

Enhancing career development of postdoctoral trainees: Act locally and beyond

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Abstract

The career development of postdoctoral trainees is enhanced by establishing career-enrichment programs and tracking outcomes not only at the institutional level but also locally within the training department.

Commentary Text

Postdoctoral fellows (postdocs) are an important engine that drives research programs and discoveries at universities and research institutions worldwide, and they make up a key element of the research workforce future. Therefore, postdoctoral career development and outcomes are critical aspects of postdoctoral training, an important topic covered extensively in several reports (e.g., Singer, 2004; McDowell, 2016; Blank, 2017; Sinche, 2016; Hitchcock, 2017; Pickett, 2018). The 2000 National Academy of Sciences, Engineering and Medicine (NASEM) report states the important principle that “the postdoctoral experience is first and foremost an apprenticeship whose purpose is to gain scientific, technical, and professional skills that advance the professional career of the postdoc” (<https://www.nap.edu/catalog/9831/enhancing-the-postdoctoral-experience-for-scientists-and-engineers-a-guide>). Extending their 2000 analysis, the 2014 NASEM report (<https://www.nap.edu/catalog/18982/the-postdoctoral-experience-revisited>) not only highlights some improvements in the postdoc experience, e.g., improved benefits and creation of postdoc offices in many institutions, but also emphasizes the continued need for better mentoring and career development.

Transitioning from a graduate student to an experienced postdoc comes with the benefit of having a higher stipend and moving one major step closer toward an independent professional position. A major fraction of graduate students in the life sciences proceed to a

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postdoc and yet, paradoxically, postdocs step onto a path that is less clear. For example, unlike doctoral students, most postdocs train without the equivalent of either a thesis committee or a dedicated departmental postdoctoral office that can serve as a second home for the trainee. Also, the postdocs experiences rely heavily on their research mentors, and opportunities to change primary mentors are rare. To address these challenges, herein we advocate for layers of career development opportunities, discuss their accessibility, and consider the competing interests of the postdoc's research training, career development, and the mentor's expectations. Based on the programs we have established at our institution, we posit that building career development opportunities at the level of the unit/department of the postdoc, coupled with broader institutional activities, can have a profound positive and rewarding impact for the postdoctoral trainees.

Concerns and issues with current postdoctoral training practices

Currently there are no universal career development guidelines that exist for the postdoc, the research mentor, the department or the institution. Practices tend to be unique to the lab, thereby leading to potential differences in training, mentorship, salary, and career development. Moreover, individual research mentors are best at training scientists in an academic setting yet only 10.6% of life sciences doctorate recipients in 2010 held tenure track appointments after 3-5 years of completing their doctorate (8.1% for doctorate recipients in 2015) (<https://www.nsf.gov/statistics/2018/nsb20181/assets/nsb20181.pdf>). There is no doubt that the benefits and resources available to postdocs have significantly improved during the last two decades. However, several issues remain including the lack of uniform term limits for postdoctoral training, and the funding pressures and regulatory burdens experienced in academia. The importance of terms limits for postdoctoral training and how to enhance promising academic and nonacademic scientific careers was highlighted as part of the need to confront and address the overarching disequilibrium challenge between the supply and demand of trained biomedical scientists (Alberts, 2014). To foster a breadth of careers, our Office of Graduate and Postdoctoral Studies has launched a Biotech Career Development Program (<https://innovation.medicine.umich.edu/biotech-career-development/>) that works with a select cohort of pre- and postdoctoral trainees and early-career scientists. This 4-month program involves attending workshops, seminars, and panel discussions to explore careers outside of academia. Participants then engage in an experiential learning opportunity, selecting from on-campus units, start-up or established companies, non-profit entities, government agencies, and law firms. As these junior academic scientists expand their sights and acquire transferable skills, the partner organizations gain access to a skilled biomedical workforce.

