutamine 100x	biosurce int	p300-100		$9.00	2	$18.00
2/4/05	trypsin-versene 1x	biosurce int	p301-100		$5.60	5	$28.00
2/4/05	RPM1 16 without phenol red&glutamine	biosurce int	p149-500		$13.05	2	$26.10
2/4/05	DMEM high glucose	biosurce int	p104-500		$8.20	5	$41.00
2/4/05	DMEM without cysteine methine	biosurce int	p158-500		$18.90	2	$37.80
2/8/05	ASE I	Biolab	R0526S		$46.40	1	$46.40
2/8/05	box microscope slide 100P red	fisher sci	03-448-3		$11.53	4	$46.12
2/8/05	slide frostd 1 sde 3x1"	fisher sci	12-518-103		$24.27	2	$48.54
2/8/05	CVR glas CIR 12mm grwth	fisher sci	12-545-82		$56.93	1	$56.93
2/8/05	coverglass, labteck,8well	fisher sci	12-565-470		$551.49	1	$551.49
2/22/05	gloves latx aloe sm	fisher sci	19-050-548A		$5.95	3	$17.85
2/22/05	stacking pans with ventilation	fisher sci	15-239-17		$25.67	1	$25.67
2/22/05	tyg tub1/4x3	fisher sci	14-169-3C		$13.89	1	$13.89
2/22/05	uffIt mlx-FG50	fisher sci	SLFG05010		$74.76	1	$74.76
2/22/05	carboyw/handle CPE 25L	fisher sci	02-961B		$56.65	1	$56.65

2/24/05	oxyblot oxidation detection kit	chemicon intl. inc	S7150		$250.00	1	$250.00
2/24/05	affi-gel protein A, 5ml	Bio Rad		1536153	$173.63	1	$173.63
2/25/05	NaCl	stores					$0.00
3/2/05	prepaid rental on high pressure	tech-air	HP-rental		$3.60	2	$7.20
3/2/05	prepaid rental on high pressure cylinders	tech-air	HP-lease		$3.60	22	$79.20
3/2/05	minitrans-blot filter paper	BioRad		1703932	$33.95	4	$135.80
3/2/05	Fisher hand tally counter	fisher sci	07-905-6		$25.12	1	$25.12
3/2/05	counting chamber	fisher sci	02-671-5		$117.51	1	$117.51
3/2/05	strpet 2ml PA/PLAS	fisher sci	07-200-572		$107.11	1	$107.11
3/2/05	autorad cassette 8x10"	fisher sci	FB-XC-810		$87.81	2	$175.62
3/8/05	DPN I	New England Biolab	R0176S		$46.40	1	$46.40
3/8/05	Hind III	New England Biolab	R0104L		$169.60	1	$169.60
3/8/05	Pst I	New England Biolab	R0140S		$46.40	1	$46.40
3/8/05	EcoRI	New England Biolab	R0101S		$42.40	1	$42.40
3/8/05	Mlu I	New England Biolab	R0198S		$46.40	1	$46.40
3/8/05	Afl II	New England Biolab	R0520S		$42.40	1	$42.40
3/8/05	Nhe I	New England Biolab	R0131S		$46.40	1	$46.40
3/8/05	Sal I	New England Biolab	R0138S		$42	1	$42.40
3/8/05	Spe I	New England Biolab	R0133S		$46.40	1	$46.40
3/10/05	monoclonal anti-a-tubulin clone B-5-1-2	Sigma	T5168-.2ml		$199.36	1	$199.36
3/29/05	alcohol 200proof 1gal	stores			$7.50	2	$15.00
3/29/05	inhibitors,complete-EDTA free	stores			$117.78	1	$117.78
3/29/05	MCT rainbow,0.65ml	fisher sci	07-200-186		$27.85	1	$27.85
3/29/05	sucrose	fisher sci	bp220-212		$46.84	1	$46.84
4/4/05	sigmaclean water bath treatment	Sigma	S5525-4oz		$34.35	1	$34.35
4/7/05	Blue Ultra Autorad film	ISC BioExpress	F-9029-8x10		$119.00	2	$238.00
4/14/05	stripette 10 ml pap/plast 200/case	fisher sci	07-200-574		$32.55	1	$32.55
4/14/05	stripette 5ml pap/plast 200/case	fisher sci	07-200-573		$30.21	1	$30.21
4/15/05	adventurer pro 53gx0.001G	fisher sci	01-921-17		$496.00	1	$496.00
4/18/05	Fungizone 20ml, plastic, Gibco	invitrogen		15290018	$12.16	1	$12.16
4/18/05	PSN antibiotic mix 100ml,pla	invitrogen		15640055	$16.26	1	$16.26
4/18/05	lipofectamine 2000 0.75ml	invitrogen		11668027	$161.15	1	$161.15
4/21/05	supersignal west pico 100 ml	fisher sci	PI34077		$61.75	1	$61.75
4/27/05	Protein standards kaleidoscope prestained	BioRad	161-0324		$100	1	$100.00
5/5/05	tip blue 100-1000uL RK ST M/CS	fisher sci	07-200-304		$24.06	1	$24.06
5/5/05	mcrvolume-G str, 0.1-10uL 960/cs	fisher sci	07-200-521		$29.10	1	$29.10
5/5/05	tris-glycine 10x sol 4L	fisher sci	bp13064		$60.67	1	$60.67
5/5/05	methanol cert ACS 4L poly	fisher sci	A412P-4		$26.57	1	$26.57

