Effective self-management for early career researchers in the natural and life sciences

Bielczyk, Natalia Z.; Ando, Ayaka; Badhwar, AmanPreet; Caldinelli, Chiara; Gao, Mengxia; Haugg, Amelie; Hernandez, Leanna M.; Ito, Kaori L.; Kessler, Dan; Lurie, Dan; Makary, Meena M.; Nikolaidis, Aki; Veldsman, Michele; Allen, Christopher; Bankston, Adriana; Bottenhorn, Katherine L.; Braukmann, Ricarda; Calhoun, Vince; Cheplygina, Veronika; Boffino, Catarina Costa

DOI:
10.1016/j.neuron.2020.03.015

Citation for published version (Harvard):
Bielczyk, NZ, Ando, A, Badhwar, A, Caldinelli, C, Gao, M, Haugg, A, Hernandez, LM, Ito, KL, Kessler, D, Lurie, D, Makary, MM, Nikolaidis, A, Veldsman, M, Allen, C, Bankston, A, Bottenhorn, KL, Braukmann, R, Calhoun, V, Cheplygina, V, Boffino, CC, Ercan, E, Finc, K, Foo, H, Khatibi, A, La, C, Mehler, DMA, Narayanan, S, Poldrack, RA, Raamana, PR, Salo, T, Godard-Sebillotte, C, Uddin, LQ, Valeriani, D, Valk, SL, Walton, CC, Ward, PGD, Yanes, JA & Zhou, X 2020, 'Effective self-management for early career researchers in the natural and life sciences', *Neuron*, vol. 106, no. 2, pp. 212-217. https://doi.org/10.1016/j.neuron.2020.03.015

Effective Self-Management for Early Career Researchers in the Natural and Life sciences
—Supplementary material—

Natalia Z. Bielczyk¶[1,2,], Ayaka Ando[3,45], AmanPreet Badhwar[4,5,45], Chiara Caldinelli[6,45], Mengxia Gao[7,45], Amelie Haugg[8,9,45], Leanna M. Hernandez[10,45], Kaori L. Ito[11,45], Dan Kessler[12,45], Dan Lurie[13,45], Meena M. Makary[14,15,16,45], Aki Nikolaidis[17,45], Michele Veldsman[18,19,45], Christopher Allen[20], Adriana Bankston[21], Katherine L. Bottenhorn[22], Ricarda Braukmann[23], Vince Calhoun[24], Veronika Cheplygina[25], Catarina Costa Boffino[26], Ece Ercan[27], Karolina Finc[28], Heidi Foo[29], Ali Khatibi[30], Christian La[31], David M. A. Mehler[32], Sridar Narayanan[33], Russell A. Poldrack[34], Pradeep Reddy Raamana[35], Taylor Salo[22], Claire Godard-Sebillotte[36], Lucina Q. Uddin[37], Davide Valeriani[38], Sofie L. Valk[39,40], Courtney C. Walton[41], Phillip G. D. Ward[42], Julio A. Yanes[43], Xinqi Zhou[44], OHBM Student and Postdoc Special Interest Group