The recent 2018 NASEM report (<https://www.nap.edu/catalog/25008/the-next-generation-of-biomedical-and-behavioral-sciences-researchers-breaking>) makes extensive and specific recommendations to involved stakeholders, many relevant to postdocs, with a goal to promote success of the next generation of scientists. These recommendations include uniform data collection on outcomes, demographics and career aspirations; creating an ecosystem that fosters entrepreneurship; making stipend adjustment to account for inflation; promotion of diversity; providing institutional ombudspersons; limiting postdoctoral training to 5 years after which employment is shifted to a staff scientist or an early stage faculty position; providing the research mentors with formal training in postdoc mentoring; and

increasing fellowship numbers and career development awards and mechanisms to facilitate career guidance. Addressing the issues involved in improving the postdoctoral experience cannot be the sole responsibility of the research mentor. A more holistic approach is needed at the national, institutional and departmental levels to ensure future success of postdocs.

National and institutional postdoc career development programs

In the United States (US), the nonprofit National Postdoctoral Association (NPA) was founded in 2003 (<https://www.nationalpostdoc.org/>) and offers an engagement forum at the national level. The NPA advocates for postdoctoral scholars to master six core competencies: discipline-specific conceptual knowledge; research skill development; communication skills; professionalism; leadership and management skills; and responsible conduct of research. Many major US research-intensive universities nowadays have a postdoctoral office or association that provides postdoc-specific institutional information and resources. However, relatively few countries have postdoc associations with examples including Canada (<http://www.caps-acsp.ca/en/>), and several international institutions such as the European Molecular Biology Laboratory (https://www.embl.de/training/postdocs/12-postdoc_assoc/). While this commentary covers issues and recommendations that can be applicable to all postdocs regardless of the country where they are training, the discussion is based mostly on experiences with post docs in the US.

Here at the University of Michigan (UM), multiple groups collaborate to support postdoctoral trainees. The Rackham Graduate School and the UM Postdoctoral Association (UMPDA) (<https://umpda.rackham.umich.edu/about/members/>) coordinate and communicate a range of policies and services for postdocs in all 19 UM schools and colleges (<https://rackham.umich.edu/postdoctoral-fellows/>). This includes monthly orientations for new postdocs, an exit survey for all postdocs, biannual networking lunches, and an annual Postdoc Advisory Group meeting of deans and faculty who oversee postdoctoral training in their unit. The UMPDA organizes numerous activities and resources, including a regional symposium, coffee and happy hours, family events, housing information, and an *Outstanding Postdoctoral Fellow* awards program. In addition, postdoctoral offices at the Medical School (<https://ogps.med.umich.edu/post-docs/>) and College of Engineering (<https://mpace.engin.umich.edu/>) provide a wide range of resources and information. For example, the Medical School offers research development resources (including grant proposal development, funding sources, identifying research collaborators, Individual Development Plans (IDPs), and personalized career advice), career development resources (e.g., access to a wide range of national links; Table 1), counseling and support, as well as dispute resolution.

Across the US, an essential and increasingly appreciated role for an institutional postdoc office is to collect data for life science trainees, including demographics (gender, racial and ethnic background, citizenship), time as a postdoc, and career outcomes classified by job sector and career type (Bank, 2017; Pickett, 2017). Initiatives for institutional postdoctoral data collection are gaining traction, as exemplified by the Next Gen Life Sciences Coalition (<http://ngliscoalition.org/>). We advocate that such data collection, coupled with postdoc career development efforts, become embraced and commonplace internationally, which will drive improved outcomes in postdoctoral training.