5/10/05	anti-calreticulin	affinity bioreagent	PA3-900		$245.00	1	$245.00
5/25/05	Not I	New England Biolab	RO189L		$201.60	1	$201.60
5/25/05	Bgl II	New England Biolab	RO144S		$42.40	1	$42.40
5/25/05	T4 DNA ligase	New England Biolab	MO202S		$50.40	1	$50.40
6/1/05	PBS10x 2x1L	fisher sci	bp665-1		$26.96	5	$134.80
6/1/05	supersignal west pico 100 ml	fisher sci	PI34077		$61.75	1	$61.75
6/1/05	mcrvolume-G str, 0.1-10uL 960/cs	fisher sci	07-200-521		$29.10	2	$58.20
6/1/05	methanol cert ACS 4L poly	fisher sci	A412P-4		$26.57	2	$53.14
6/1/05	big digit alarm timer 4-chanel	fisher sci	14-649-17		$20.81	1	$20.81
6/1/05	minitrans-blot filter paper	BioRad		1703932	$33.95	3	$101.85
Jun-05	Alexa fluor R 488 0.5ml	invitrogen	A11008		$122.00	1	$122.00
Jun-05	Alexa fluor R 546 0.5ml	invitrogen	A11010		$122.00	1	$122.00
Jun-05	Alexa fluor R 633 0.5ml	invitrogen	A21070		$122.00	1	$122.00
Jun-05	annexin V,Alexa fl 500ul	invitrogen	A13202		$344.00	1	$344.00
Jun-05	Hoechst 33342, TRIH 10ml	invitrogen	H3570		$64.00	1	$64.00
Jun-05	brefeldin A from penicil 5mg	invitrogen	B7450		$60.00	1	$60.00
7/1/05	Mediatech Trypsin/EDTA	fisher sci	MT25052CI		$4.72	1	$4.72
7/1/05	Mediatech DMEM w/L-glutamine	fisher sci	MT10013CV		$3.56	1	$3.56
7/11/05	80K-H antibody	BD bioscience		610481	$395.00	1	$395.00
7/12/05	syringe gas tight 50ul	fisher sci	14-824-30		$31.34	2	$62.68
7/12/05	1.7ml graduated microcentrifuge natural,500/pk	ISC BioExpress	C3269-1		$10.00	5	$50.00
7/12/05	4-way flipper racks small natural	ISC BioExpress	R-4932-1		$8.25	5	$41.25
7/12/05	80-place rack,natural,5/pk	ISC BioExpress	R4910-1		$24.00	2	$48.00
7/12/05	0.65ml graduated microcentrifuge tubes,rainbow	ISC BioExpress	C3268-2		$16.00	2	$32.00
7/15/05	eppendorf microcentrifuge 5415D with free rotor and tubes	fisher sci	05-401-15		$1,475.00	1	$1,475.00
7/25/05	blue tips bulk	fisher sci			$11.00	5	$55.00
7/25/05	tris/glycine/SDS 10x 1L	fisher sci	bp1341-1		$36.66	1	$36.66
8/12/05	1kb DNA ladder	fisher sci	bp2578-100		$80.50	2	$161.00
8/22/05	supersignal west pico 100 ml	fisher sci	PI34077		$61.75	1	$61.75
8/22/05	SDS 100g	fisher sci	bp166-100		$26.14	1	$26.14
8/22/05	Tricine 100g	fisher sci	bp315-100		$35.88	1	$35.88
8/22/05	glv klngrd s	fisher sci	19-120-3052B		$14.66	3	$43.98
8/22/05	glv klngrd L	fisher sci	19-120-3052D		$14.66	1	$14.66
9/14/05	AgeI restriction enzyme	New England Biolab	RO552S		$46.40	1	$46.40
9/14/05	T4 DNA ligase	New England Biolab	MO202S		$50.40	1	$50.40
9/28/05	wizard plus DNA miniprep	fisher sci	PRA7510		$279.40	1	$279.40
						total	$78,758.85

