

Closing Gaps in our Knowledge of PhD Career Pathways: How Do Biological and Life Sciences PhD Holders Transition into the Workforce?

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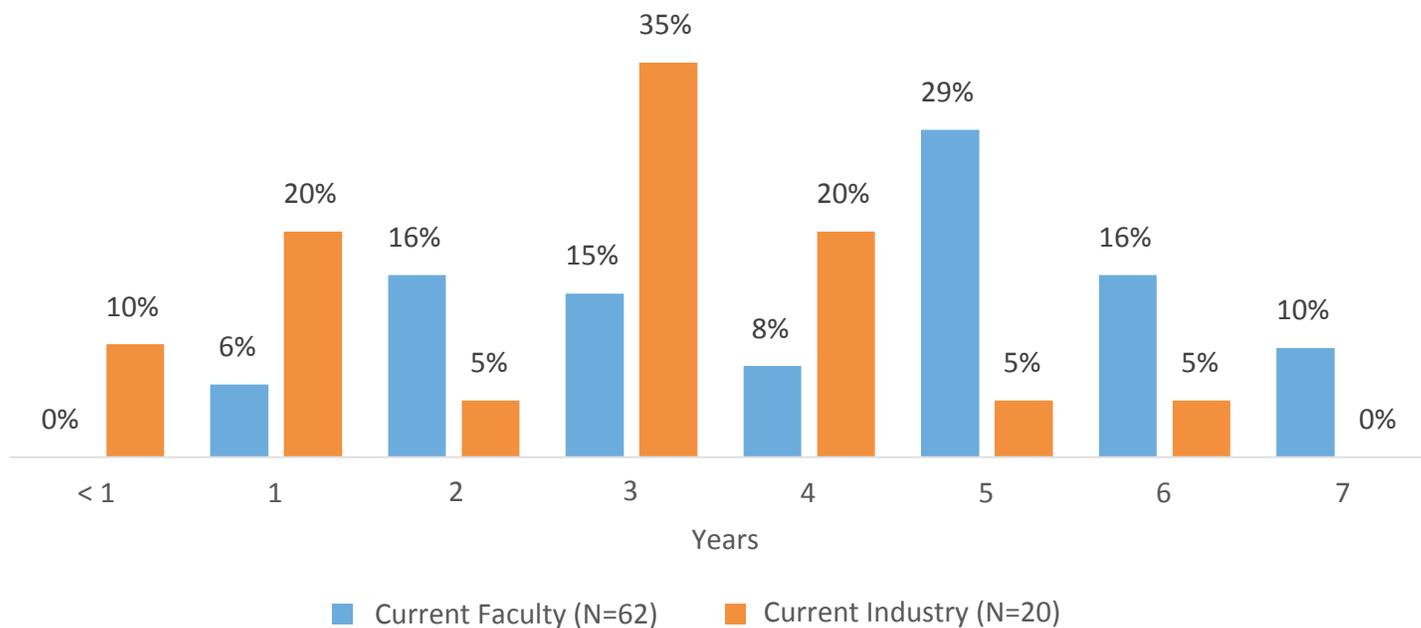
PhD holders in the biological and life sciences pursue a wide array of careers in postsecondary, for-profit, not-for-profit, and government sectors. Among recent PhD recipients who continue to work in the postsecondary sector, many pursue postdoctoral researcher positions to develop additional research and lab management skills, and these opportunities are increasingly seen as a prerequisite to a tenure-track faculty position (Sauermann & Roach, 2016, Stephan, 2013). Although there are approximately 79,000 postdocs currently employed in the U.S. (Ferguson, McTighe, Amlani, & Costello, 2017), there is relatively little research on the benefits of postdoctoral appointments (Kahn & Ginther, 2017), particularly for those who transition into industry. What we do know is that postdoctoral researchers have experienced challenges related to professional development, the increasing length of postdoctoral appointments, finding a permanent position, and finances (DeJesus, 2012). Using survey data from the Council of Graduate Schools' (CGS) PhD Career Pathways project, this brief provides new insights into the career outcomes of 996 PhD holders in the biological and life sciences three and eight years post-degree with a particular emphasis on those who have been employed as postdoctoral researchers in academic institutions.

