

The present and future of research on the postdoctoral experience

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Abstract:

Taking a postdoctoral position is an important step toward a faculty position for many academic researchers. A postdoctoral position is generally considered an opportunity to hone laboratory skills and narrow down a promising research focus. However, there is little published scholarship on the effectiveness of the many different aspects of the postdoctoral experience beyond research training. This article compares the types of published research focused on postdoctoral workers and offers commentary on future avenues of investigation that may be beneficial to postdoctoral workers and all members of academia.

In many scientific fields, particularly the biological sciences, a postdoctoral research position is a necessary part of the career development path (Nerad and Cerny 1999). Working in a postdoctoral position is widely considered to provide the opportunity to develop a unique research focus that will serve as the foundation of future research as an independent investigator, while being buffered from the demands and stresses faced by tenure-track faculty (Reskin 1976; Akerlind 2005). Largely, postdoctoral positions are successful in helping to form a core set of research interests. However, the range of expectations put on junior faculty members does not simply involve research, and the effectiveness of the postdoctoral experience in providing training in other areas such as teaching and mentorship is not yet clear.

Currently, the vast majority of published articles focusing on the postdoctoral researcher fall into four general categories: commentaries or editorials, longitudinal studies, surveys or interviews, and reports about specific institutional postdoctoral programs. Each of these types of publication is useful in its own way, but each also has its limitations. The following sections will discuss these types of articles, with some examples provided.

Commentaries and editorials.

The postdoctoral world has been discussed in numerous editorial pieces and even in a special issue of *Science* dedicated to "life as a postdoc". These commentaries help shed light on the issues facing postdoctoral researchers across the nation and around the world. For example, the bottleneck of postdoctoral researchers waiting for tenure-track positions has been noted, and there has been a call to integrate postdoctoral workers into the greater "learning community" of the university.

Unfortunately, some commentaries present the situation in an exceedingly gloomy light or oversimplify the nature of a postdoctoral position (e.g., by lumping postdocs with undergraduates on the spectrum of university students) (Gonzalez 2001). The good editorials strike a balance and present specific, constructive ideas for improvements, such as the institution of yearly progress meetings for all postdocs or formalized instruction for faculty members regarding mentorship of their postdocs. Editorials can stimulate discussion, but they only represent the

opinions of a handful of people at most. Therefore, they cannot provide the data necessary to truly understand or evaluate the postdoctoral experience in an evidence-based way, as the fields of undergraduate *science* education and science in general are currently studied.

Longitudinal studies.

Longitudinal studies have traditionally focused on the career placement, grant funding, and tenure of postdoctoral researchers after they find permanent positions (Robertson et al. 2007; Ross et al. 2009; Levitt 2010). In fact, the earliest article about postdoctoral workers that can be found on PubMed is one such study of the subsequent careers of postdoctoral applicants (Bowen 1953). This limited focus is largely due to the nature of the data that are available about former postdoctoral fellows: publication lists, funding sources, and places of employment. Unfortunately, these data essentially reflect career development as it is defined in academia. This scope is not sufficient to capture the range of future careers for a postdoctoral fellow, which may include teaching-centered faculty positions, industry positions, writing/editing positions, or entrepreneurship, to name a few (Mintz 2011). Future studies would be strengthened by following postdocs who enter these so-called "nontraditional" careers. Even when focusing on the academic career path, it is important to note that research is not the only part of a faculty position. Therefore, it may also be informative to study the correlation between career success, whether self-reported or assessed by external metrics, and the level of additional training experiences (e.g., classes taught, ethics courses taken, and mentoring opportunities) received during the postdoctoral fellowship.

Because longitudinal studies are observational, their greatest strength is their ability to provide data that reflect the actual situation being studied instead of serving as an experimental model. However, they do not allow for experimentation to determine causal relationships, and it can be difficult to maintain participation throughout studies lasting long enough to generate informative data about career choices. It can also be difficult to track postdocs, in particular, because some may take multiple positions or enter into highly dissimilar careers. Therefore, longitudinal studies are best suited for the analysis of broad

questions using publicly available data, which may ultimately hinder their usefulness for broadly assessing the postdoctoral experience.