Obviously, prices will need to be adjusted for inflation and type of lab. Note that this is only lab supplies and equipment. Personnel are not part of the listed costs.

H. Checklist before attending interview

Talk Materials
- laptop
- laptop power cord and video adapter (especially if you use Mac laptops)
- 10' extension cord for your laptop
- memory stick containing:
  - job talk
  - PDFs of publications and preprints
  - additional slides, posters from postdoc work
  - CV, teaching statement, research proposal
- ditto for Dropbox or other cloud versions of these materials

Hard copies
- reprints of all publications
- copy of CV, teaching statement, research proposal
- printed copies of slides or poster materials
- webpage printouts of faculty you will be meeting (to review)

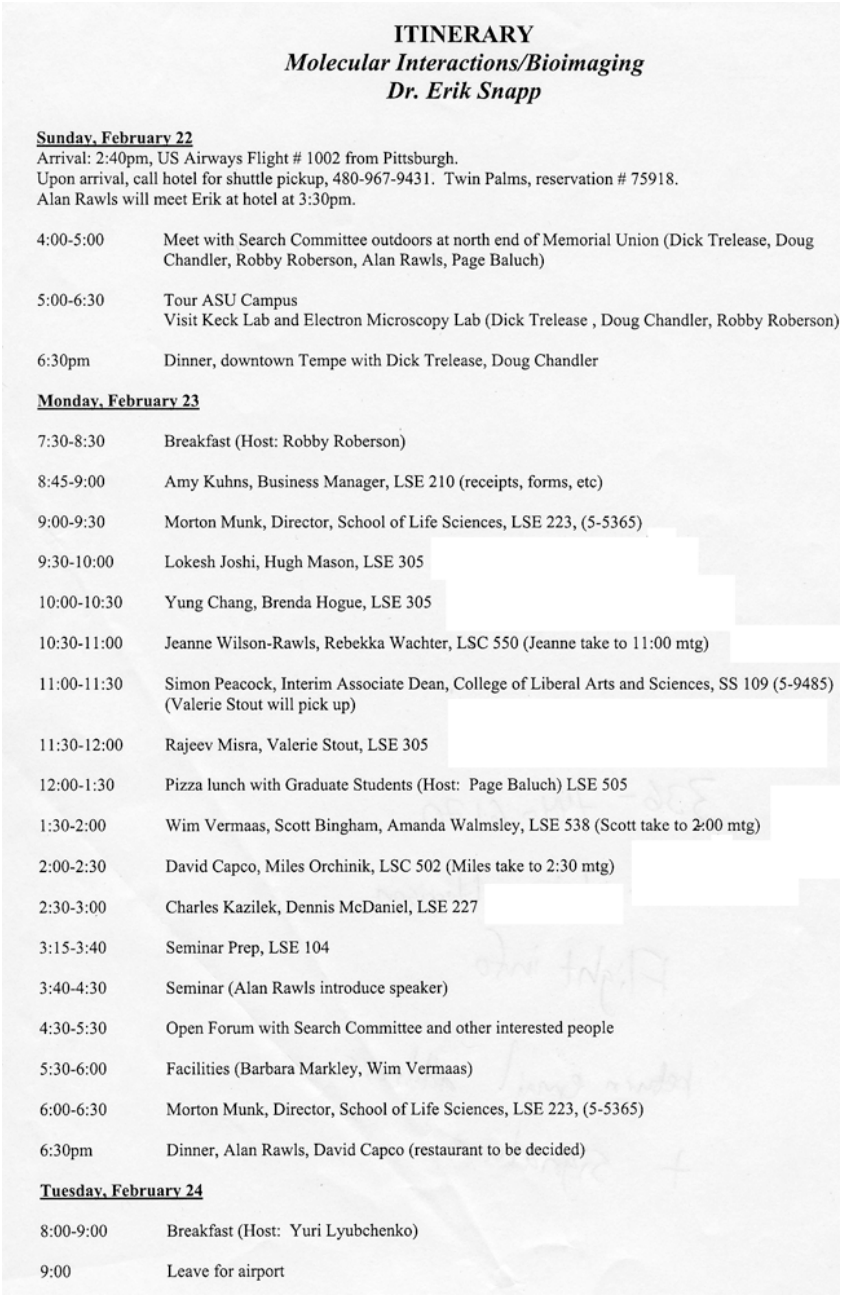
Copy of latest Interview Schedule (though this many change)
Contact phone numbers of your hosts and the department administrator
Flight/train itineraries
Hotel and School/Institute information including addresses and maps

