

What your PI forgot to tell you: why you actually might want a job running a research lab

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ABSTRACT A PhD in biomedical science and the critical thinking skills that it provides can open the door to many different careers. The current popular scientific press and blogosphere too often portray the job of a research-intensive faculty member and principal investigator (PI) as both unattainable and undesirable. We want to make sure our trainees include our own career path among their options, as for each of us it has been a fantastic, family-friendly, and highly impactful career.

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MARK: Hey Amy, it was fun to see your kids at Happy Hour last week. How was your son's basketball game? It's strange to have both of my girls out of the house now and seldom stopping by the lab, although since Lily's at the University of North Carolina (UNC) she does sometimes stop by to grab a cup of tea with me between classes. That's one of the great things about this job.

AMY: Totally! Which reminds me that I worry sometimes that we are failing to convey to many of our students and postdocs the many great things about our job as faculty at a research-intensive university. With all the concerns about the tight job market and difficulty in getting funding, I worry that many students and postdocs are not considering careers in academia, which would be unfortunate. Even more worrisome, we may be disproportionately discouraging women and those from underrepresented groups at a time when our nation needs all of its talent to meet global challenges. While our job, like all jobs, has pluses and minuses, I feel so glad to be in this flexible, creative, and impactful profession.

Each day presents itself with a mixture of totally different challenges that continue to stretch me as a scientist and a person. On any given day, I may first see my kids off to school, then Skype with

someone across the planet about a collaboration, look at microscopy data with a grad student, meet colleagues for a departmental strategic planning meeting, coach an undergrad on study habits, and then give a postdoc feedback on their grant proposal. I'm sure your days look like this, too.

On any day like this, I can squeeze in the second-grade play on Fables, see the basketball game, or even take a yoga class because I am in control of my schedule. I also use more different parts of my brain on a given day than I ever thought I had! I am thinking, listening, articulating ideas, composing reactions, and explaining biology—all while trying to thoughtfully cheer on young scientists and colleagues. Each of these activities feeds me and stretches me intellectually or emotionally but also helps others around me develop to their full capacity.

I can't emphasize enough how much I have appreciated the flexibility in this job that has helped me find balance between running a research program and having a family. I had my first child 3 months before I started my lab, and my second came 2 years after the lab started. Through all of the snow days and the mysterious pediatric fevers and rashes, I have been able to be there to have hot chocolate or administer the Tylenol because I was my own boss. This isn't to say that there aren't days when I feel overwhelmed and question what I am doing, but the fact that I can control my schedule has helped me get out of those slumps.

There are vanishingly few careers that give you the creative space to run a small business based on your own ideas, the independence to manage a team of bright people on your own, the ability to contribute to future generations of your intellectual family, and the flexibility to show up for your actual family when they need it. Like any entrepreneurial effort, choosing our career meant we face significant challenges of finding funds to keep the lab open and identifying and training the right team. However, having friends in other high-skill jobs, from medicine, to law, to running a small business, to working in industry, I know that none of these careers is

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Abbreviations used: ASCB, American Society for Cell Biology; IRACDA, Institutional Research and Academic Career Development Award; NIGMS, National Institute of General Medical Sciences; NIH, National Institutes of Health; PI, principal investigator; UNC, University of North Carolina; URM, underrepresented minority.

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without its stressors, and most don't come close to matching the flexibility and independence we have.

I think there are some delusions about a 9-to-5 career—probably based on consuming too many 1970s syndicated TV shows as children. Based on all my friends in diverse and rewarding professional careers, including those using their scientific talents in academia, industry, or otherwise, working 9 to 5 is a myth for most people with intellectually and/or emotionally stimulating jobs. What is exceedingly rare is having the autonomy and flexibility that a career like ours offers.

MARK: That totally fits with my own experience as my daughters grew into young women. I have loved many aspects of my job and the flexibility it gave me in combining my job with raising a family. We all have bad days: a grant rejected, an encounter with Reviewer #3, or some cruel posts on Rate My Professor. Yet somehow we have failed to convey the things we love about our job to our students and postdocs as they weigh different career options, each of which has its pluses and minuses.

