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CAREER ADVICE

Strategic career building during your PhD: a timeline for maximizing your opportunities

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Abstract

PhD training can be incredibly versatile, leading to many downstream careers. There is potential to gain training to help you enter any of these careers after graduation. However, it is often only in retrospect that the options and optimal strategies become clear. Here we provide a strategic framework to empower PhD researchers to build and expand their career options in a method compatible with tomorrow's career ecosystem. The strategic framework encourages early career researchers to take a self-directed approach to establish flexible career goals, diversify exposures and build professional networks. Researchers increase their chances of success by building early markers of multiple career pathways into their PhD program. The framework emphasizes self-direction, adaptability and resilience, enabling early career researchers to embrace new opportunities and to navigate uncertainties. This structured approach empowers PhD researchers to maximize their opportunities, positioning them for long-term success in the various career options within and beyond academia.

A PhD in biomedical sciences offers a pathway to advance knowledge and to contribute to scientific research. However, in today's competitive job market, it is crucial for PhD researchers to consider their long-term career options beyond academia. Graduates can pursue industry research and development, science policy, medical writing, entrepreneurship, and more. Recognizing these possibilities is vital for PhD researchers to make informed decisions and shape their professional journey.

PhD researchers face a unique set of challenges and opportunities in career development. While their primary focus is on conducting research and contributing to knowledge in their field, they must also consider their long-term career prospects in a competitive job market. For previous cohorts of PhD researchers, there was an expectation that graduates will pursue academic careers as independent researchers and educators. While this path remains a viable option, the reality is that academic positions are limited and competitive. As a result, PhD researchers need to explore alternative career paths beyond academia.

There is a common perception within academia that a PhD program primarily equips trainees with specialized knowledge and technical skills. While these skills are important, and often the place where graduates can most readily perceive their knowledge gain over the duration of the program, they do not form the foundation of PhD training. The key transformation that occurs in graduates is independent of these discipline-specific skills, and forms the basis for the versatility and adaptability of PhD graduates in the workplace: independence, project management, evidence-assessment, self-directed learning, problem-solving ability, communication and leadership. Employers highly value these transferable skills, both within academia and beyond. PhD researchers must recognize the need to develop these broader skill sets to excel in diverse career paths. The choice can be overwhelming, and the lack of hard deadlines can make it easy to put off these training decisions indefinitely.

Surrounded by academic role-models, PhD researchers often need more guidance regarding non-academic career

options. Many early career researchers may need to be made aware of the range of opportunities available to them in industries, government agencies, non-profit organizations and entrepreneurial ventures. While this provides a challenge, PhD researchers also have unique opportunities for career development. They can access many resources within their academic institutions, including career services, professional development workshops and mentorship programs. PhD programs often provide opportunities for collaboration with industry partners, internships and teaching experiences, which can enhance trainees' skills and expose them to different career paths. Professional societies also serve as a high-quality source of career development opportunities, including workshops, networking and training, and often funding for attending external events.

Here we suggest a strategic framework and timelines for empowering PhD researchers to control their career development. These guidelines are a flexible framework that should be molded to individual circumstances. They ensure that early career researchers are proactive in shaping their professional journey, maximizing their potential, and positioning themselves for long-term success in a variety of career options both within and beyond academia. While intended for the PhD researcher as a personal driver, aspects of these guidelines can be built into the personal mentorship program offered by supervisors. We also advocate for the inclusion into formal PhD programs of a structured method to expand career options during a PhD.

DESIRED OUTCOMES

The professional career structure for scientists has changed markedly over the past decades, and is now characterized by a plethora of opportunities and a shortage of stability. Thus, while unemployment among biomedical PhD holders is close to zero, the uncertainty in this career structure can drive anxiety. To forge a successful career in this ecosystem, PhD researchers must take early control over their career development. At each career point, PhD trainees and graduates can strategically build up options for their next career, providing them with the versatility and control to seize opportunities.

Underlying the success of biomedical PhD researchers are the core attributes taught in PhD training – self-confidence in the ability to learn, an exceptional capacity for quality assessment of evidence, a trained proficiency for self-reflection and course correction, experience in professional communication, and a fearlessness at taking on projects with a long horizon. These skills gained through a PhD make biomedical PhD graduates highly sought after across various industries. However, for individual PhD holders, career opportunities come from the "optional extras" that distinguish their PhD from that of other applicants. In an academic career trajectory, these extras come in the form of research outputs and technical skills. In contrast, for non-academic careers, the extras come in the form of added training and familiarity with those career pathways.