Key Findings:

- Among PhD holders eight years post-degree who hold a faculty position (N=160), two-thirds reported that their immediate previous position was as a postdoctoral researcher (with the remainder coming nearly exclusively from other faculty or research positions).
- Within this current faculty group, more than half reported postdoctoral appointments lasting five or more years with an average length of 4.24 years. For former postdocs currently working in industry, 40% left by the end of the third year with an average length of postdoctoral appointments being 3.42 years. (Figure 1)
- For PhD holders three years post-PhD who are currently employed as a postdoctoral researcher, the median salary is \$55,000, with nearly a third earning less than \$50,000 (N=136). Their counterparts in faculty positions, however, had higher earnings, with over one third earning above \$100,000 and a median salary of \$85,000 (N=117). At three years out, an even greater share of PhD holders who worked in the business or for-profit sector reported earnings over \$100,000 with a median salary of \$125,000 (N=89). (Figure 2)
- While those employed in industry enjoyed higher earnings compared to faculty and postdocs, PhD holders in industry positions reported that their jobs were not as closely related to their field of PhD study. However, many of these PhD holders in industry still work in scientific research positions. (Figure 3)
- Across all cohorts, PhD holders in industry reported applied research (30%), management (23%), and development (20%) as their primary job responsibilities whereas faculty members reported teaching (43%), basic research (21%), and applied research (16%). (Figure 4).

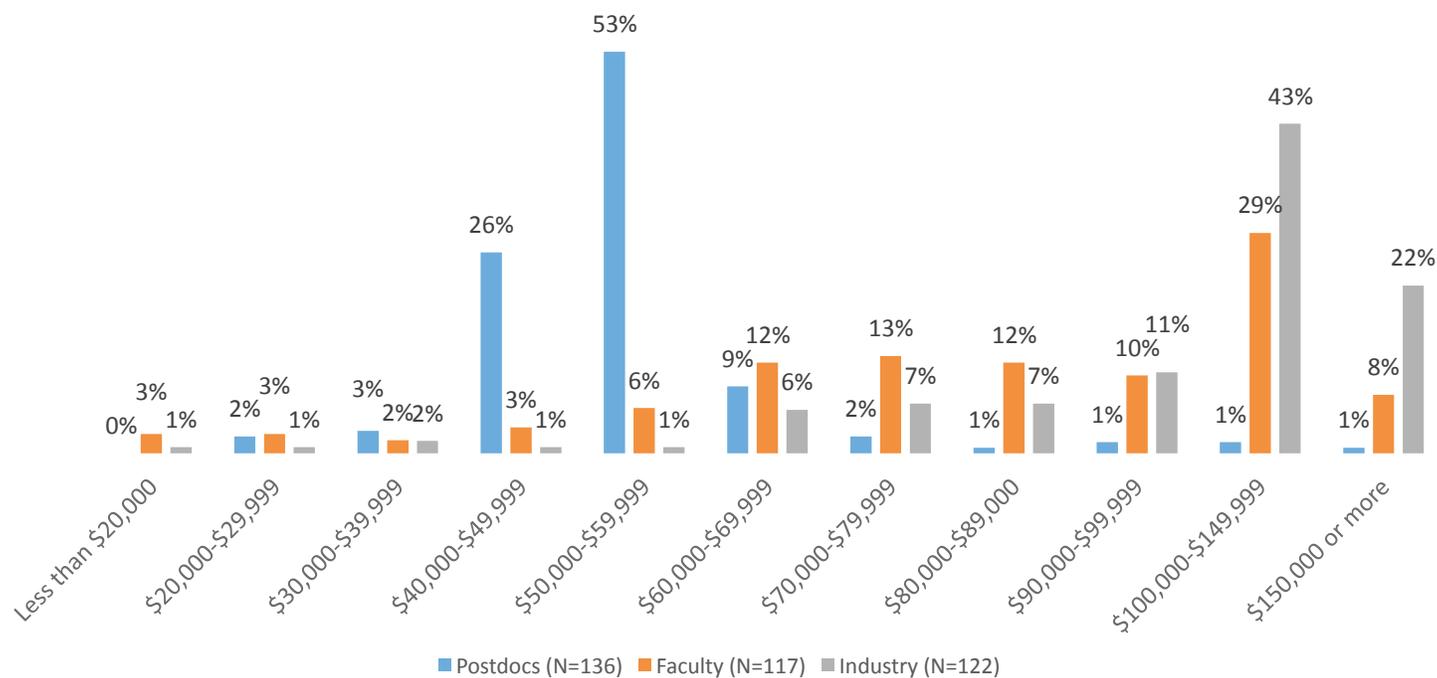


Figure 1: Length of Postdoctoral Appointments by Job Type (8-Year Cohort)