Interview clothes, shoes, extra replacement clothes if something happens, and toiletries

Umbrella

Cash/Credit Card for cab rides, Uber/Lyft account,

I. Two examples of the author's interview schedules
Prepare for a long day.



ITINERARY
Molecular Interactions/Bioimaging
Dr. Erik Snapp

Sunday, February 22
Arrival: 2:40pm, US Airways Flight # 1002 from Pittsburgh.
Upon arrival, call hotel for shuttle pickup, 480-967-9431. Twin Palms, reservation # 75918.
Alan Rawls will meet Erik at hotel at 3:30pm.

4:00-5:00	Meet with Search Committee outdoors at north end of Memorial Union (Dick Trelease, Doug Chandler, Robby Roberson, Alan Rawls, Page Baluch)
5:00-6:30	Tour ASU Campus Visit Keck Lab and Electron Microscopy Lab (Dick Trelease , Doug Chandler, Robby Roberson)
6:30pm	Dinner, downtown Tempe with Dick Trelease, Doug Chandler

Monday, February 23

7:30-8:30	Breakfast (Host: Robby Roberson)
8:45-9:00	Amy Kuhns, Business Manager, LSE 210 (receipts, forms, etc)
9:00-9:30	Morton Munk, Director, School of Life Sciences, LSE 223, (5-5365)
9:30-10:00	Lokesh Joshi, Hugh Mason, LSE 305
10:00-10:30	Yung Chang, Brenda Hogue, LSE 305
10:30-11:00	Jeanne Wilson-Rawls, Rebekka Wachter, LSC 550 (Jeanne take to 11:00 mtg)
11:00-11:30	Simon Peacock, Interim Associate Dean, College of Liberal Arts and Sciences, SS 109 (5-9485) (Valerie Stout will pick up)
11:30-12:00	Rajeev Misra, Valerie Stout, LSE 305
12:00-1:30	Pizza lunch with Graduate Students (Host: Page Baluch) LSE 505
1:30-2:00	Wim Vermaas, Scott Bingham, Amanda Walmsley, LSE 538 (Scott take to 2:00 mtg)
2:00-2:30	David Capco, Miles Orchinik, LSC 502 (Miles take to 2:30 mtg)
2:30-3:00	Charles Kazilek, Dennis McDaniel, LSE 227
3:15-3:40	Seminar Prep, LSE 104
3:40-4:30	Seminar (Alan Rawls introduce speaker)
4:30-5:30	Open Forum with Search Committee and other interested people
5:30-6:00	Facilities (Barbara Markley, Wim Vermaas)
6:00-6:30	Morton Munk, Director, School of Life Sciences, LSE 223, (5-5365)
6:30pm	Dinner, Alan Rawls, David Capco (restaurant to be decided)