The defining signature of successful post-PhD careers is the ability of the applicant to present evidence for a conscious decision to enter that pathway. Applications (cover letters and CVs) that can articulate that the applied job was a long-term ambition of the applicant will show higher levels of success than applications that appear to be a "Plan B". These "Plan B" applications are particularly obvious among applicants originally planning an academic career who diverted into a non-academic pathway with little early preparation. Signatures of these unsuccessful applications include a focus on academic markers (for example, listing PCR technical skills in a job application for an office job), neglect of industry-specific markers (for example, not using the word "compliance" in a job application in the pharmaceutical industry), and an absence of early (pre-graduation) evidence that the applicant intended to go towards this industry (for example, the absence of any public communication experience in a journalism job application). Employers rightfully prioritize applicants who show evidence that they are applying for their "Plan A" career over applicants who barely conceal the "Plan B" status.

Our guidelines for PhD career development are therefore centered on the following axiom: PhD researchers should build up a credible record of interest markers throughout the course of their studies for a "Plan A", a "Plan B" and a "Plan C" career pathway. We emphasize that this does not involve the time commitment needed for full training in each career. The key is to have the ability to seed a future cover letter and CV with Plan A, B or C "markers" that can be used to signify advanced foresight and interest in the career pathway. Small markers, each requiring minimal time investment, can disproportionately increase the applicant's ability to tell a narrative in their job application (see Figure 1). The applicant's ability to weave a convincing theme throughout their application sets apart successful applications from generic ones.

A TIMELINE OF STRATEGIC CAREER BUILDING

In this framework for career opportunity building, we see four key stages corresponding to each of the 4 years of a standard PhD program (Box 1). At each stage, we suggest that PhD researchers deliberately plan their approach to training and career development.

