



Future of Research - How Can We Improve Career Awareness and Preparedness? A workshop at the NatureJobs Career Expo Boston 2015

PATRICIA R. GOODWIN¹, KEARNEY T. W. GUNSALUS², ERICA M. WALSH³, GARY S. MCDOWELL⁴

1. Department of Biology, Brandeis University, Waltham, MA, 02453, USA

2. Department of Molecular Biology and Microbiology, Tufts University, Boston, MA, 02111, USA

3. Department of Pathology, Brigham and Women's Hospital and Harvard Medical School, Boston, MA, 02115, USA

4. Center for Regenerative and Developmental Biology, Department of Biology, Tufts University, Medford, MA, 02155, USA

ABSTRACT

Current issues surrounding research and funding, in particular questions about training and workforce stability, affect career development amongst graduate students and postdocs. The Future of Research Symposium, held in Boston, USA, in October 2014, was organized by early career researchers to facilitate discussions about the scientific enterprise and central to these discussions were a series of postdoc-led workshops aimed at discussing problems, and identifying solutions. On May 20th at the *NatureJobs* Career Expo 2015 in Boston, USA, postdocs from the Future of Research organization led a workshop using a similar format, inviting participants to identify barriers to career awareness and preparedness for early career researchers, and possible solutions to these problems. Here we present the data from this workshop and summarize the main points raised, for the use of the early career research community.

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CORRESPONDENCE:

gary.mcdowell@tufts.edu

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INTRODUCTION

Most biomedical research trainees are well acquainted with the axiom, "There are many non-academic career paths available for science PhDs." It is a common refrain at career panels and discussions about the growing size of the biomedical research workforce. Now that as few as 10% of trainees will go on to have a faculty position (Table 3–18 in (National Science Foundation, 2014)), a multiplicity of non-academic career options is essential to justify the number of graduate students currently in the system. Yet, at the same time, choosing an academic postdoc after completing a PhD is often described as "the path of least resistance." Thus, the easiest path to follow in science may also be the path least likely to result in long term employment.

To address this disconnect, the Future of Research organization invited job-seeking researchers to a workshop at the *NatureJobs* Career Expo on May 20th in Boston. The **Future of Research** symposium (FoR), held to give voice to graduate students and postdocs in the ongoing dialog about policies that shape the scientific establishment, included four postdoc-moderated workshops focused on training, workforce stability, funding structure, and the metrics and incentives in place in the research system. The recommendations from this meeting were reported in a white paper (G. S. McDowell et al., 2014) and focused on greater stability in science funding, greater connectivity amongst researchers at all levels, and increased

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transparency in tracking data on career outcomes (as discussed further in (Polka, Krukenberg, & McDowell, 2015)).

At the *NatureJobs* Career Expo in Boston, USA, moderators from FoR adapted the methods used in the original workshops to the question, "How Can We Improve Career Awareness and Preparedness?" Problems and solutions were discussed in particular to identify actionable steps for individual postdocs, PDAs, postdoctoral offices (PDOs), other administrators, and professional societies to take in enacting these and other solutions with participation from stakeholders at all levels. The *Naturejobs* workshop aimed to better characterize the barriers that steer trainees towards academic science career paths and away from "alternative" careers. We solicited the job-seekers' help in describing the "resistance" that makes a postdoc "the path of least resistance." Here we outline the key themes that emerged from the discussions and provide the raw data in the Supplemental Materials.

METHODS

The workshop was carried out as described previously (Mazzilli et al., 2014; G. S. McDowell et al., 2014) with the following modifications. Briefly, the workshop was a 50-minute session with all participants discussing the same question, "How Can We Improve Career Awareness and Preparedness?" After a 5-minute introduction, participants were separated into four groups. The number of participants per group was around 30. In the first 20 minutes, individual participants were asked to write down the perceived problems on sticky notes and to post them on the wall (selected quotes from these notes appear below in italics). Working as a group, participants categorized these individual responses and identified major themes. In the next 20 minutes, participants were then asked to individually write down possible solutions to the identified problems in a similar manner. Solutions were categorized according to the level of implementation, ranging from actions that can be accomplished by individual graduate students and postdocs to those requiring action from society as a whole. For the final 5 minutes, all groups came back together and a volunteer participant from each group summarized the group's discussion to all participants.