1 Stichting Solaris Onderzoek en Ontwikkeling, Veldstraat 48, 6533 CD Nijmegen, the Netherlands
2 Welcome Solutions, Veldstraat 48, 6533 CD Nijmegen, the Netherlands
3 Department of Child and Adolescent Psychiatry, Centre for Psychosocial Medicine, University of Heidelberg, Blumenstrasse 8, 69115 Heidelberg, Germany
4 Centre de Recherche de l'Institut Universitaire de Gériatrie de Montréal (CRIUGM), 4545 Queen Mary Rd, Quebec H3W 1W6, Canada
5 Université de Montréal, 2900 Edouard Montpetit Blvd, Montreal, Quebec H3T 1J4, Canada
6 Trinity College Institute of Neuroscience, Trinity College Dublin, Dublin 2, Ireland
7 The State Key Laboratory of Brain and Cognitive Sciences, The University of Hong Kong, The Hong Kong Jockey Club Building for Interdisciplinary Research, 5 Sassoon Road, Hong Kong
8 Department of Psychiatry, Psychotherapy and Psychosomatics, University of Zurich, Lenggstrasse 31, 8032 Zurich, Switzerland
9 Zurich Neuroscience Center, University of Zurich and Swiss Federal Institute of Technology Zurich, Winterthurerstrasse 190, 8057 Zurich, Switzerland
10 Department of Psychiatry and Biobehavioral Sciences, University of California, Los Angeles, 660 Charles E. Young Drive South, Los Angeles, CA 90095, USA
11 Neural Plasticity and Neurorehabilitation Laboratory, University of Southern California, 2250 Alcazar Street, CSC 133, Los Angeles, CA 90089, USA
12 Departments of Statistics and Psychiatry, University of Michigan, Ann Arbor, MI 48109, USA
13 Department of Psychology, University of California, Berkeley, Berkeley, CA 94702, USA
14 Systems and Biomedical Engineering Department, Faculty of Engineering, Cairo University, Giza 12613, Egypt
15 Athinoula A. Martinos Center for Biomedical Imaging, Department of Radiology, Massachusetts General Hospital, Harvard Medical School, Charlestown, MA 02129, USA
16 Department of Psychiatry, Yale University School of Medicine, 300 George St, New Haven, CT 06519, USA
17 Center for the Developing Brain, Child Mind Institute, 101 E 56th St, New York, NY 10022, USA
18 Department of Experimental Psychology, University of Oxford, Woodstock Rd, Oxford OX2 6GG, UK
19 The Florey Institute of Neuroscience and Mental Health, University of Melbourne, 30 Royal Parade, Parkville VIC 3052, Melbourne, Australia
20 Cardiff University Brain Research Imaging Centre, School of Psychology, Maindy Road, CUBRIC, Cardiff CF24 4HQ, UK
21 Future of Research, 82 Wendell Avenue, STE 100, Pittsfield, MA 01201, USA
22 Department of Psychology, Florida International University, 8th Street, DM 256 Miami, FL 33199, USA
23 Utrecht, the Netherlands
24 Tri-institutional Center for Translational Research in Neuroimaging and Data Science (TReNDS), Georgia State University, Georgia Institute of Technology, Emory University, 55 Park Pl, 18th Floor, Atlanta, GA 30303, USA
25 Department of Biomedical Engineering, Eindhoven University of Technology, Postbus 513, 5600 MB Eindhoven, the Netherlands
26 Institute of Psychiatry & Department of Radiology, Hospital das Clinicas da Faculdade de Medicina da Universidade de São Paulo, Rua Dr. Ovídio Pires de Campos, 785 – Cerqueira César – CEP: 01060-970 São Paulo, Brazil
27 C.J. Gorter Center for High Field MRI, Department of Radiology, Leiden University Medical Center, C3Q, PO Box 9600, 2300 RC Leiden, the Netherlands
28 Centre for Modern Interdisciplinary Technologies, Nicolaus Copernicus University in Toruń, Wileńska 4, 87-100 Toruń, Poland
29 Department of Psychiatry, University of New South Wales, Centre for Healthy Brain Ageing (CHeBA) School of Psychiatry Level 1, AGSM (G27) Gate 11, Botany Street UNSW NSW 2052, Sydney, Australia
30 School of Sport, Exercise and Rehabilitation Sciences, College of Life and Environmental Sciences, Centre of Precision Rehabilitation for Spinal Pain (CPR Spine), University of Birmingham, Edgbaston, Birmingham B15 2TT, UK
31 Department of Neurology and Neurological Sciences, Stanford University, 780 Welch Road, Palo Alto, CA 94304, USA
32 Department of Psychiatry and Psychotherapy, University of Münster, Albert-Schweitzer-Campus 1, Gebäude A9, 48149 Münster, Germany
33 Montreal Neurological Institute, McGill University, 3801 University Street, Montreal H3A 2B4, Canada
34 Department of Psychology, Stanford University, Jordan Hall, Building 420, Stanford, CA 94305, USA
35 Rotman Research Institute, Baycrest Health Sciences, 3560 Bathurst St., Toronto, ON, Canada
36 Department of Family Medicine, McGill University, 5858, Chemin de la Côte-des-Neiges, Montreal, Quebec H3S 1Z1, Canada
37 Department of Psychology, University of Miami, Coral Gables, FL, USA
38 Department of Otolaryngology, Head & Neck Surgery, Massachusetts Eye and Ear, Harvard Medical School, 243 Charles St, Boston, MA 02114, USA
39 Brain and Behaviour (INM-7), Wilhelm-Johnen Strasse, 52425 Juelich, Germany
40 Otto Hahn group Cognitive Neurogenetics, Max Planck Institute for Human Cognitive and Brain Science, Juelich, Germany
41 School of Psychology, University of Queensland, Sir Fred Schonell Dr, St Lucia QLD 4072, Brisbane, Australia
42 The Turner Institute for Brain and Mental Health, School of Psychological Sciences, Monash University, 770 Blackburn Rd, Monash University, 3800, Melbourne, Australia
43 Department of Psychology, Auburn University, 226 Thach Hall, Auburn, AL 36849, USA
44 School of Life Science and Technology, University of Electronic Science and Technology of China, No. 2006, Xiyuan Ave, West Hi-Tech Zone, Chengdu, Sichuan, P.R. China
45 denotes equal contribution