As you know, I am currently serving on the Council for the National Institute of General Medical Sciences (NIGMS), which funds most basic biomedical science research in the United States. One of the most interesting aspects has been to get a behind-the-scenes look at how NIGMS is reshaping efforts to train the biomedical workforce. I love their new emphasis on ensuring that our trainees are exposed to all of the diverse careers available to those with PhDs. As my trainees finish and think about careers, I have been impressed to watch them assess their skill sets and explore how they can put their scientific and critical thinking skills to work in an area about which they are passionate, whether it's in teaching, bench research, science writing, medicine, or running their own lab. I think my trainees are typical of folks who earn a biomedical science PhD at universities like ours—of my 32 PhD and postdoc alumni, 31 are working in science-related jobs.

AMY: I haven't been around as long as you, but I can say that 100% of my trainees have also stayed in science-related careers, where they apply their scientific training in science all the time. But these days so many of them seem to think becoming a PI at a research-intensive institution is either impossible and/or undesirable. I wish we could figure out how we, as current faculty, can help students realize that a research-intensive career is actually a pretty great job on most days. Our trainees are exposed to the constant drumbeat of negativity fostered by journals and the blogosphere—bad funding, few jobs, mean editors, impact factor, sexual harassment, infinite postdocs, and so on. All of these reflect genuine issues, but the many pluses of our career don't seem to generate similar news stories. We don't necessarily help by our own complaining about grants, reviewers, and email overload.

MARK: That is so true. But the reality of my career is actually quite different. A research-intensive faculty job is, from my perspective, both attainable and desirable if it fits the unique set of skills and passions a trainee brings to the table. As you know, I don't run a huge lab, but six of my PhD students and five of my postdocs went on to tenured or tenure-track positions at research-intensive universities in the United States or abroad, and another five have faculty positions in which undergraduate teaching is central.

AMY: But your trainees must be an aberration—haven't you seen Jessica Polka's famous "scientific workforce pipeline" diagram (www.ascb.org/2014/compass/compass-points/where-will-a-biology-phd-take-you/)? It suggests that only 15% of PhDs in biomedical science get tenured or tenure-track jobs—that sounds daunting to many folks.

MARK: I have been wondering about that issue myself. I love Jessica's work. I have known her since she was an undergrad in Ted Salmon's lab upstairs. However, as she notes in her piece, "the data on postdocs are so poor, many institutions can't estimate the number of postdocs they have within an order of magnitude. Hopefully, clear data on these job markets will empower trainees to make better-informed career decisions." Further, even a close look at that diagram reveals that things are not so grim, although there are certainly nowhere near enough tenure-track jobs available. There is a perception that the number of academic jobs is on the decline, but in reality, there have been a steady number of tenure-track jobs and a similarly constant number of postdocs over the last 15 years (www.nsf.gov/statistics/2016/nsb20161/#/report). The odds for achieving an academic job really haven't changed in the way one might think based on the increased pessimism. In addition, 30% of PhD students move directly into the job market without a postdoc. We have many UNC Biology PhDs who are doing cool things, ranging from editing, to policy, to law, who chose that route. Even more important, everyone's story is a unique one. We all need to look more closely at the data we have and recognize their limitations in predicting what is possible for any individual's career track.

I recently saw an interesting study by the NIGMS (www.nigms.nih.gov/News/reports/Documents/IRACDA-outcomes-report.pdf) in which they evaluate the success of their Institutional Research and Academic Career Development Award (IRACDA) Programs—like UNC's SPIRE Program—which are designed to "develop a diverse group of highly trained scientists to address the nation's biomedical research needs." Their analyses suggest IRACDA programs are highly successful—73% of alumni are employed in academic research and/or teaching faculty positions. However, what jumped out at me from the study was the control group. They matched IRACDA participants with postdocs at the same institution who had a National Institutes of Health (NIH) postdoc fellowship (i.e., a Ruth L. Kirschstein NRSA F32). Strikingly, 67% of the folks with NIH postdoc fellowships are now in academic research and/or teaching faculty positions! Even more striking, of those who went on to faculty positions, 85% are employed in research universities and medical schools, 6% at master's-degree granting institutions, and 6% at primarily undergraduate institutions. At the January 2017 NIGMS Council meeting, Kay Lund, Director of the NIH Division of Biomedical Research Workforce Programs, presented some follow-up data suggesting the F32 recipients also do very well in obtaining their first NIH R01 grants when they do take faculty jobs (<https://videocast.nih.gov/Summary.asp?file=21111&bhcp=1>). It's certainly true that IRACDA and F32 recipients are a selected subset of all postdocs (for example, only U.S. citizens or green-card holders are eligible), but here at UNC many of my postdocs have obtained NIH or similar fellowships. In my lab, 14 of my 17 postdoc alumni had their own funding from the NIH or other agencies. To me, these data say that obtaining a research-intensive faculty job is not an impossible dream.