The workshops identified a large number of problems and potential solutions. In the following sections, we summarize the identified problems and proposed solutions. We also present all identified problems and proposed solutions as raw data (see Supplementary Materials).

RESULTS

PROBLEMS: WHAT ARE THE OBSTACLES PREVENTING YOUNG SCIENTISTS FROM EXPLORING POTENTIAL CAREERS?

To illustrate the types of obstacles identified by participants, let's imagine a cohort of typical scientific trainees (graduate students or postdocs) who are contemplating career paths outside of academia and follow them through the hypothetical job search. When and where along their path will they encounter difficulties? What are the internal and external barriers that inhibit the trainees' progress towards jobs outside academia?

CULTURAL BARRIERS IN ACADEMIA

The first barrier trainees might encounter in a non-academic job search is disapproval from the faculty within academia. Although a wide variety of non-academic career paths may be viewed favourably in general by faculty for trainees, when it comes to a Principal Investigator's (PI's) own trainees leaving academia, the PI may be less than encouraging. Workshop participants' responses included:

"Academic stigma of leaving academia"

"Academic culture shames leaving it."

"PI wants [you to follow] an academic career,"

"PI wants you to follow their career path."

Because industry research is profit-driven, while academic research is perceived as being more curiosity-driven, industry careers may be viewed by academics as less noble or worthy than academic careers. Faculty who are passionate about and proud of their research may view leaving academia as giving up. Crucially, it is in a PI's best interests to keep trainees on an academic career path, because this will keep them motivated to publish, which directly benefits the PI. Under our current system, the relationship of mutual benefit between PI and trainee is strongest when the trainee remains on an academic career path. The perceived stigma against leaving academia was so strong amongst some workshop participants that they expressed the need to keep their non-academic job search a secret from their PI. Thus, attitudes in academia towards industry careers can prevent trainees from even considering a non-academic career.

LACK OF KNOWLEDGE AMONG JOB SEEKERS AND THEIR MENTORS

Supposing trainees ignore the pressures to stay in academia and resolve to pursue alternative careers; where should they begin looking for alternative careers? What jobs might they enjoy? What are they qualified to do? Many of the participants in our workshop described themselves as under-informed about non-academic career options:

"Don't know much about what's available outside of academia nor how to get a foot in the door"

"Not enough exposure to people with alternative careers"

"Don't know where to look for jobs"

"Lack of knowledge about alternative careers"

"Lack of awareness of non-bench science careers"

Though many graduate programs are beginning to take steps towards informing their students about non-academic career paths (such as hosting career panels), students still feel uninformed about their options. They have a vague awareness that options exist, but little clarity about how to determine which options are most suitable for them.

LACK OF EXPERIENCE AND MENTORS OUTSIDE ACADEMIA

Let's imagine that some self-motivated trainees have identified alternative career paths that they find appealing. Whom can they ask for advice about how to transition into their chosen industry? The responses from our workshop's participants suggest that connecting with helpful mentors is a significant challenge.

"Mentors [PI's] don't know about alternative careers"

"Lack of mentors"

"No clear path to next career move"

Even the most supportive of PIs will likely have limited knowledge about what is required to find jobs outside of academia. Job-seekers must therefore be able to connect with mentors in other fields. However, a trainee who has only worked in academic research labs may not know anyone in pharmaceutical companies, science publishing, the biotech industry, or in science policy. Job-seekers in our workshop reported that although they are well-aware that they ought to be "networking" with someone somewhere, they are unsure about how to establish these connections in the first place.

DIFFICULTY RECOGNIZING OR OBTAINING SKILLS SOUGHT BY INDUSTRY

If trainees finally find mentors to advise them on their chosen career paths, conversations with

those mentors could lead them to discover that their academic research experiences have inadequately prepared them for their dream jobs.

"Lack of experiences industry requires in qualifications."

"No relevant experience for alternative careers."

"Limited skill sets and opportunities to increase them."