¶ Correspondence: natalia.bielczyk@gmail.com (NB)

Part 1 A summary of online resources for ECRs

Table 1 A list of online resources for ECRs

Category	Name	Remarks
Grant opportunities	*International Brain Research Organization (IBRO)*	An organization that provides international grants for Research Fellowships, travel grants in brain research
Time management	*Time Out*	A break time reminder app that gently reminds you to take a break on a regular basis
	Stretchly	A break time reminder app that reminds you to take breaks when working with computers
Grow network	*Twitter*	A social platform that allows you to disseminate and advertise your own work, get first-hand information, and have a voice in your community
Open peer review	*biorxiv*	A preprint server for biology
	psyarxiv	A free preprint service for the psychological sciences
	F1000Research	A preprint server that publishes all your findings including null results, data notes and more
	Peeriodicals	A lightweight virtual journal with you as the Editor-in-chief, giving you complete freedom in setting editorial policy to select the most interesting and useful manuscripts for your readers
Joining Hackathons	*Brainhack organization*	A unique conference that convenes researchers from across the globe and a myriad of disciplines to work together on innovative projects related to neuroscience
Sharing ideas	*GitHub*	Online service to share your work
Peer coach programmes	*Donders Institute, Nijmegen*	A peer coaching program
	Institute of Electrical and Electronics Engineers (IEEE)	An online mentoring program that allows mentees to apply for a particular mentor
Developing mentorship skills	*Early Faculty Online Training program*	A program that offers a range of training information for mentors to develop their mentorship skill-sets

	Stanford Biosciences	A range of resources and written materials providing additional training for mentees and mentors
Career	*LinkedIn*	A social network specifically designed for career and business professionals to connect
	Cheeky Scientist association	The world's largest PhD-only job search training platform specifically for helping PhDs enter or transition into industry careers
	Bigger pharmaceutical or biotechnology companies (e.g., Roche)	Companies that offer full PhD and Postdoc programs, which can allow one to gain both research career advancement and gain industry experience at the same time
Science-themed hackathons	*Brainhack*	An international organization that coordinates multiple international hackathons focused on neuroscience- and network research
	HackOverflow	A world-renowned hackathon in computer science organized by the Stanford Women in Computer Science association
	McGill Physics Hackathon	A world-renowned hackathon in computational physics organized at McGill University in Montreal, Canada
	Odyssey Hackathon	The biggest blockchain hackathon in the world where blockchain meets science, organized in Groningen, the Netherlands
	Eduhack	A hackathon focused on building solutions for today's education problems

Part 2 Tips to avoid common pitfalls in science

A Good planning and experimental design

Do a robust literature review. Look out for contradictory results and null findings to build the best prior to the outcome of your experiment.

Keep up to date. Look at experimental designs from recent literature to avoid using outdated or flawed practices or data acquisitions.

Do not reinvent the wheel. Use validated and publicly available analysis tools wherever possible.