Data Source: Council of Graduate Schools, *Understanding PhD Career Pathways for Program Improvement* (NSF/DGE #1661272 and Mellon Foundation #31600612), Fall 2018 Alumni Survey.

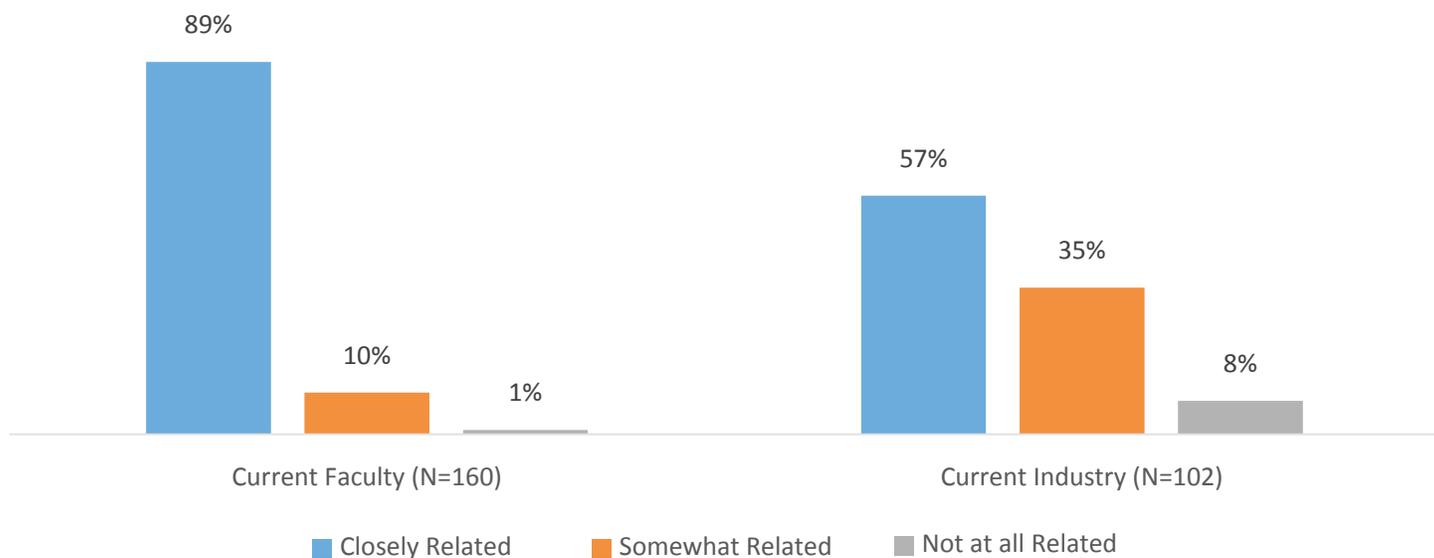
Figure 2: Salaries by Job Type (3-Year Cohort)



Data Source: Council of Graduate Schools, *Understanding PhD Career Pathways for Program Improvement* (NSF/DGE #1661272 and Mellon Foundation #31600612), Fall 2018 Alumni Survey