The need for effective engagement of postdocs with career development resources

In our experience, active participation by postdocs, either within their research unit or through the university/school postdoc associations is variable but can be enhanced with targeted workshops, seminars and individual advising. Our medical school currently trains nearly 700 postdoctoral fellows, and the number of postdocs who expressed interest in one or more offering of career-related activities is nearly 500. Postdoc participation and the number and type of offerings have grown significantly during 2018. For example, nearly 50 unique workshops and seminars were held, with an average attendance of 15 postdocs per career development session. Feedback evaluations are routinely collected in order to improve the offerings desired by the postdocs. Examples of the breadth of presentation include: (i) *Faculty Corner* (presentations by select faculty that address academic challenges and preparation for job searching), (ii) Seminars by contents experts (topics cover careers in science publishing, time management, effective 'elevator pitches', technology transfer opportunities, what pharma companies are looking for), and (iii) Workshops (e.g., Think Like an Actor, Speak Like a Pro; Engage via Career Stories). In addition, one-on-one meetings related to career advising, curriculum vitae and cover letter review, and job interview preparation (30 minute appointments) is provided by two full-time staff. The recent growth in postdoc participation that we observed can be attributed to the expansion of communications that highlight upcoming career seminars and resources, coupled with improvements in the quality and relevance of the offerings. Aside from sending regular email announcements pertaining to career development opportunities to postdocs and faculty, social media tools (such as Twitter and Facebook, which is used by our graduate and postdoc office) can further reach the postdoc community given that they are becoming commonplace for all age groups, particularly ages 18-29 (<http://www.pewinternet.org/2018/03/01/social-media-use-in-2018/>). Full assessment of outcome measures, location and time of venues, and communication tools, while still in the early phases since the beginning of our expanded program in 2017, is essential to maximize success of the program.

Major barriers to postdoc engagement in career development programs include the understandable postdoc commitment to demanding research projects, coupled with concerns that activities that take time away from research might be perceived negatively by their mentors. Such demands could also interfere with work-life balance and limit the time available to enrich one's training with career development opportunities (Figure 1). Worse yet, such pressures could even interfere with career aspirations and lead to stagnation in a postdoc "treadmill" because of insufficient preparation for finding a permanent independent position (Bourne, 2013).

However, it is within the grasp of institutions and departments, research mentors, and trainees to harmonize the seemingly disparate demands of time and expectations with productive career-enrichment, professional skill building, and career-promoting exposures. One key beneficial but often underutilized skill is time management (Andrade, 2013), which includes working hard while working smart, among additional transferrable skills (Sinche, 2017). Other attributes that enhance the career success of postdocs include: setting goals and priorities; learning to multi-task; having passion for their research project(s); maximizing the likelihood for success by undertaking more than one project; being not only a doer but a finisher; openness to critique; being respectful and honest with others and with one's self;

and, serving not only as the mentee to their faculty research mentor but also as a mentor to other lab members such as graduate and undergraduate students (Omary, 2016). These attributes instill and solidify the support and trust of most postdoc research mentors. For research mentors who are wary of their postdocs dedicating necessary time to career development activities, institutional “mentoring the mentor” programs can have a positive impact on the postdoctoral training experience (Omary, 2008) and on the department culture. Notably, the US annual National Institutes of Health *Research Performance Progress Reports* now require reporting on “What opportunities for training and professional development did the project provide?” (<https://grants.nih.gov/grants/rppr/index.htm>). It would be instructive to consider approaches that would facilitate analyses of aggregated data for this component of the progress report, which has been in place since 2014 (<https://grants.nih.gov/grants/guide/notice-files/NOT-OD-14-113.html>).

Making the case for local postdoc career development to supplement institutional efforts

The career development of postdocs builds on foundational and essential support provided by the research mentor (Figure 2). In addition to the institutional resources discussed above, and the resources and networking opportunities provided by national postdoctoral association(s), scientific discipline-specific societies, and national and international scientific meetings, we advocate for active engagement of postdocs at the ‘local’ level of the research mentor home department or center/institute. One test case that has been highly successful in our institution is the establishment in 2009 of the Physiology Department Postdoctoral Club, which holds monthly career development meetings over lunch supported by department funds. The Club has a president and vice president (each serving 1-year terms, peer-selected by the postdocs) who organize the activities of the Club, including inviting internal and external speakers (some being postdoc alumni) to discuss career opportunities spanning academia, government, industry, nonprofit, and science communication, as well as their personal success stories. The Physiology Postdoc Club has now grown to include more than 50 postdocs, with 50-100% of the trainees attending the monthly meetings.

