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Professional societies can play a vital role in career development

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ABSTRACT

Ph.D.s in the life sciences are seeking nonacademic careers in large numbers, and private sector employment is reaching an all-time high. In this climate, trainees are seeking mentors and opportunities to understand and explore different career paths. Scientific societies such as the Society for Developmental Biology play vital roles in professional development to support members at all stages of their careers and promote a range of employment opportunities. To this end, the Professional Development and Education Committee of the society offers full day workshops and sessions at regional and annual meetings that support constituents throughout their careers. For example, a new GetHIREd! workshop the day before the 2019 annual society meeting was developed as an interactive job skills workshop for postdoctoral fellows to gain insights into the job application process. The committee also aims to advocate for innovative approaches to teaching and science literacy in both the classroom and through outreach activities. The activities offered by scientific societies can reach a broader audience than individual institutions, and have lasting impacts in the quality of their members' careers by augmenting professional development opportunities.

1. Introduction

An academic job is no longer a conventional career for a Ph.D. holder. In 1997, more than half of Ph.D.s in the life sciences worked in educational institutions, but academic employment has steadily dropped to 43% in 2017 (Langin, 2019). In biomedical fields in the United States, only 10% of Ph.D.s are expected to hold tenure-track positions five years after receiving their degrees, which paints a foreboding picture of the academic job market (Blank et al., 2017; Biomedical Workforce Working Group, 2012). In contrast, private sector employment has grown to where the proportion of Ph.D.s working in the private sector has reached an all-time high of 42% in 2017, now matching the academic employment numbers (Blank et al., 2017). This shift in the job market is well reflected in career prospects of newly minted Ph.D. recipients. The National Science Foundation's Survey of Earned Doctorates revealed that the proportion of Ph.D.s who accepted job offers other than postdoctoral positions has increased from 21.4% in 2012 to 26.1% in 2017 (National Science Foundation, 2018). The same survey also revealed that more than a third of Ph.D. holders had no definite post-graduation plans.

Graduate programs have heeded the changing trend in the career paths of Ph.D. recipients and started to provide their students with skill

sets for and experiences in fields outside of academic research. For instance, numerous Ph.D. programs organize panel discussions and invite their alumni pursuing non-academic careers, such as in patent law and science policy, to share their experiences. A small number of universities provide additional career-development support, including organizing group tours at local companies and encourage graduate students to do summer internships (Dorn, 2019). Granting agencies have also recognized the need to prepare students for careers in and outside of academics. The National Institutes of Health's Broadening Experiences in Scientific Training (BEST) program provided 5 years of funding to awardee institutions for career-development offerings to prepare trainees for diverse careers in biomedicine (Beans, 2018). Despite these efforts, graduate programs face various challenges in organizing events and training for non-academic careers, such as the need for broad faculty support and limited financial resources. Thus, the current efforts reach a limited number of trainees. Many Ph.D. recipients remain unsure how to make career choices that best fit their talents and needs (Beans, 2018).

The mismatch between students' growing interest in nontraditional career choices and limited support by degree-granting institutions could be mediated by professional societies. Several scientific societies offer a variety of professional development offerings for their members. The

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Federation of American Societies for Experimental Biology (FASEB) has its own career center and provides on-site career services. Other societies, such as The American Society for Cell Biology (ASCB) and the American Society for Biochemistry and Molecular Biology (ASBMB) organize webinars regarding nonacademic careers, mini courses in biotech and post career blogs for their members. The offerings between societies are diverse and have the advantage of reaching broader audiences, taking the pressure to provide these services off of individual institutions.

The existence of a group promoting professional development at the Society for Developmental Biology (SDB) can be traced back to a group of women scientists who wanted to provide a supportive atmosphere for each other within SDB and to de-gender the vocabulary, types of questions and interpretations drawn from experiments in developmental biology. This group, the Women’s Caucus was active as early as the 1960’s, publishing a pamphlet in 1976 called *Sexisms Satirized*, and the group advocated and fought for policy changes in funding (Gilbert and Rader, 2001).