AMY: Those are pretty striking data—and so different from the perception of most of our trainees. I know our trainees also worry about the funding climate, which isn't an unreasonable concern. However, I hope they have heard about the efforts of NIGMS Director Jon Lorsch and his staff to refocus their funding efforts on the number of investigators funded rather than simply the number of grants awarded. This has led to a rebound in number of PIs funded by the NIGMS, so that in 2015 and 2016, the NIGMS exceeded the numbers at the previous peak in the early 2000s right after the doubling of the NIH budget. Further, in 2015 and 2016, the success rate for NIGMS Research Project grants like R01s was at a

healthy 29.6% (www.nigms.nih.gov/Research/application/Pages/successrateFAQs.aspx). This is a substantial rebound from the dip in success rates during the recent recession; it dropped below 20% in 2013. Of course the “payline” is a flexible target, with program officers having the discretion to fund a grant that was scored in the 40th percentile or not fund grants that scored below the 29th percentile. Importantly, program officers often use that flexibility to help new investigators get into the system. The new MIRA grant program (www.nigms.nih.gov/Research/mechanisms/MIRA/Pages/default.aspx) is also providing exciting new opportunities to potentially fund more investigators. If the NIGMS succeeds in this broader effort, most of us may have smaller teams running on a single grant, but more investigators will have the opportunity to carry out NIH-funded research.

MARK: I also am a strong supporter of the efforts NIGMS has made and is making to increase the diversity of the scientific workforce. This is one of the most critical issues we face as a field. I recently had great conversations with African-American UNC alumni at the American Society for Cell Biology (ASCB) and elsewhere who chose careers at small colleges or are leading efforts to increase diversity in the biomedical workforce. They are all doing great work and are excited about their jobs. However, those conversations, combined with recent studies of female scientists and those from other underrepresented groups, left me concerned that our current system is turning our most talented trainees away from considering a research-intensive faculty job as a career goal. Even more disturbing to me is that this seems to be disproportionately affecting women and other underrepresented groups.

AMY: I think one issue may be how long people think they need to spend in a postdoc before starting in a research-intensive job. Although postdoc pay has risen steadily in the last 30 years, even when inflation is factored in (\$16,000 in 1987; \$20,000 in 1997; \$37,000 in 2007; and \$47,000 in 2017; inflation adjusted: 1987, \$34,202.68; 1997, \$30,260.31; and 2007, \$43,334.41; <http://datahand.scientopia.org/2014/05/20/historical-trends-in-predoc-and-postdoc-stipends-and-average-grant-sizes/> and www.bls.gov/data/inflation_calculator.htm), this time of training often coincides with finding a partner, a first mortgage, and childcare costs, which all add up. In fact, although the time most folks who enter our career spend in a postdoc before starting their own lab is 5 years or so, there are certainly contexts in which it takes longer to get a job—this is another area where we need more data!

Another thing that might be underappreciated is the relative personal financial stability of a research-intensive academic job: it is pretty unrivaled. Tenured and tenure-track faculty members at our institution earn a significant part of their salary for their undergraduate teaching duties. Although that is less the case at medical schools or soft-money research institutes, where PIs need to raise a much more substantial fraction of their salaries from grants, even those faculty members benefit from contracts that provide stability in the short term. That contrasts with many of our colleagues in industry, where changes in research priorities or company mergers can put someone’s job in immediate jeopardy at a moment’s notice.