Four key improvements have been introduced by the Physiology Department during the past 10 years. *First* is the appointment of an outstanding faculty mentor to serve as the Department Postdoc Program Chair/Director, a role similar to a PhD graduate program chair. The Physiology Department was the first department in our medical school with a Postdoc Chair; there are now nine departments (basic and clinical) with this position. The departmental Postdoc Chair oversees a budget to support postdoc activities, receives department compensation for her/his time commitment, and leads annual individual meetings with every postdoc working with faculty who hold primary appointments in the department. In addition to independent review of their IDPs, these meetings have led to identification of co-mentors and career development resources not known to the postdocs. *Second*, the department expanded teaching opportunities for postdocs by establishing a physiology lab-based course directed to Master’s program and upper-level undergraduate students that is team-taught by the postdocs and overseen by a faculty member. The course combines lecture and laboratory components, and gives the postdocs an opportunity to develop a curriculum, teach, write and grade exams, and hold office hours in their area of expertise. This innovative course has been well-received by both the teaching postdocs and

the students enrolled in the class. *Third*, the department established an annual postdoc symposium that includes an external keynote speaker and features research presentations made by postdocs who have received department awards for scholarly, service or teaching accomplishments. In particular, the awards are given to both early stage (years 1 or 2) and later stage (years 3 or 4) postdocs. *Fourth*, the local postdoc meetings have grown to provide better appreciation for the available resources (e.g., techniques, instruments) and the ongoing research by different department faculty, which has fertilized new collaborations.

Inspired by the Physiology Postdoc Club and best practices in other departments, the Medical School has established a pilot program to create postdoctoral chairs in multiple basic science and clinical departments. The role of these postdoc chairs is analogous to a graduate program director, but acknowledges that postdocs are experienced scientists and require less oversight. The postdoc chairs are anticipated to serve as a local trusted guide and mentor, distinct from the research mentor. Having a postdoc chair position with departmental or institutional compensation explicitly values postdoctoral training as an important component of the department mission, entrusts a specific faculty member with the role of postdoc advocate, and creates a broad foundation of faculty allies for the postdoctoral community. Importantly, in this pilot phase, the postdoc chair is tasked with devising a system whereby each postdoc within the department will receive career development feedback annually. This differs from a graduate committee where students receive scientific guidance, and is rather intended as a brief check-in to ensure that postdocs receive career advice from several faculty and are directed towards useful resources.

It is important to emphasize that local and institutional career development are not mutually exclusive, but complementary. The advantages that a local program offers are numerous: a faculty overseer who champions postdoc career development; more direct knowledge of the postdocs and any in-house issues or politics; a sounding board and more visibility for the postdocs within the department; a somewhat smaller group with a shared discipline and likelihood to develop camaraderie and a home; an opportunity to engage alumni who may provide postdoc job opportunities; funneling of job and networking opportunities through the departmental Postdoc Chair; and establishing a culture that engages more postdocs in career development. Success of a department-specific postdoc group is highly dependent on having the necessary support (financial and administrative) from the department and its leadership. To maximize the benefit for the postdocs, leverage resources, and minimize redundancies, local departmental postdoc clubs need to work closely with the school and university postdoc offices.

Conclusion

We draw attention to the importance of institutional postdoc career development, particularly that provided by the local unit (department/institute/center) where the postdoc is being trained. Local units should be the hub for postdoctoral career development, mentoring and training. What is needed for the success of local postdoc career development is limited administrative and financial support, coupled with department buy-in, an organizational framework and the creativity of the postdocs to make it work. Local units should collaborate with university organizations, faculty, postdocs, administrators, and external entities to support the personal growth and professional development of each postdoc in preparation for a wide range of independent professional career opportunities. This paradigm can apply