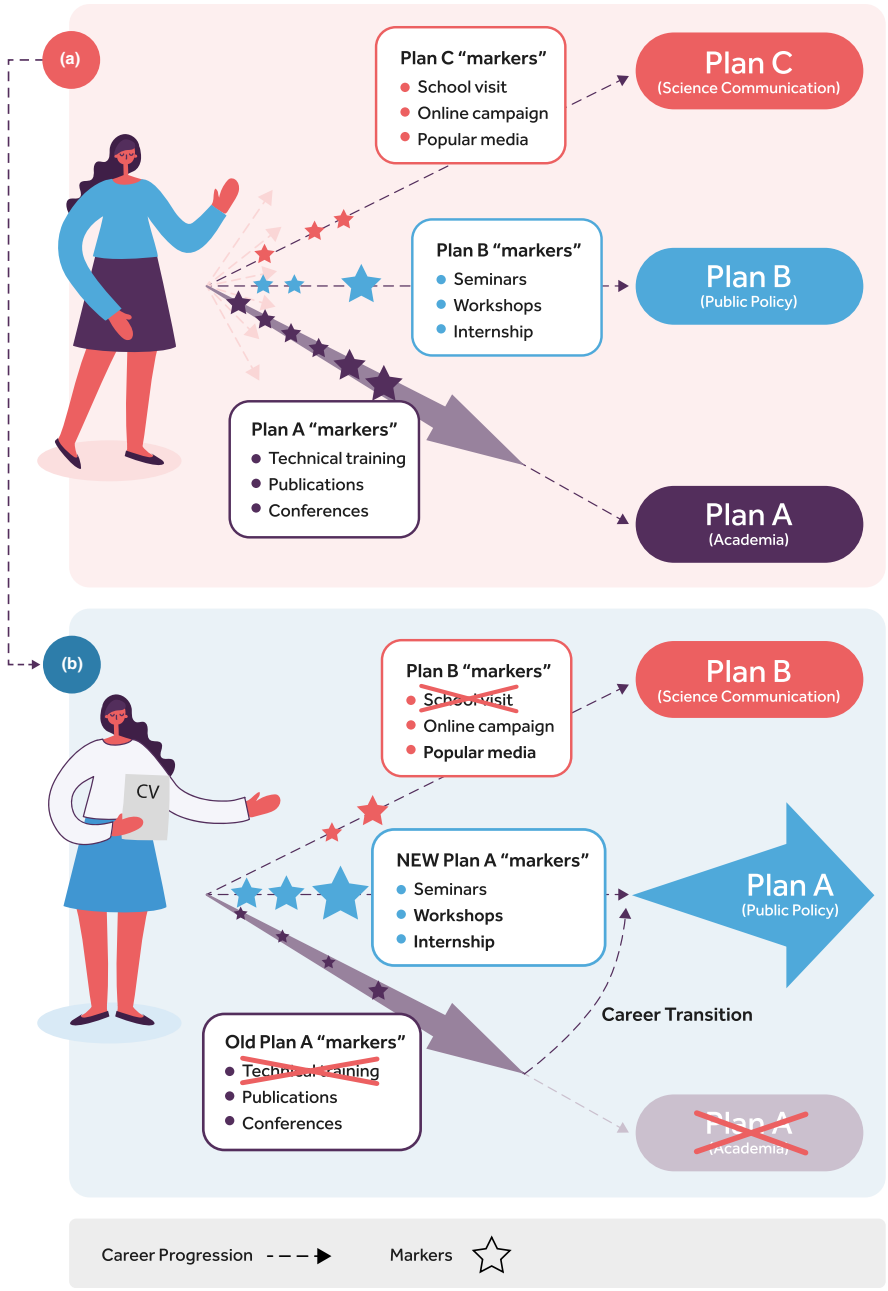

Figure 1. Parallel career options in practice. **(a)** Sam is a PhD trainee who aims for a career in academic research ("Plan A"). She lightly explored a few alternative career pathways, before deciding she was also interested in public policy ("Plan B") and science communication ("Plan C"). Sam developed early markers of interest in "Plan B", such as attending policy seminars or workshops, and early markers of interest in "Plan C", with a school visit and developing a popular media communication program. In her final year, Sam did a brief internship in the policy sector. At the end of this, Sam decided she would rather pursue a public policy career than an academic research career. **(b)** To transition to a public policy career, Sam completely rewrites her CV, from the new perspective that her original Plan B was always her Plan A. On her CV, she removes the technical aspects of her training that were so central to her original plan, and de-emphasizes other markers not relevant to the job. By contrast, she emphasizes the early markers of interest in public policy, and looking back over her list of training/skills, she brings in some of the science communication markers that could be re-purposed as public policy markers. "CV Sam" looks very different from "reality Sam", with her rewritten personal history making it look as if public policy was always her "Plan A" rather than a last-minute detour! Small anecdotes can lead off a cover letter: "Early on in my PhD on immunology, I read a book by Ben Goldacre on evidence-based medicine. This was a pivotal development for me, as it illustrated the importance of good clinical trials policy to ensure that the best drugs reach patients. I followed this up with a short workshop on health economics, and. . ..".

Box 1. Timeframes and a PhD

- The timeframes presented here are for a 4-year PhD program. While there is a large diversity of PhD durations and different programs, it is helpful to outline an example structure. PhD trainees and mentors should tailor these different stages to fit the duration and structures of their own programs and circumstances.
- For early career researchers in shorter programs, prioritize key milestones and align research projects with career goals. PhD researchers in more extended programs can explore additional skill development and career exploration opportunities while maintaining research progress.
- Regardless of program length, the core principles of the strategic framework remain applicable. Early career researchers should establish career goals, diversify their skill sets, engage in self-assessment, build professional networks and remain adaptable.

In the first year of your PhD, you should concentrate on your research and the training you need to run your research effectively. This will include basic health and safety courses and PhD-specific courses on using high-end machines or techniques. We also suggest introductory courses in R and biostatistics, which can be a foundation for more advanced work in later years and have broad utility across multiple careers. Start keeping a spreadsheet of all the training courses you do. Include the "who, what, when, where, why" for each course and a list of seminars you attend, with date, person, title and seminar program name. This seems like trivial information at this stage, but at the end of your PhD, this can become pivotal information to make your cover letter and CV stand out for a particular job. Even basic items such as liquid nitrogen safety training and scientific writing courses can be used as examples of intent at later stages.

At the start of the second year of your PhD, you should start toying with the idea of career pathways. You should not be deciding at this stage! Instead, the intent is, by the end of the second year, to come up with a "top three" that will constitute your "Plan A", "Plan B" and "Plan C". This means having an open mind about potential avenues and dipping your toes into many ponds. You will have limited time for courses and career-building activities, so do not over-commit to any individual career options. At this stage, it is better to have 10 1-h commitments, across a breadth of career pathways, than one 10-h commitment in a single pathway. Take advantage of university networking events, workshops, seminars, online activities, career days, etc. You must look outside your lab and immediate environment to encounter different career pathways

Box 2. Examples of career development opportunities beyond academia

By no means a comprehensive list, we suggest that biomedical PhDs can have successful professional careers in the following areas:

- Education across the sector
- Entrepreneurism, in particular, biotech start-ups
- Public service, in particular regulation, funding bodies, science policy and public health
- Science administration, in particular grant writing, grant administration, laboratory management
- Law, in particular, patent law in biomedicine
- Public engagement and science communication
- Professional, scientific writing and journalism
- The charitable sector, in particular, patient advocacy and medical bodies
- The pharmaceutical industry, across the sector from research to sales
- The biotech sector, including product development and troubleshooting
- The health sector, such as diagnostics
- Information technology, data science and analytics
- Finance, in particular, venture-capital
- Private consultancy across any of the above

(Box 2). As in the first year, good record-keeping is necessary, as it allows you to retrospectively fit these exposures into your final narrative.