The current Professional Development and Education Committee (PDEC) of SDB plays an active role in providing support to its members at different levels in their careers and reaches audiences at both the national and regional levels (Fig. 1). The mission of PDEC includes nurturing the professional development of SDB membership and promoting the range of employment opportunities available at all career stages. The PDEC chair sits *ex officio* on the Board of Directors, thus integrating PDEC activities with the annual national and regional meetings and being visible in all activities within the society. In support of education, and promoting the field of developmental biology, PDEC bestows teaching awards, organizes symposia and workshops, and confers education grants for developing innovative pedagogy and outreach programs. Facilitating teaching and learning about developmental biology through outreach activities is another central mission of PDEC. In addition to direct contributions to events such as the USA Science and Engineering Festival, regional meetings hold sessions on how to effectively organize and execute outreach activities.

SDB through PDEC also offers full day workshops in support of professional development on the day prior to the annual meeting. A bootcamp for new faculty has been offered on even-numbered years since 2006, and its aim is to guide new faculty with tips on grant-writing, mentoring lab members, designing curricula, and communicating science to name a few. A re-bootcamp offers inspiration to midcareer faculty. Recognizing the need to reach and support trainees as they enter the job market, PDEC developed and offered the first GetHIRED! full day workshop in 2019. Here we describe our new offering (the GetHIRED! boot camp for trainees) and the education symposium organized at annual SDB meetings, all designed to guide and support trainees as they

make their career choices.

2. GetHIRED!

GetHIRED! was developed as an interactive job skills workshop for postdoctoral fellows to gain insight into the job application process, from decoding job ads to contract negotiations (Fig. 2). Hosted for the first time at the 2019 annual SDB meeting and co-sponsored by the Harvard Department of Stem Cell and Regenerative Biology, the goals for the workshop included ensuring that prospective applicants recognized different types of academic institutions and walked away with feedback on one section of the job application – their teaching statements.

The workshop was divided into four sessions throughout the day, with 5 contributing facilitators and 25 attendees from institutions across 10 states and 5 countries. Sessions included: 1) How to read a job ad; 2) How to develop a teaching philosophy and edit your teaching statement; 3) Developing a great chalk talk; and 4) Negotiating a contract. Each session had an interactive component meant to demonstrate active learning and stimulate discussion. Multiple perspectives were shared from the facilitators that included an instructional designer, two faculty from research-centered institutions, and two faculty from primarily undergraduate institutions (PUI).

To help trainees navigate the job market, current job ads were displayed and facilitators led a discussion of how to decode the ads. Ads were chosen that represented the range of available positions in academia, including from PUIs that emphasize instruction, research institutions with information on general research areas and potential areas for collaboration, and clinical research in professional school settings. Participants reviewed the ads in small groups and were directed to focus on the themes presented in each: teaching, research, and potential job expectations. Through the decoding of job ads, participants not only became aware of the diversity of institutional types and available positions at institutions, but also gained an appreciation for the different

GetHIRED!

- H**one your soft skills for the interview
- I**lluminate your strengths
- R**ole play negotiations
- E**dit your teaching statement
- D**evelop a lean and mean chalk talk

Fig. 2. GetHIRED! was developed by PDEC to assist SDB postdoctoral fellows in preparing to enter the job market.

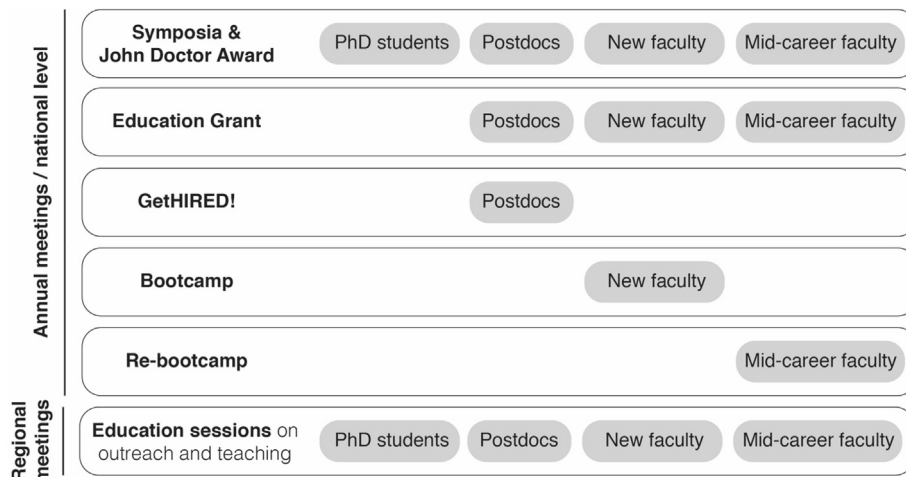


Fig. 1. The PDEC is responsible for diverse offerings to SDB members at all levels of their careers, at regional meetings and the annual conference.

expectations each type of institutions and position had of their faculty.