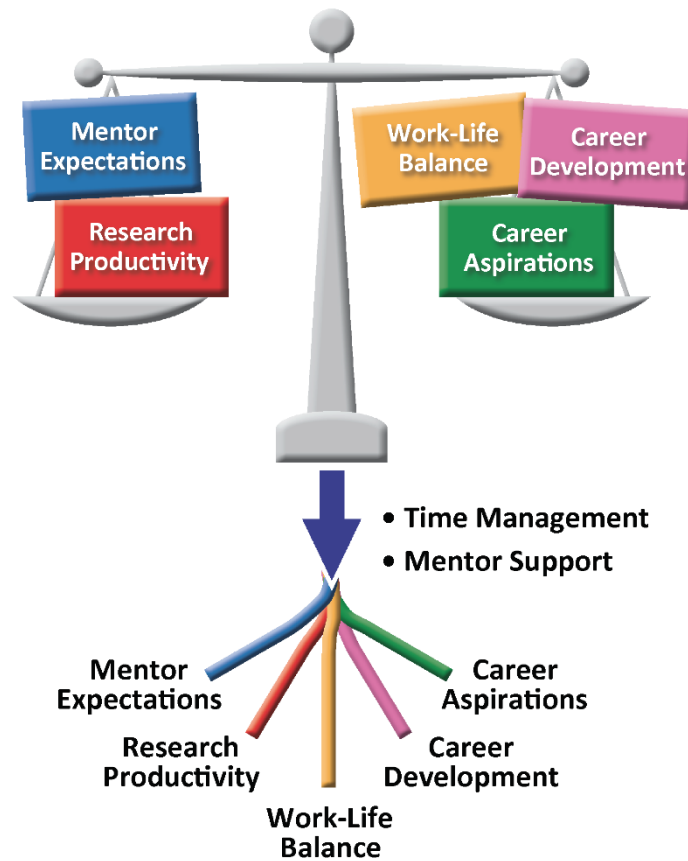
to any research institution that trains postdocs anywhere in the world. Broad dissemination of best practices and data collection benefit not only postdoctoral trainees, but also the research enterprise at large.

References:

- Alberts B, Kirschner MW, Tilghman S, Varmus H. 2014. Rescuing US Biomedical Research from its Systemic Flaws. *Proc Natl Acad Sci* **111**:5773-5777.
- Andrade FH. 2013. Time management in the busy professional environment: Take that first step. *Gastroenterology* **145**:36-38.
- Blank R, Daniels RJ, Gilliland G, Gutmann A, Hawgood S, Hrabowski FA, Pollack ME, Price V, Reif LR, Schlissel MS. 2017. A new data effort to inform career choices in biomedicine. *Science* **358**:1388-1389.
- Bourne HR. 2013. A fair deal for PhD students and postdocs. *eLife* **2**:e01139.
- Hitchcock P, Mathur A, Bennett J, Cameron P, Chow C, Clifford P, Duvoisin R, Feig A, Finneran K, Klotz DM, McGee R, O'Riordan M, Pfund C, Pickett C, Schwartz N, Street NE, Watkins E, Wiest J, Engelke D. 2017. The future of graduate and postdoctoral training in the biosciences. *eLife* **6**:e32715.
- McDowell GS, Gunsalus KT, MacKellar DC, Mazzilli SA, Pai VP, Goodwin PR, Walsh EM, Robinson-Mosher A, Bowman TA, Kraemer J, Erb ML, Schoenfeld E, Shokri L, Jackson JD, Islam A, Mattozzi MD, Krukenberg KA, Polka JK. 2015. Shaping the Future of Research: a perspective from junior scientists. *F1000Res* **3**:291.
- Omary MB. 2008. Mentoring the mentor: Another tool to enhance mentorship. *Gastroenterology* **135**:13-16.
- Omary MB. 2016. Mentoring: A necessary but not sufficient ingredient for enhancing success. *Gastroenterology* **150**:1067-1070.
- Pickett CL, Tilghman S. 2018. Becoming more transparent: Collecting and presenting data on biomedical Ph.D. alumni. *PeerJ Preprints* **6**:e3370v2.
- Sinche M. Next Gen PhD: A guide to career paths in science. Cambridge, MA: Harvard University Press; 2016.
- Sinche M, Layton RL, Brandt PD, O'Connell AB, Hall JD, Freeman AM, Harrell JR, Cook JG, Brennwald PJ. 2017. An evidence-based evaluation of transferrable skills and job satisfaction for science PhDs. *PLoS One* **12**:e0185023.
- Singer M. 2004. The evolution of postdocs. *Science* **306**:232.