"Entry restricted by industry experience."

"Industry values industry experience but not academic experience."

Although completing a PhD teaches essential skills such as critical thinking, project planning, and data analysis, industry job postings may require more than just these qualifications. Communication, people-management, and budgeting were all listed by workshop participants as useful and marketable skills that are rarely emphasized in academic training. In addition to these specific skills, industry job postings may specify previous industry experience as a necessary job qualification. To acquire this experience, trainees would need volunteer or internship opportunities and the flexibility within their work schedules to pursue those opportunities.

LITTLE TIME TO SPARE FOR JOB SEARCH OR ACQUIRING DESIRABLE EXPERIENCE

Once trainees understand which skills they need to add to their arsenals in order to land a job, they must then carve out time from their busy schedules to acquire those skills. When trainees begin searching for jobs in earnest, they must devote time to networking, informational interviewing, researching companies, writing resumes and cover-letters, and interviewing for jobs. Typically, they must do all of this while continuing to work full-time in the lab, which for many scientists means working well beyond the 9:00 to 5:00 workday.

"Not enough time in the day"

"Overwhelming workload as a postdoc -> less time to explore options"

"No time left to focus on our own careers"

"No time to explore options"

"Burnt-out!"

TOO FEW JOBS

Suppose that our trainees have overcome all of the barriers mentioned above. They have built strong resumes that make them competitive applicants, and they have identified openings for jobs for which they feel they are well suited. They will still face stiff competition with other scientists to land that job.

"Saturated job market"

"Limited job openings"

"Too much supply, not enough demand"

"Trouble finding jobs especially in remote cities with few industries"

VISA ISSUES FOR NON-US CITIZEN JOB SEEKERS

For non-US citizens, visa issues create an extra barrier to finding a job outside of academia. Because student visas expire when a student graduates, non-US job seekers cannot have a time-lapse between the end of their graduate school training periods and the beginning of their subsequent jobs. Furthermore, companies may look more favorably on hiring US citizens as

opposed to foreign candidates because US citizens do not require the company's support through the work visa application process and the number of non-academic work visas, such as H-visas, is limited.

"Immigration constraints"

"Unable to enter industry because of J visa"

"Entry level positions restricted by visa type"

PERSONAL INSECURITIES OF JOB SEEKERS

Given the long list and wide range of challenges that face non-academic job seekers, it's not surprising that many trainees at the workshop expressed a lack of confidence about leaving the academic career path.

"Will I survive outside academia?"

"Fear of the unknown"

"Lack of confidence"

"Where do I fit in industry?"

It's natural to postpone or avoid any undertaking that one fears could result in failure. A lack of confidence can paralyze potential job-seekers from taking the first steps towards changing their careers. The alternative - pursuing a postdoc - may be riskier or wasteful in the long-term, but in the short term, it is the safer, easier option.

SOLUTIONS: WHAT ACTION COULD BE TAKEN TO OVERCOME THESE BARRIERS?

Though many barriers to finding a career outside of academia exist, these barriers are by no means insurmountable. The large numbers of individuals with science PhDs who are currently working outside of academia are proof that it is possible. Success will primarily depend on the initiative and effort of the job seeker, but there are things that PIs, graduate programs, and industry employers can do to facilitate the process.

CHANGE MINDSET TO BE MORE DELIBERATE ABOUT JOB SEARCH

The first step trainees must take towards non-academic careers is to positively decide that there are science careers outside of academia which interest and excite them. This step may require a significant change in how young scientists see themselves and envision their futures. It requires the scientists to reflect upon their own strengths and weaknesses, to decide what they want from their careers, and evaluate what constitutes a worthy use of their scientific training use of their PhDs.

"Start thinking about your career EARLY"

"Diversify interests"

Once graduate students or postdocs have decided to leave the academic career path, they need to adopt a different mindset towards the remainder of their training. Many participants' suggested solutions were self-directed. These suggested solutions point out that trainees must be proactive about their job searches, and that they need to be methodical and deliberate about researching alternative careers.

"Be proactive."