An important goal of the workshop was to send participants off with tangible feedback to a specific piece of their job packet. One of the hardest parts of the job application for trainees to write is the teaching statement. Postdoctoral fellows rarely have teaching opportunities, and thus writing a statement of teaching philosophy becomes an awkward stretch for the candidate. In an activity-heavy session, participants learned about uncovering misunderstandings and the value of teaching for the transfer of information, as opposed to the more common content-driven lecturing. Analogies were made between classroom teaching and mentoring graduate students in a research lab, showing the parallels of how these skills can be applied equally to both environments. Once the essential understandings of teaching and mentoring were realized and discussed, participants exchanged their teaching statements (attendees were required to submit drafts of their teaching statements prior to the workshop), and provided each other feedback in groups of three. Thus, at the end of this session everyone had a clearer sense of what a teaching philosophy was and how to develop their own philosophy based on their individual experiences in addition to suggested revisions to their teaching statements from multiple people.

While the first two sessions of the workshop focused on preparing to apply to different positions, the second half of the workshop was dedicated to the interview and selection stages of the experience. An important yet mystical part of a campus interview is the chalk talk. Expectations of the chalk talk vary widely depending on the type of institution and position. In an effort to impress upon the participants the importance of knowing their audience, how the chalk talk may be applied in various settings was discussed in the context of different types of academic institutions. For example, at a teaching-focused PUI candidates could use an active teaching style in their chalk talk to demonstrate their understanding of best practices in pedagogy and how they plan to use proven strategies in their classrooms. Examining a department and school's teaching needs and culture is required to determine how a candidate fits within the current curriculum and can contribute more broadly to the institution as a whole. Being aware of the target audience and demonstrating an understanding of active engagement is also important at the non-PUI. At research-intensive institutions, audience members may be of different stages in their training and from a broad range of disciplines. Thus, some of the skills reviewed in the teaching session may be applied to describe a research plan with immediate and long-term goals, plans for independence, general infrastructure needs, model organism considerations (such as shared housing opportunities, proximity to the lab, costs, etc.), specific equipment needs and access to core facilities (facility types, costs, etc.), and anticipated funding sources.

The final session was a thoughtful view into what happens once the candidate has received an offer, and how to approach negotiations. This conversation was led by a current department Chair with extensive hiring experience. Participants were eager to learn both the logistical aspects such as who one negotiates with and what items are negotiable, and the soft skills needed to understand when and how much to push in the process. Highlighted was also how to be cognizant of the challenges during negotiations from the candidate's and institutional perspectives. Significantly, this session brought to light the importance of being up front and honest in the negotiation process.

The overall theme of the workshop was to assist participants in preparing for seeking an academic position. Emphasizing the importance of ground work and communication, PDEC aimed to prepare SDB postdocs to be competitive in a challenging job market. Based on survey results, it was noted that participants appreciated the interactive nature of the workshop, the facilitators involved, and the variety of topics presented. Areas to develop in the future include more time for additional feedback on other parts of individual application materials, mock chalk talks, and practice negotiation sessions. Thus, opportunities exist to expand and enhance the workshop by tailoring the day to include breakout sessions for research versus teaching specific interests and participant practice sessions (chalk talks, negotiation) as desired. Half of participants

reported that similar workshops were not available at their home institutions, and all said they would recommend the workshop to their friends preparing to enter the job market, speaking to the importance of these experiences and the need to continue this service to SDB members in the future.

3. Education grants and awards

In addition to the workshops that support members at different levels of their careers, the society works to help its members meet the call for changes in science education and the growing interest in science literacy. SDB supports science education by funding creative education programs. Members have received the SDB education grant in support of proposals ranging from courses such as the Embryology Course at the Marine Biological Laboratory (Woods Hole, MA) and the Developmental Biology Teaching Workshop (Darling Marine Center, ME), to outreach programs such as BioEYES (Shuda et al., 2016). Since its initiation, BioEYES has grown to over ten sites across the globe in three countries, and is a success story of how a developmental model organism the zebrafish can be used in outreach. To help professionalize teaching, SDB also has awarded outstanding education research posters and the John Doctor Award for educational videos at the annual meeting. These activities are brought to the fore at regional meetings with education sessions and the annual meeting with education symposia.