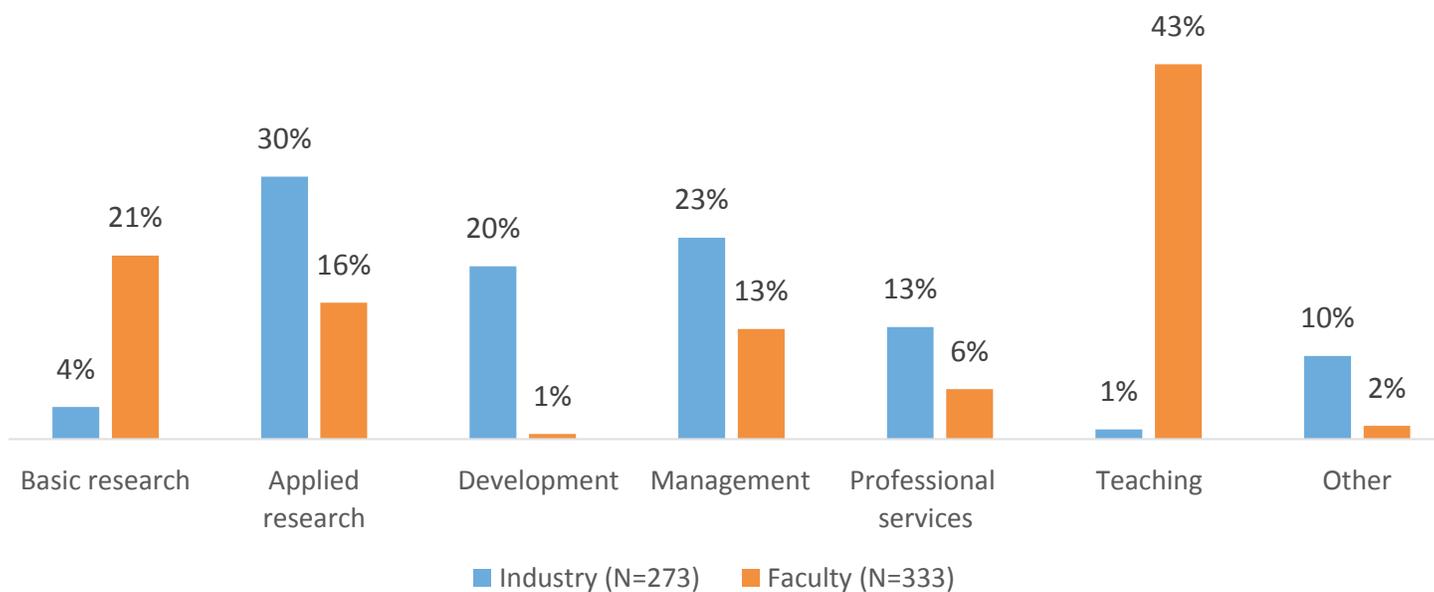


Figure 3: Job Relatedness by Job Type (8-Year Cohort)



Data Source: Council of Graduate Schools, *Understanding PhD Career Pathways for Program Improvement* (NSF/DGE #1661272 and Mellon Foundation #31600612), Fall 2018 Alumni Survey.

Figure 4: Primary Job Responsibility (All Cohorts)



Data Source: Council of Graduate Schools, *Understanding PhD Career Pathways for Program Improvement* (NSF/DGE #1661272 and Mellon Foundation #31600612), Fall 2018 Alumni Survey.



Takeaway Points

- Many current faculty members held relatively long postdoctoral appointments prior to holding their current positions. Postdoctoral opportunities undoubtedly offer valuable training and professional development experiences to PhD degree holders. However, it was not clear from the data whether the doctoral or the postdoctoral experience significantly enhanced their preparation for a faculty position.
- In addition to the length of postdoctoral appointments, the state of postdoctoral researcher salaries remains a concern. Relatively low salaries of postdoctoral positions may deter promising researchers from pursuing what appears to be an important pathway to faculty jobs.
- Postdoctoral research appointments come in many forms. While many postdocs are funded through NIH grants that set a minimum salary, not all postdocs are funded through such grants. Although many institutions use the NIH scale for postdoctoral salaries, our survey shows that factors such as field or funding source may explain some of the lower salaries.
- Postdocs moving to a career in industry typically do so after three years and realize higher salaries, thus providing more immediate returns on their educational investment while still using many of the research and other skills acquired during PhD study.
- Finally, while a move to industry may bring a higher salary, PhD holders in the biological and life sciences may be holding jobs that are not quite as closely related to the domains of their doctoral studies. To the extent that PhD holders in industry are able to secure careers working in applied research and development activities, it appears that PhD training positions them with broader research skills and disciplinary knowledge necessary for launching a career beyond academic research.