"Assign time to research job options"

"Budget time/have a game plan"

"[View] rejection as a learning process"

REDEFINE THE PI:TRAINEE MENTORING RELATIONSHIP

Strong mentoring relationships, like all relationships, are based on frequent, open, and honest communication. Perceived (or actual) stigmas against leaving academia can prevent trainees from being honest with their PIs about their future plans, which makes effective mentoring impossible. In order to create an environment where trainees can be honest about their career goals, the scientific community must discover a way to make mentoring relationships between academic PIs and non-academically-inclined trainees mutually beneficial. Respondents recognized the need for frequent communication between PIs and trainees about career goals and progress, and the need to legitimize non-academic career paths among academic mentors.

"Institutions need to change PI:postdoc relationship guidelines"

"Check points/IDP [Individualized Development Plan]"

"Data [to show]: postdocs who spend time on career development just as productive"

"Students [should] communicate goals to PI"

Once trainees have communicated to their mentors which career paths they wish to pursue, and if their PIs are supportive of their choices, they can begin working on plans to identify the skills, experiences, and contacts that they will need to acquire.

ENHANCE CAREER PREPARATION IN GRADUATE SCHOOL AND POSTDOCTORAL PROGRAMS

To realign graduate school curricula with the new reality of the scientific workforce, higher priority needs to be placed on skills that are considered valuable in the non-academic workforce, including writing, oral presentation, people management, and budgeting skills. Respondents described their training in these transferable skills as "spotty." Some students learned these skills incidentally, and some fortunate students received individual instruction from their PIs, but few had formalized or required training. Classes teaching "soft" skills would be of use to students and postdocs whether they set their sights on academia or industry. Explicit training in how to approach a job search was also recommended as a way to ease the transition out of academia and into other industries.

"Career development program, starting from grad school"

"Transferable skills education"

"Extra programs in universities on start-ups, finance, tech"

"Training in networking skills"

FIND MENTORS OUTSIDE OF PI

It is unreasonable to expect PIs to be experts about all the potential career paths available to trainees; therefore mentors who can provide information about these careers must be sought elsewhere. Workshop participants identified many ways to make connections with scientists outside of a academia in order to gain more knowledge about other career paths, including informational interviewing, mentoring programs, and seminars. They also suggested support groups as a way to share resources amongst job seekers. Support groups would also provide emotional support and accountability for goal setting during the job search process.

"Mentor/Mentee program (outside institution)"

"Get a non-academic mentor"

"Informational interviews"

“Create support groups”

“Invite business people to share expectations of skills and values”

IMPROVE CAREER COUNSELING AND ALUMNI ACCESS FOR GRADUATE STUDENTS AND POSTDOCS

Workshop participants, particularly postdocs, expressed a desire to have their schools provide more career resources, including career counselors and better access to alumni networks. Access to career counseling would provide valuable feedback about resume preparation, interviews, and how to network. Increased access to alumni would enable job seekers to make useful connections with potential mentors in a wide variety of industries and positions.

“Formal career counseling at graduate school”

“Postdocs cut-off from Alumni connections and Resources - increase access”

“Access to alumni”

CREATE WAYS TO BRIDGE THE ACADEMIA-INDUSTRY GAP

Another substantial issue identified by workshop participants is the disconnect between trainees in academia and professionals in industry. Participants were eager to have more contact with industry, either through one-day events, mentoring partnerships, or internships.

“Industry open house”

“industry outreach!”

“Shadow someone in industry”

“Non-academic collaborations”

“Create work-study positions for PhDs outside of academia”

USE WEB TOOLS TO SHARE INFORMATION

Lack of information - whether about career paths, the skills required for these careers, job search strategies, or job opportunities - was identified as one of the main barriers preventing trainees from pursuing non-academic careers. Nothing can disseminate information faster or more widely than the internet, so it is not surprising that respondents suggested many web-based solutions to share information.