MARK: Our department’s continuing struggles to make sure we have a diverse faculty reflect a nationwide problem. I just read an article that put this into perspective (Gibbs *et al.*, 2016). Among the pool of U.S. citizens and permanent residents, the proportion of underrepresented minority (URM) PhD graduates grew from 2.5% in 1980 to 13% in 2013. In contrast, the percentage of URM assistant professors at medical schools only grew from 3.9% in 1980 to 5.8% in 2014. Similarly, the National Science Foundation

reported that of the 13,900 biological/life scientists working as assistant professors in all 4-year colleges, only 900 (or 6.4%) were Black or Hispanic.

AMY: That certainly fits what we see around us here and makes one wonder about the underlying issues. Did you see the series of articles about that by Kenny Gibbs and colleagues (Gibbs and Griffin, 2013; Gibbs *et al.*, 2014, 2015)? They were pretty sobering.

MARK: What did they say?

AMY: They studied the career goals of scientists at different career stages and found something really striking. They found, like others have, that interest in having a faculty job decreased as folks progressed through their training. However, to my surprise, objective performance in their scientific work (publication record or time to degree) and quality of advisor relationships were not significantly different between scientists with high versus low interest in faculty careers. Instead, the interviews found interesting differences based on gender and ethnicity and indicated that interest in pursuing faculty careers was driven by personal values. Perhaps not surprisingly, worries about career–life balance issues were a prominent issue for women. Across all groups, the choice of nonacademic career paths also correlated with a need for their work to have a higher level of applicability than they felt would be attainable in a university. These are not unreasonable concerns—in fact, I think our most perceptive students are those who best recognize challenges faced by folks in our or many other professional careers in doing impactful work. I do worry that our trainees don’t have a chance to see all the time we spend on helping many people’s lives in our wider scientific community—from the advice we give undergraduates on next steps after graduation, to introductions to help a graduate student in the neighboring lab meet a collaborator or helping a postdoc transition his or her experimental rhythms to parenthood.

MARK: That brings us right back to what we talked about at the beginning of our conversation—that we have failed to effectively communicate many of the great things about our career. When we’re having a bad day, the issues are often open for all to see: a grant or paper rejected, a new teaching approach that failed on the first try, a faculty meeting that went on too long. In contrast, some of the greatest aspects of our job are found in interactions that occur outside the lab, on the phone or in one-on-one settings that likely go unnoticed.

You already talked about work–life balance, but I think are students don’t fully appreciate the many ways one can have a broad societal impact as a research-intensive professor. I have taught literally thousands of students, and I know I have influenced the futures of at least some of these. In my lab, I have directly mentored more than 75 undergrads, 18 grad students, and 20 postdocs, all of whom have gone on to amazing careers across the job spectrum. Looking back, the innumerable one-on-one interactions with these folks are among the things I value most.

I also have had a chance to be part of creating a new program to increase the number of URM students who go on to STEM degrees and PhD’s in science. Our career also offers great outreach opportunities (<https://loop.nigms.nih.gov/2016/05/sharing-our-passion-for-science/>). I loved the story you told me this week about the grade school science fair, and my students have been great supporters of DNA Day across North Carolina. I have had a chance to shape educational innovations through efforts of the ASCB and my own university. Finally, through service at the NIH, I have had a chance to shape the future of science. I think the human impact of our career is a great one, and we do a poor job of telling this to our trainees.

AMY: And don't forget the reason we got into this business in the first place—the incredible opportunity to get paid to learn new things about how the world works! Sometimes our grumbling about the day-to-day grind of experimental trouble-shooting and article revisions might convey to our trainees the wrong message about that as well. I think we need to let them hear more often about how excited we are about their latest data, yesterday's seminar, the great paper presented by someone in our joint lab meeting, or how much we learned on that trip to our favorite scientific meeting.

MARK: Exactly. That reminds me of the essay Ron Vale wrote when he won ASCB's Keith R. Porter Lecture Award in 2009—"It's a Wonderful Life: A Career as an Academic Scientist" (Vale, 2015). He hit on all those points and more!

AMY: We need to do something about this! We need our trainees to explore the full range of career options, each with advantages and disadvantages, but I want to make sure the research-intensive academic career is among them. I know that UNC has a new student/postdoc-led group called ARIC, for Academic and Research Intensive Careers. Maybe we could talk to them?

MARK: And we should talk to the broader leadership in our Office of Graduate Education about making sure our presentation of diverse careers includes our own!

AMY: Maybe we could write a piece for ...

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