Conversation Starters for PhD Program Improvement

We encourage graduate schools to engage in campus conversations about life science PhD careers to ensure that career diversity is seen and celebrated. Culture change happens incrementally and requires active participation of students, postdocs, faculty, and employers. A good first step is understanding how your campus community communicates about career options for PhDs and postdocs. Some of the questions that you may want to begin asking your campus colleagues (e.g. graduate school staff, college deans, graduate program directors, etc.) and others include:

- What kind of professional development opportunities does your institution provide PhD students in the life sciences for their career preparation and transition from graduate school, particularly for postdoctoral research opportunities?
- What kinds of professional development opportunities do postdocs receive at your institution?
- Are postdoctoral research opportunities a necessary stepping stone for a career in business, government, or non-profits?¹ Could internships during doctoral study help clarify whether a postdoc makes financial and career sense?
- How can PhD students and postdoctoral researchers benefit from an Individual Development Plan (IDP) to prepare them for the career of their choosing?
- How does your institution ensure a smooth and timely transition for postdoctoral researchers into permanent roles as faculty members or in other capacities (through policies, resources, etc.)?

Note: Biological and life sciences include fields that study organisms, including molecular and cellular processes through microbes, plants, and animals to evolutionary biology and ecosystems. These fields of study include, but are not limited to, Anatomy & Cell Biology, Biochemistry, Biological Sciences, Botany, Genetics, Health & Medical Sciences, Microbiology, Nutrition & Food Studies, Pharmacology, and Zoology. Small cell sizes prevented further analysis by fine field of study.

¹ Kirschstein National Research Service Award (NRSA) Stipends mandate a minimum salary (\$52,704 for a first-year postdoc in FY20 on a sliding scale for years of postdoctoral experience).



Additional Resources

National Postdoctoral Association (NPA): Since 2003, the National Postdoctoral Association has been the leading educational organization tasked with improving the postdoctoral experience. The NPA advocates for postdoctoral associates in academic, industry, non-profit, and government sectors. Learn more about the [National Postdoctoral Association](#).

Individual Development Plans (IDP): With increased focus on career planning in doctoral education, several disciplinary societies and academic institutions have created resources meant for doctoral students and postdoctoral associates. These resources can be used iteratively by early career academics and their mentors to assess career options and set goals. Learn more about IDPs from the [American Psychological Association](#) and the [University of California, Berkeley](#).

Graduate Career Consortium (GCC): Since 1987, the Graduate Career Consortium is a 400+ member organization of higher education professionals who work with graduate students and postdoctoral associates on issues related to career and professional development. Learn more about the [Graduate Career Consortium](#).

About the Data Source

The CGS PhD Career Pathways Project Fall 2018 Alumni Survey was distributed to doctoral degree recipients that were three, eight, or fifteen years out of their PhD in selected programs at participating institutions. Each of the universities administered the survey individually and shared the resulting data with CGS. This brief is based upon this aggregated data set, which includes 996 doctoral degree recipients in biological and life sciences fields (e.g. Anatomy & Cell Biology, Biochemistry, Biological Sciences, Botany, Genetics, Health & Medical Sciences, Microbiology, Nutrition & Food Studies, Pharmacology, Zoology) from 55 institutions. For this analysis, we focused on biological and life sciences PhD alumni who were employed as of October 1, 2018.