By the start of the third year of your PhD, you should have a good idea of your "Plan A", "Plan B" and "Plan C" career pathways. Discuss these ideas broadly and bring your supervisor into the discussion. A good mentor–mentee relationship can allow these parallel pathways to start to get built into the experience. We acknowledge, however, that for many PhD trainees, such a positive mentorship partnership will not exist, especially in cases where "Plan A" is not an academic career. In those situations, we advise PhD researchers to reach out more broadly to identify mentors relevant to their sector. Many professionals outside academia will be happy to have a mentoring role if it is clear upfront that time commitments are limited. At this stage, career development activities should become more focused, and you should be diligent about not wasting time on side projects. For example, do not get roped into a lot of time in public engagement if it is not one of your desired career pathways. Spending an average of 1 h per week on career development during this year will allow you to accumulate multiple markers of interest in these three career pathways, ideally a mix of low-commitment (seminars) and high-commitment (workshops, multi-day training courses) markers. If you consistently find one set

of events boring, that is helpful information – the career may be less appealing to you than you initially thought and can be replaced by other topics you find surprisingly rewarding. These events can be through your university or through online events, but, where possible, prioritize free in-person events. If a particular career path is a passion and currently unavailable locally, consider starting it up yourself. For example, "Green Labs" programs are highly supported at many universities if an ambitious PhD researcher or post-doc takes the initiative to start it up. Related to this, remember to record any examples of your leadership experience, such as starting or spearheading initiatives, taking the lead on organizing and maintaining collaborations, chairing a committee or student society. These examples of leadership are often very useful during interviews, and it is difficult to remember examples in a high-pressure situation if you haven't recorded and prepared.

In the final year of your PhD, these exposures have hopefully strengthened your desire to build a future career along one of these pathways. At this point, you should choose which of your plans will be the "Plan A" after graduation. Don't worry; this is not a forever commitment! It is simply a decision on where to focus your first application and first position, and it is not unusual for professionals to have careers that circulate between different points of interest. Investing an average of 2 h per week towards career development at this stage is a reasonable balance between your future career and your need for a successful PhD. Some of these hours will need to be committed to early planning – spending a few days at the start of the year looking for courses and conferences ensures that you can invest that time well later in the year. At this stage in your PhD, national and international travel is expected to present your research – this can often be dovetailed with your career development activities. For example, a conference that is more biotech- or policy-focused can be selected to present your research or a conference location can enable you to also visit a center of excellence on your career development front. Many programs allow short internships to provide deep exposure. Make sure to fully commit to your career development during this time! Do not work on your thesis during your internship – it is a wasted opportunity that makes you look uncommitted to a future reference or potential employer. At this stage, you should not only build up your markers of interest in your chosen career path but also build up your network. Make sure to meet people at events, take names and follow up with connections reminding people where you met. LinkedIn is a very active tool outside of academia, and you should start making multiple connections on LinkedIn and other social media networks for people in positions you would like to have. Part of the aim of creating a network is also to learn the "language" of your selected career. Every career has particular buzzwords – knowing what they mean and how they are used is a key way to signal to a potential employer that you have a genuine interest in their field. By immersing yourself in a social media network filled with people from your chosen career, you will absorb the language, style and hot topics being discussed, making yourself look like one of the in-group during your application and interview.

Finally, you are at the application stage! Writing a cover letter and CV is a different topic, but every industry needs a tailored application. Use your spreadsheet of experiences to demonstrate your early and deep interest in the topic. Make these markers of interest stand out by dropping CV items that are not related (Figure 1). Use your cover letter to tell a personal narrative that gives the impression that your aim from day 1 was also to apply for this job. And good luck!

CONTINUOUS REINVENTION

The advice that we have given here is tailored for PhD researchers in the biomedical sciences. However, much of this strategic framework could be applied to post-docs or professionals who have already left academia. For Millennial and Gen Z scientists, a single stable career pathway is the exception rather than the norm. We suggest looking at each position as a 3–6-year opportunity to build expertise, aiming for lateral or upward moves after each stint. In each position, focusing on the job aims while building markers of interest in potential lateral moves will increase your versatility and opportunity. Often the highest positions are reached by creating a series of multi-sector experiences that complement each other in unexpected ways.

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AUTHOR CONTRIBUTIONS

Adrian Liston: Conceptualization; writing – original draft; writing – review and editing. **Lydia E Makaroff:** Conceptualization; writing – original draft; writing – review and editing.

CONFLICT OF INTEREST

The authors declare no conflict of interest.