4. Professional development symposium

The annual meeting of a professional society is an excellent venue in which professional development seminars and consultations may take place. Networking with people from different institutions but with similar career interests is possible, and PhD trainees can easily attend the career events outside their daily lab schedules or supervisors' permission. SDB dedicates 2 h in its annual meeting for the symposium, which covers a broad range of topics outside of academic research, such as inquiry-based learning, education research, and mentorship as examples.

In 2018, the symposium took the form of a panel discussion, and professionals, who are developmental biologists by training and currently working in the fields of science communication, science outreach, biotech, and publishing were invited to speak. Compared with previous symposia, this panel discussion had the biggest audience (18% of the annual meeting attendees), which suggests the heightened interest of SDB members in non-academic careers. Few people who came to the event looked for specific information; the majority of the attendees were curious about various employment opportunities outside of academia as well as the best way to make a transition out of academia. The audience expressed concerns about the stigma associated with non-academic jobs and the lack of relevant skills and experience. A small but notable portion of the audience was comprised of research supervisors, who were as unacquainted with non-academic career paths as their trainees, and wanted to learn how to provide better guidance to lab members. In fact, *Nature's* survey conducted in 2017 revealed that only 30% of the Ph.D. students agreed or strongly agreed that they received useful advice regarding careers outside of academia from their supervisors (Woolston, 2017). The speakers of the symposium detailed their journeys to their current jobs, including fellowship opportunities, transferable skills and best/worst advice they had received. After the symposium, research supervisors commented that they obtained tips for mentoring their students and would consider giving "opportunities for trainees to engage with their interests." What resonated with the audience the most was speakers' satisfaction with their work. One of the attendees mentioned, "They look happy with their choice outside of academia." This remark encapsulates the benefit of such event; it not only demystifies the non-academic careers, but also introduces them as fulfilling and valuable career options.

5. Final thoughts

A range of jobs available for PhD recipients in life science is expanding. In academia, different types of institutions have different expectations for their faculty in research and teaching. Outside of academia, private sector has become an attractive workplace and new jobs keep emerging especially in interdisciplinary fields. Professional development programs for trainees, therefore, is more important than ever and we believe that scientific societies can play a vital role in helping their members learn about and explore a broader spectrum of employment opportunities. Tapping into the diversity of their memberships, professional societies can organize workshops to target members at different levels of their careers. Sessions at regional and annual meetings can expose constituents to new skills and networks. Moreover, the impact of professional development activities organized by scientific societies could go beyond trainees since the programs could support research mentors and ease the resources on institutions. Professional societies in science have been crucial in advancing research in their disciplines and it is time to allocate their institutional knowledge and resources to advance their members' careers as well.

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References

- Beans, C., 2018. Biology graduate programs educating students for life beyond academia: broadening horizons for young scientists. *Bioscience* 68 (2), 53–59.
- Biomedical Workforce Working Group Report, 2012. In: Health NIO. National Institutes of Health, Bethesda, MD.
- Blank, R., Daniels, R.J., Gilliland, G., Gutmann, A., Hawgood, S., Hrabowski, F.A., et al., 2017. A new data effort to inform career choices in biomedicine. *Science* 358 (6369), 1388–1389.
- Dorn, C., 2019. Ph.D. outcomes - one university at a time. *ASBMB Today* 18 (7), 58–61.
- Gilbert, S.F., Rader, K.A., 2001. Revisiting women, gender, and feminism in developmental biology. In: Creager, A.N.H., Lunbeck, E., Schiebinger, L.L. (Eds.), *Feminism in Twentieth-Century Science, Technology, and Medicine*. The University of Chicago Press, Chicago, pp. 73–97.
- Langin, K., 2019. In a first, U.S. private sector employs nearly as many Ph.D.s as schools do. *Science*. <https://doi.org/10.1126/science.caredit.aax3138> [Internet].
- National Science Foundation, National Center for Science and Engineering Statistics, 2018. Doctorate Recipients from U.S. Universities: 2017. Special Report NSF 19-301, Alexandria, VA. Available at: <https://ncses.nsf.gov/pubs/nsf19301/>.
- Shuda, J.R., Butler, V.G., Vary, R., Farber, S., 2016. Project BioEYES: accessible student-driven science for K-12 students and teachers. *PLoS Biol.* 14 (11), e2000520.
- Woolston, C., 2017. Graduate survey: a love-hurt relationship. *Nature* 550, 549–552.