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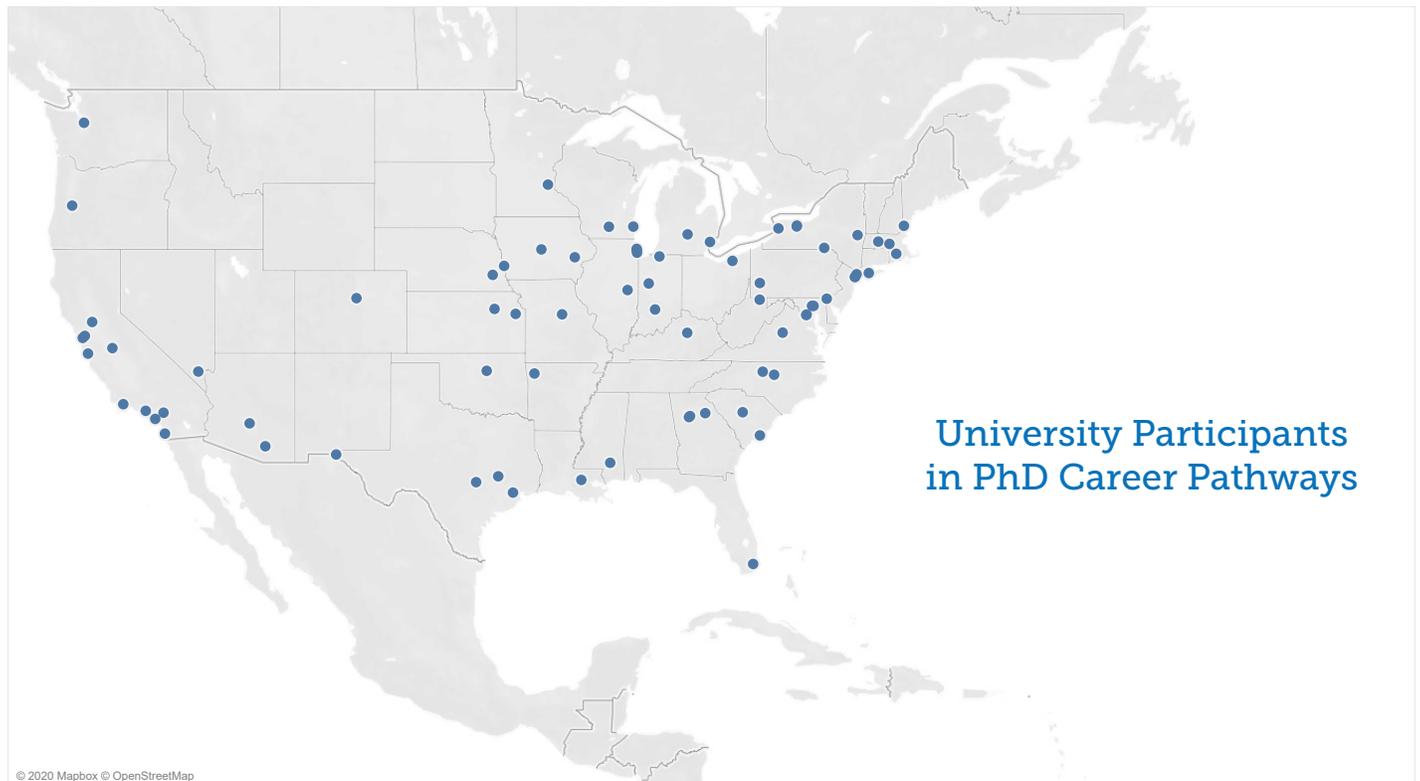
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The CGS PhD Career Pathways Coalition

CGS PhD Career Pathways is a coalition of 75 doctoral institutions working to better understand and support PhD careers across all broad fields of study. Over the course of the project, universities will continue collecting data from current PhD students and alumni using surveys that were developed by CGS in consultation with senior university leaders, funding agencies, disciplinary societies, researchers, and PhD students and alumni. The resulting data will allow universities to analyze PhD career preferences and outcomes at the program level and help faculty and university leaders strengthen career services, professional development opportunities, and mentoring.

About CGS

For over 50 years, the Council of Graduate Schools has been the only national organization dedicated solely to advancing master's and doctoral education and research. CGS members award 86.9% of all U.S. doctoral degrees and 59.8% of all U.S. master's degrees. CGS accomplishes its mission through advocacy, the development and dissemination of best practices, and innovative research.



The brief was prepared by Radomir Ray Mitic and Hironao Okahana. R.M. analyzed the data and prepared an initial draft. H.O. directed the underlying research activities and supervised the analysis for this work. Both authors discussed and contributed to the final brief. Janet Gao and Christian P.L. West contributed to the data cleaning and preparation. Suzanne T. Ortega, Enyu Zhou, Christian P.L. West, Janet Gao, Julia Kent, and Jeff Engler reviewed and commented on earlier drafts. Matthew Linton provided production support. This brief is based on work supported by grants from The Andrew W. Mellon Foundation (grant number 31600612) and the National Science Foundation (grant number 1661272). Any opinions, findings, and conclusions or recommendations expressed in this brief do not necessarily reflect the views of the funders.