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Figure 1: Harmonizing research productivity and mentor expectations with career development, career aspiration, and work-life balance. Research productivity and mentor expectations can at times oppose work-life balance, being engaged in career development opportunities, and pursuing career aspirations. These seemingly at odds aspects can be harmonized by effective time management and mentor support.



Author

Figure 2: Local postdoc support provides proximal and effective access to meaningful career development opportunities. Postdoc career development starts with the research mentor but can be significantly bolstered by the engagement of local support mechanisms that we term the “L Factor.” Additional networking and resources can be made available at the level of the school or university where the postdoctoral training is carried out, in addition to national postdoctoral association(s), discipline-specific organizations, and national and international meetings and symposia.

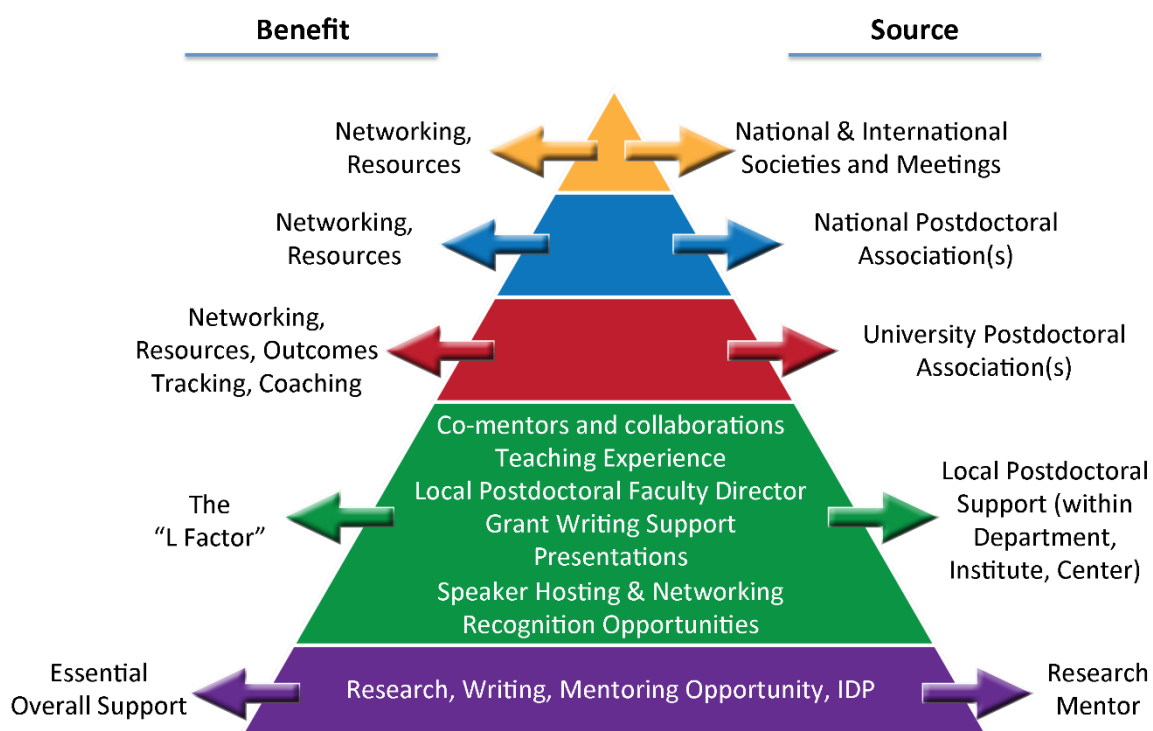


Table 1: Postdoc open access resources

Resource	Link
Science Careers	https://jobs.sciencecareers.org/?_ga=1.155765947.1469154522.1409920411
Nature Jobs	https://www.nature.com/naturecareers/
Minority Postdoc	http://minoritypostdoc.org/
The Versatile PhD	https://versatilephd.com/
Pathways to Science	https://www.pathwaystoscience.org/Postdocs_portal.aspx
Making the Right Moves	https://www.hhmi.org/developing-scientists/making-right-moves