“Webinars/meetings [with] broad panel discussions”

“Reach out to industry via social media”

“LinkedIn-like service for mentoring,”

“Create a website for discussion”

“website that spells out all of the opportunities available”

DISCUSSION

LIMITATIONS OF THE DATA

It's important to remember that all of the issues listed above are the perceived difficulties of job seekers. Any PhDs who had little difficulty finding a job would not be likely to attend the *NatureJobs* Career Expo, or a workshop about the barriers to finding jobs. Our participants concluded that there are too few jobs for scientists based on their personal experiences in the job market, as opposed to reported numbers about job openings. Given that they report being

under-informed about job opportunities, they may be failing to connect with employers who are seeking to hire someone with their exact qualifications. Likewise, respondents' reports that there is a stigma in academia against non-academic careers is based on perceived attitudes and individual experiences.

It was beyond the scope of our workshop to evaluate the accuracy of these perceptions. However, should either of these perceptions prove to be incorrect or exaggerated, the problems raised by workshop respondents should still not be ignored. Even in this best-case scenario, where fewer barriers to finding a job exist than trainees believe, there is still a significant communication problem between industry employers and their potential employees, or a disturbing lack of trust between academic PIs and their mentees.

Furthermore, these barriers still need to be openly addressed. Students' and postdocs' belief in these barriers is enough to discourage them from seeking out non-academic careers and to keep them on the academic "path of least resistance." To ensure that students and postdocs are choosing career paths that reflect the new reality of the scientific workforce, changes need to be made to improve trainees' awareness of and preparedness for non-academic careers.

SUMMARY

The problems and suggested solutions that were identified by workshop participants can be summarized in three main themes that must be addressed to reduce the barriers between academia and other scientific industries:

- 1. Change the mentor:mentee relationship so that non-academic career planning is cooperative and proactive.** Through early and regular meetings to discuss students' and postdocs' career trajectories, and the use of Individualized Development Plans (IDPs), mentors and mentees can create an effective plan for the mentee's career advancement. The success of these plans will require both the acceptance of non-academic career pathways from PIs, and self-reflection and effort on the part of trainees.
- 2. Increase trainees' exposure to the non-academic communities in science.** More interactions with scientists working outside academia will allow trainees to discover more about which careers would suit them and how to break into those careers. This could take the form of more seminars, more mentoring relationships or shadowing, or more internship programs. Increased contact between academia and other industries has the potential to benefit those industries as well, by allowing them to get to know their potential hires more closely than they could in an interview.
- 3. Increase emphasis on transferable skills in grad school curricula and increase career resources for graduate students and postdocs.** To improve early career researchers' employability, graduate schools could begin providing formal training in experimental design, scientific writing, and oral presentation. To give graduate students and postdocs a leg up in the job search, schools could provide access to career counseling advice and alumni networks.

The academic science community is currently at a crossroads. It is coming to grips with the fact that the majority of graduate school and postdoctoral training focuses on preparation for academic career paths, which only a minority of trainees will follow. For graduate studies and postdoctoral positions to genuinely be periods of training, curricula and mentoring approaches should reflect the career paths that trainees are likely to follow today, and not be based on typical career trajectories from decades past.

RESOURCES AND FURTHER READING

There are many resources that early career researchers can use to raise their own career

awareness and prepare themselves, which we list below.

WEBSITES

NatureJobs: <http://www.nature.com/naturejobs/science/>

NatureJobs Career Community: <https://careerscommunity.nature.com/>

ScienceCareers: <http://sciencecareers.sciencemag.org/>

MyIDP: <http://myidp.sciencecareers.org/>

Graduate Career Consortium: <http://gradcareerconsortium.org/>

ARTICLES

Utilizing the *NatureJobs* Career Expo to Explore Career Options (G. McDowell, 2015);

A call for transparency in tracking student and postdoc career outcomes (Polka et al., 2015);

Get Over the Guilt (Matrone, 2015);

Education: The PhD Factory (Cyranoski, Gilbert, Ledford, Nayar, & Yahia, 2011);

What Do I Want to Be with My PhD? The Roles of Personal Values and Structural Dynamics in Shaping the Career Interests of Recent Biomedical Science PhD Graduates (Gibbs & Griffin, 2013).

SUPPLEMENTARY MATERIALS

Input from participants was collated into the attached document by group, with categories determined by the participants of the individual groups.

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