Pilot analysis. Use a small sample, publicly available data, or in silico generated data, to test analysis pipelines and iron out issues before data collection begins.

Pre-register your study. Pre-registration means specifying, in as much detail as possible, the planning for a study, i.e. the research hypothesis, the number of subjects and power estimation, description of experimental stimuli, procedures, measures, plan for data analysis, etc. This planning should be posted in a time-stamped, locked file in an online repository which can then be accessed by editors and reviewers of academic journals (e.g. in the Open Science Framework, www.OSF.io).

Impact and novelty. Plan for null results. Publish replications. Use preprint servers. If the work is risky or unlikely to generate highly novel results, consider pre-registration and registered reports.

B Mitigating risk and robust logistics

Quality checks. Always check your data quality during data collection to allow identification and correction of problems and to enable mitigation strategies during results interpretation.

Data access. Relying on collaborators or other institutions for data can be efficient, but don't invest time and energy into data collection until you are sure you will have access to it.

Ethics/regulatory approval. Before the project starts, check whether there is an ethics approval in place or if you need to write one. Later in the process, keep an eye on expiry dates. Ask colleagues about the time required for approvals, plan for delays and amendments.

Equipment. Ask operators for maintenance schedules on any equipment you will use. Make sure the equipment is well maintained. Avoid collecting data spanning a major upgrade as it may introduce biases. If you cannot avoid this, ensure that you model this potential confounding factor in your analysis, or employ a case/control design with case/control pairs collected close in time on the same equipment. Use phantoms or calibration data before and after all equipment modifications in any longitudinal study.

Expertise. When planning your experiment, go through all phases of data collection, analysis and interpretation and ensure that you have access to all the required expertise.

C Tracking and monitoring progress

Support staff. If you train Research Assistants or students, keep a close eye on their data collection, especially early on. Request progress reports and supervise whenever possible to ensure protocols have been communicated correctly.

Pilot analysis. Run analysis on the first few data points acquired to identify mistakes early on.

Plan and compare. Write down milestones and assign dates to them. Compare actual progress with planned progress regularly to identify where you might be over- or underestimating the time required for different phases.

Be honest. Reflect on your abilities, successes, and failures. Undertake further training or find collaborators with the required expertise to address your weaknesses as you progress.

D Closing out and publishing work

Pre-plan your analysis. Deciding on how to analyze the data before collection is essential to avoid close-out issues.

Mind P-hacking. Do not analyze and re-analyze data until you find a 'significant' result.

Involve collaborators early. Send working manuscripts to collaborators early for advice and input. Involve your co-authors in the writing process as much as you can, and as early on as you can.

Venues. Make a list of suitable publication journals at the design stage of your project. Have back-ups in mind.

E Robust career planning

Diversity. Do not rely on only one project; have multiple streams at different stages to smooth out your career progress.

Redundancy. Plan for failure. Assume projects will not complete on time or may be halted indefinitely. Collaborate with others and ensure a flow of publications and outputs from multiple sources.

Funding. Funding cycles are typically 6-12 months, so plan for acquiring funds. Make use of publicly available datasets wherever possible.

Employment. Do not wait for the end of your thesis to apply for postdoc positions and only attend conferences in your last 6-12 months to shop around and advertise yourself. Building a good network early in your training will increase your chances of securing sequential postdocs. Diversify skills wherever possible.

Supervision. Choose your supervisor wisely. Do not be overly reliant on their time; most are busy, some are neglectful. Develop a broad and diverse network of mentors and collaborators to avoid being solely reliant on your supervisor (see: **Fig. 1B**).

Part 3 Advice for researchers who are considering a career switch

If you aim for a tenure track position in academia, there are multiple steps you may take to increase your chances in the job recruitment process (Bielczyk, 2019). However, one should not ignore opportunities beyond the professorial route, as many PhD holders find fulfilling careers in other domains. As mentioned in the Introduction, the demographics in academia are rapidly changing, with the percentage of researchers staying in academia decreasing. Although higher education remains a large sector of employment for doctoral graduates, a significant proportion of PhDs and postdocs will not pursue a career in academia. The exact numbers vary depending on the country and, while the vast majority of doctorate holders in Poland and Portugal work in higher education, this is only true for one-third of them in the Netherlands, Belgium, and Denmark. Similarly, about 65% of PhD holders enter a postdoc in the US, as opposed to only 30% in the UK. Changing course from academia to another profession is a professional development opportunity, and should not be considered a failure. Also, a decision to try a position in industry is not a definite decision to leave academia, as there are also multiple success stories of transitioning back.