Tuesday, February 24

8:00-9:00	Breakfast (Host: Yuri Lyubchenko)
9:00	Leave for airport

Wednesday, March 31, 2004

9:00 -10:00AM	**Dr. John Condeelis & Dr. Robert H. Singer, Co-Chairs** Department of Anatomy & Structural Biology	Co-Chairs Conf. Rm. 629 Forch. Bldg.
10:05-10:45AM	**Dr. Peter Satir, Professor** Department of Anatomy & Structural Biology	Rm. 610 Forchheimer Bldg. 430-4061
10:50-11:30AM	**Frank Macaluso, Michael Cammer, Jeff Wyckoff & Shailesh Shenoy** **TOUR OF THE ANALYTICAL IMAGING FACILITY & MULTIPHOTON LABORATORY** Department of Anatomy & Structural Biology	Rm. 641A/B Forch. Bldg. 430-2890/3547
12:00-1:00PM	**SEMINAR: FIFTH FLOOR LECTURE HALL**	Forchheimer Bldg.
1:15-2:15PM	**LUNCH: Dr. Erik Snapp & Postdoctoral Fellows:** Amber Wells, Alex Rodriquez, Mike Lorenz, & Daniel Larson	AECOM Faculty Club Conf. Rm. Mazer Dorm
2:20-3:00PM	**Dr. Dianne Cox, Assistant Professor** Department of Anatomy & Structural Biology	Rm. 306A MRRC Bldg. 430-4005
3:05-3:45PM	**Dr. Tom Meier, Associate Professor** Department of Anatomy & Structural Biology	Rm. 603 Golding Bldg. 430-3294
3:50-4:30PM	**Dr. Ben Ovryn, Associate Professor** Departments of Anatomy & Structural Biology	Rm. 602 Golding Bldg. 430-2739
4:35-5:15PM	**Dr. Birgit H. Satir, Professor** Department of Anatomy & Structural Biology	Rm. 907A Ullmann Bldg. 430-4063
5:20-6:00PM	**Dr. Pamela Stanley, Professor** Departments of Cell Biology	Rm. 516 Chanin Bldg. 430-3346
6:30PM	**Dinner: Drs. Erik Snapp, Rob Singer, John Condeelis & Dennis Shields**	Le Refuge Inn 620 City Island Avenue Bronx, NY (718) 885-2478

J. Sample Letter of Offer

Dear Dr.Snapp:

It is with great pleasure that we write to offer you a position on the faculty of the [redacted]. Your training, accomplishments, letters of recommendation, and seminar presentation were carefully evaluated by the Appointments and Promotions Committee of the Department and members of other departments and were thought to be outstanding. Your recruitment has everyone's enthusiastic support.

Faculty Appointment and Salary

With acceptance of this letter, you will be appointed to the faculty at the rank of Assistant Professor and In Residence status. This faculty appointment carries with it the eligibility for tenure. Your faculty appointment is subject to the terms outlined in this letter and to the provisions of the College's System of Appointments, Titles, and Compensation Arrangements. This and other policies of the College of Medicine applicable to faculty can be found on the College web site at http://www[redacted]/home/policies2/policies.htm.

Your initial faculty appointment is for a three-year period, and will begin on or about October 1, 2004.

Your salary in your initial year of appointment will be $90,000, and you will be eligible for appropriate annual increments in conformity with the policy for faculty adopted each year. During your first three-year appointment your salary will be supported by University Funds. Upon renewal of your appointment, the source and amount of salary support for this period will be reviewed by the Dean, based upon your performance and within the context of the extramural funding that may by then be available.

Benefits

The institution offers a generous plan of medical and dental coverage, pension benefits comprising 17% of your salary on a shared basis, life and disability income insurance and a $7,600 per year college tuition benefit at any accredited institution for children of faculty members. Details concerning these benefits are readily available from our Faculty Benefits office. If you have any questions in this regard, you can contact the Faculty Benefits Office at [redacted].

Moving Expense Reimbursement

[redacted] will provide funds to assist you in covering your moving expenses, both laboratory and personal, as detailed in [redacted]s Moving Expense Policy in the Faculty Handbook.