Surveys and interviews.

Surveys are a valuable tool for collecting data from or about postdocs, and longitudinal studies are often based on surveys. However, the use of a well prepared survey or set of interview questions extends beyond gathering information about the later careers of postdocs; surveys can also reveal the concerns and motivations of postdocs. With this information in hand, changes can be implemented to correct some of the issues raised. For example, when postdocs at the University of North Carolina, Chapel Hill, were invited to post research opportunities for undergraduates to mentor, many reported in a survey that they were reluctant to do so without prior instruction (Pukkila and Milgram 2001). This scenario led to the creation of a workshop to discuss mentorship, with the goal of allaying fears and producing a better experience for both postdocs and undergraduates in mentor-mentee relationships.

However, the issues raised by a survey are sometimes too broad to be corrected in such a straightforward manner. For example, a survey conducted in Canada revealed that 70% of postdoctoral respondents believe that their career counseling is insufficient, a conclusion echoed by a study set in Australia (Akerlind 2005). Unfortunately, while it is important to be aware of this insufficiency, it is difficult to implement a far-reaching solution. Gathering information from current and former postdocs by means of surveys and interviews can bring new issues to light, but future studies will always be necessary both to validate any methods employed to address those concerns and to determine the effectiveness of those methods.

Postdoctoral program case studies.

A number of successful research and teaching programs involve postdoctoral scholars, and descriptions of these programs are increasingly being published in the literature. Published program descriptions are most useful in presenting new ideas to a wider audience, which may lead to the establishment of similar programs elsewhere. They also support the improvement of existing programs by incorporation of particularly novel or effective concepts reported by the authors at another institution. However, as with commentaries, reports about postdoctoral programs only reflect specific situations and frequently lack any data assessing the success of the program.

One recent report describes a program developed at the National Cancer Institute that is designed to provide its fellows with a strong foundation in education, mentored research, and professional development (Chang et al. 2005). It is likely that touching on all of these important areas provides a great advantage to the postdoc by the end of the fellowship, but the benefits of the program have not yet been formally assessed. With quantitative data reflecting the success (or failure) of specific postdoctoral programs like the

one at the National Cancer Institute, it would be easier to determine how to improve the postdoctoral experience and how to make postdocs more competitive for employment in any number of settings. Moreover, quantitative data with appropriate sample sizes and statistical analyses would be useful to administrators who wish to justify the development or continuation of such programs for postdocs.

Conclusions.

Postdoctoral fellows report their own scientific research efforts with great success and often continue to publish effectively at the next stage of their careers (Ross et al. 2009); in fact, a survey of the published research articles in two recent issues of *Science* found that 43% had postdoctoral first authors (Ghayur 2008). However, there is a need to study the nature of the postdoctoral position itself and, particularly, how to provide the maximum benefit for the postdoctoral researcher in all facets of career development. In many cases, it is no longer sufficient simply to devote one's full effort to the laboratory. Training opportunities in the areas of teaching and learning, time management, mentorship, and ethics are also extremely useful for a postdoctoral researcher, especially when continuing into academia. Future efforts to understand the basis of successful postdoctoral programs and identify the preparation that postdoctoral fellows need before they start their own careers will benefit the field of research and scholarship as a whole.

Since the founding of the first university postdoctoral association 18 years ago (Aschwanden 2006), more and more universities have created postdoctoral program offices or associations, both within the university and beyond (Felfly 2011). These entities represent centralized sources for the acquisition of larger amounts of data regarding the experiences of postdoctoral researchers around the globe and could be used to facilitate future studies aimed at identifying the most effective aspects of postdoctoral programs. Even fundamental issues such as the definition of a "postdoc" remain to be adequately addressed (Akerlind 2005), meaning that the future is wide open for important research about the postdoctoral experience. With the increasing availability of journals covering education, pedagogy, and policy, the time is right to move forward.

Acknowledgments

I thank Dr. Sarah Mudrak for critical reading of the manuscript, and two reviewers for helpful comments.

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