So, where to start? You can consider doing an internship in a private company during your research contract. For example, an initiative that helps PhD candidates in the Netherlands to get internships is the Professional PhD Program (PPP) by the PhD Network Netherlands (PNN, https://www.hetpnn.nl/en/2013/05/06/ppp/). Their program offers PhD candidates the possibility to do a short-term paid internship during their PhD at one of several companies, such as banks or funding agencies. Projects like PPP provide a low-threshold opportunity for PhD candidates to get an impression of the world outside the lab and educate companies that are often not aware of all the transferable skills that academics have acquired in their scientific education.

It is recommended to start actively looking for opportunities at least a few months before your current contract expires as finding a suitable industry position takes time. The best method at the early stage may be to tap into your professional network of colleagues who work outside of academia as they might inform you about upcoming vacancies at their workplace. You can also join post-degree training programs to ease the transition into industry and get a grasp of how working in certain industries looks like in practice (e.g., workshops in data science are a popular way of training academics and preparing them to take industry positions, https://www.insightdatascience.com/).

One way to increase your general employability, both in academia and beyond, is developing your transferable skills. In fact, spending a few years in academia gives a broad spectrum of transferable skills. Examples of such transferable skills are mediation, negotiation, communication, organization, scheduling, management, mentoring, coaching, journalism. While long experience in academia might hamper your chances of landing a good position in industry in some circumstances, all of these skills can make you competitive on the open job market.

You also need to realize that recruiters in industry speak a language of business and management rather than a language of science, so you need to *translate* your resume to this other language before applying for a job in industry. If you have a hard time defining your core or transferable skills, there are multiple online tools that can assist you. For instance, Transferable Skills Assessment (https://www.unl.edu/careers/documents/miscellaneous/TransferableSkillsAssessment.xlsx) is a free online tool for identifying competencies obtained during the PhD program and getting an overview of what we should improve on for further career development. Another example is Gallup StrengthsFinder (https://www.gallupstrengthscenter.com/home/en-us/strengthsfinder), a commercial program to explore five main personal strengths.

If you do decide to apply for a position in industry, there are online services dedicated to helping you adjust your CV to industry standards and to find your first job, e.g., the Cheeky Scientist Association (https://cheekyscientist.com/). It is also essential to prepare for a job interview by getting familiar with the working culture of the company you are applying for. For most large companies, you can find some information and testimonials online. You can also research the working conditions within the company through online services such as Glassdoor.

While holding a PhD can sometimes mean that you are overqualified for a specific job, for the most part, holding a PhD is a valuable asset. For example, large companies with strong Research & Development departments (e.g., *Google* or *Amazon*) and IT startups often welcome candidates with a PhD as they are innovative and independent. There are also companies (e.g., *Roche*), which offer full PhD and Postdoc programs so that you can both advance your research career and gain industry experience at the same time. In **Supplementary Material, Part 4**, we list exemplary professions in which a PhD title is typically an asset rather than a liability.

What should you do if you do not have a clear idea of which profession to go for next? If you are looking for ideas for your new career path, it could be worth considering the popular belief "whatever you are naturally drawn to when you are procrastinating is what you should do for a living." Think about how you are spending your time and reflect on what you are passionate about; many ECRs have never held positions outside of academia and some may have yet to discover their natural talents. Furthermore, the job market is very dynamic; along with the development of internet services and social media, new professions are continuously being created. For example, ten years ago, professions such as a YouTuber or a vlogger did not exist, while now, these are the dream jobs for over 50% of children in the United Kingdom. Similarly, new trends in science, including science journalism and communication between research teams and industry, are rapidly developing. As Steve Jobs famously said, "stay hungry, stay foolish"—and, you never know when the time will come to connect all the dots.