Assistance with the Purchase of a Home

To facilitate your home relocation, [redacted] will provide assistance in financing a home provided: 1. The relocation mortgage assistance to purchase a home is part of your employment commitment; 2. you are relocating within the IRS guideline from a distant geographical location to a home which is within reasonable commuting distance of the College, the distance of that relocation being at least fifty miles plus the distance between your former home and former place of employment; 3. purchase of said home will take place within twelve months from the date of initial employment with the College/University. Subject to University review of title, appraisal of the property, your credit history, and similar considerations, generally this mortgage program will consist of providing a second mortgage of up to 50% of the appraised value of the home, at a rate 3 points below prevailing mortgage rates for comparable loans. Further details are available from Mr. [redacted], Director of Human Resources, at [redacted].

Laboratory and Office Space and Support

The College will designate appropriate space for you by the time of your arrival. We will work with you to prepare this space, at college expense, to meet your needs. Eventually, you may be interested in moving to the new building and if so, can design your space there when appropriate. You will be provided with a one-time start up budget based on your needs to be used for equipment costs and a per annum budget for each of your first three years of appointment for supplies and other laboratory costs. The start up package will total approximately $400,000. Included in this start up package, the College will support a Level B Research Technician (approximately $34,000 per year plus 30% fringe benefits), graduate student or postdoctoral stipend for the same three-year period. This does not include postdoctoral or graduate students supported by other programs, such as training grants or your salary. With the approval of the Dean, these commitments or portions thereof may be extended.

You will have access to all common equipment within the Department of [redacted] and all core facilities, including the [redacted] Imaging Facility. We will guarantee access to comprehensive microscopy including all required software licenses in the [redacted]. User fees for the use of these microscopes (consult the [redacted] web site) will come from your start up package. In addition, the college will support the purchase of a light microscope dedicated to your program's needs at a cost not to exceed $125,000. This microscope may be housed either within your laboratory or within the [redacted] as space is available.

Secretarial and administrative (budgetary and bookkeeping) support will be provided by the Departmental Office.

It is the policy of [redacted] to provide College, departmental, and interdepartmental support for new faculty. However, it is also our policy to encourage investigators to become independent and interactive. The College's expectation is that by the end of your initial three years you will have

secured grant funding sufficient to cover 75% of your salary. If funds from other sources of support become available during the initial three years of your appointment, University Funds support of your salary will be reduced to the extent awarded on such extramural funds. The balance of the extramural funding will be available for support of your program, in addition to your "start-up package".

Research and Teaching Responsibilities

As a faculty member in the Department of [redacted], you will be expected to attract post-doctoral fellows and graduate students on various training programs and training grants administered by basic science departments. The performance and accomplishments of each member of the faculty are reviewed on a regular basis. Faculty responsibilities will be similar to those of your peer faculty members in other departments and will include teaching activities related to cell biology. Teaching will be deferred for one year and committee assignments reduced for two years to facilitate the start up of your research program.

Reliance on Representations

We are relying on the various written and oral representations that you have made in the course of applying for this position, and our understanding is that you have disclosed in full any issues that relate to your professional standing.

One of the strengths of our institution is the mutual support for new faculty within the various departments and the college, and our commitment to the development of investigators with strongly interactive research programs. We are certain that you will find the [redacted] environment both supportive and scientifically stimulating. We look forward to your acceptance of this offer and it is our intent that you enjoy a long, productive, and rewarding career at the [redacted]. Many of us, including Dean [redacted], would be happy to speak or meet with you to address any matters that need further clarification.

We are excited at the prospect of your joining our Department and College. Please sign and return a copy of this letter to us by June 1. And please call if you have any further questions.

With best wishes we are,

K. A Negotiation Email

On 5/7/04 11:24 AM, "erik snapp" <snappe@mail.nih.gov> wrote:

> Dear [redacted],
> That plan sounds good. I would ask that my appended letter include:
>
> 1) My lab would be guarenteed sufficient access to the system. For
> example, my lab would be guarenteed at least 50 hours per week, with
> at least 20 hours during weekday hours from 8 AM to 8 PM. I wouldn't
> object to more time, but I would like something in writing.
>
> 2) During my start-up period, the department will provide the laser
> lines, filter sets, or objectives that are necessary for my research.
>
> 3) My start-up will include any funds sufficient to cover any user
> fees for the diaphragm and FCS systems.
>
> 4) Start-up will include funds sufficient to cover xerox fees, email
> accounts, connection of computers to the internet, regular mail, FAX,
> FedEx, lab coats (and lab coat washing), radiation safety lab
> monitoring and product delivery, radioactive waste pickup, and
> dishwasher/autoclaving personnel fees. I don't know what the fee
> schedules are for these items, so I can't request a dollar amount.
>
> 5) The College or Department will cover costs associated with any
> remodeling required for my lab space. This is alluded to in my
> letter, but I would like it stated more explicitly.
>
> 6) My start-up will include site licenses for my lab for the EPR and
> Huygens Professional deconvolution software, at least for the first
> three years of my start-up.
>
> 7) The other start-up costs I requested, plus the travel and printing
> cost additions.
>
> Finally, I wanted to briefly discuss salary. In our conversation
> on my second visit, you had thrown out a number of $90k as a typical
> starting salary. My letter of offer includes a twelve month salary
> of $80k. My 9 month salary offer from [redacted] is is $65k. Though with
> summer salary, this rises to $86664. Could [redacted] at least match
> this?
> Thank you for your time. Also, I appreciate all of [redacted]'s
> time and answers to my questions.
> Erik

L. Additional Resources

http://www.sciencemag.org/careers/how-prepare-interview

http://www.bwfund.org/pages/55/Career-Development/

https://careers.agu.org/careers/

National postdoctoral association:
http://www.nationalpostdoc.org/site/c.eoJMIWOBIrH/b.1388059/k.DBBE/NPA_Home.htm

American Society of Cell Biology newsletter (especially the Women in Cell Biology columns, which frequently have career advice).
http://www.ascb.org/index.php?option=com_content&view=category&layout=blog&id=66&Itemid=280

Burroughs Welcome and HHMI offer a free book:
Making the Right Moves: A Practical Guide to Scientific Management for Postdocs and New Faculty, available for download:
http://www.hhmi.org/programs/resources-early-career-scientist-development/making-right-moves

The Professor is In by Karen Kelsky, Ph.D.
note: this is aimed primarily at applying for positions in Literature and Arts Departments, but has many useful sections equally relevant for the application process in biomedical sciences.

About the Author

The author grew up on the south coast of Oregon in Coos Bay. His first grade teacher, Mrs. Hill, sparked his early interest in science with a table covered with bones, crystals, fossils, a small microscope, and a terrarium with green anoles. He knew then that he wanted to be a scientist. He got his first research opportunity while attending Harvard College. At the time, he was cooking for the head of research of a biotechnology company and her family. She knew Erik was interested in a career in science and helped him find a summer research position in a protein chemistry lab at the company. This experience confirmed Erik's desire to become a scientist.

Erik went to Oregon Health Sciences University to study protozoan parasite biology with Dr. Scott Landfear and developed an interest in fluorescence microscopy. Green fluorescent protein was cloned and first used around that time, so he sought to join a live cell microscopy lab for his postdoctoral training. He joined Dr. Jennifer Lippincott-Schwartz's lab at the National Institutes for Health to learn confocal microscopy and biophysical techniques to study protein organization and trafficking in cells. He worked on structure-function of the endoplasmic reticulum (ER) organelle.

When he started his own lab at the Albert Einstein College of Medicine, he focused on quality control of secretory proteins and ER stress. Erik's lab created the first live cell biosensor of misfolded secretory protein levels. While studying these phenomena, his lab learned that many fluorescent proteins perform poorly in environments other than the cytoplasm of cells, e.g., in the ER and other organelles. In cell organelles, the luminal chemistry can be distinct, which can cause normally cytoplasmic proteins to misfold, become quenched or get modified in inappropriate ways. Recently, his lab developed a new palette of inert fluorescent proteins suitable for a variety of cellular environments.

As a professor, Erik served on several faculty search committees. He also discovered that in addition to research, that he enjoyed teaching and mentoring young scientists. He developed courses in microscopy and experimental design, as well as lectures in Cell Biology and Responsible Processing of Images. He served as the Chair of his department's graduate committee, on the Einstein Graduate Executive Committee, and the Belfer Postdoctoral Committee. In 2016, Erik left Einstein to pursue helping graduate students and postdoctoral fellows with career development and graduate education at Janelia Research Campus. He continues to study and optimize fluorescent proteins for noncytoplasmic environments. In his spare time, Erik still enjoys cooking, bird watching, long distance running, and wildlife photography.

Photo by Matt Staley.