Part 4 A list of potential careers in industry to consider for holders of a PhD in the natural and life sciences

Below, we list ideas for career options outside academia for PhD graduates.

Data Analyst/Data Scientist

Data scientists are experts in data analysis. They collect, visualize and analyze large amounts of data. Data scientists are typically trained in math, statistics, computer science, information science, finance or economics. Data scientists must have high technical and analytical skills and should be adept at using a variety of statistical programming languages such as R, SAS or Python. Data scientists often use complex analytical techniques, such as machine learning and deep learning. They can freelance through online platforms such as Upwork or find jobs in IT and business-related fields. If you hold a PhD and have relevant experience, you could become a senior data analyst and supervise junior data analysts.

Data steward

The amount of (digital) data has increased enormously over the past years and the pressure for good data management and open and reproducible science using these data creates the need for new data professionals. These data professionals are also often called data stewards and they combine different sets of skills related to research data management, processing, and analysis.

Working on research infrastructure

You can search for employment at organizations providing tools and infrastructure for research such as data centers or service providers like ORCID, DataCite or Crossref.

Consultant

There are many different consulting firms (*McKinsey* and *Boston Consulting Group* being some of the well-known ones) looking for highly educated professionals. As a consultant, you provide professional advice to individuals or companies. As an employee of a consultancy company, you would need to re-qualify and learn about the products and services offered by the company.

(Freelance) Scientific Consultant

You can also choose to become an external scientific consultant, who is hired as a freelancer by companies to solve specific issues. This is an especially interesting option if during your scientific career you have mastered a certain technique (e.g., engineering highly specialized equipment) which is now a crucial element of larger projects in large companies. There is a high demand for such external consultants, especially in the pharmaceutical industry and in engineering.

Grant advisor/Project acquisition

Conducting research most often depends on grants. Many organizations (including universities and research institutes) and private companies employ professionals to advise others on available grants and aid with grant applications. Furthermore, private companies are offering commercial grant consultancy.

Publisher

Consider applying your knowledge about publishing and reviewing scientific articles by working for a publisher. There are over 2,000 for-profit publishers on the market, but most large scientific societies also lead their own, non-profit journals.

Software Developer

Software developers build, design, and test software for consumers. They should have the technical expertise to write, test, and maintain code, strong analytical skills and be capable of long periods of extreme concentration. They can work in a variety of industries and are currently in high demand. PhD candidates in natural and life sciences often need to write and run scripts throughout their PhDs; however, becoming a software developer often requires additional training.

Research Scientist

Research scientists set up and conduct projects and experiments in a specific scientific area in R&D departments of private companies, much like they would in an academic institution. They can work in a wide range of areas, including industry (i.e., tech companies, pharmaceutical producers, etc.), government laboratories, environmental organizations, large hospitals, and other research organizations. Day-to-day work could entail gathering, analyzing, and interpreting data, as well as designing projects and putting together research proposals. Research scientists should have strong written and verbal communication skills, as they may be expected to work in diverse teams and liaise with other staff.

Lab manager

As a lab manager, you help to keep the lab running. You may take care of lab equipment and all of the organizational tasks to support the ongoing research. The lab manager is a function you can get in an academic institution as well as in industry.

Medical Science Liaison

Medical Science Liaisons (MSLs) are excellent communicators who liaise between clinicians and researchers. They must be able to tailor complicated information to their target audience clearly and concisely, as they help ensure health-related products are utilized effectively. They can be found in the pharmaceutical, biotechnology, medical device, and other health-care industries or contract research organizations. Since science communication is a compulsory competence to obtain such a position, it may be helpful for those interested in MSL positions to use social media, such as tweeting and blogging, as a platform to market themselves and practice writing for a non-scientific audience.

Market Research Analyst

A market research analyst's primary role is to analyze the key advantages/disadvantages of the company's technologies/products and ideas to assess their commercial value. Market research analysts often work in innovation-based sectors: biotechnology, electronics, and IT (although market research analyst roles exist in most industries). They must have excellent oral and written communication skills and strong analytical thinking with a knack for business.

Healthcare Information Technology Specialist

Health IT specialists manage technical aspects of handling patient health data. They may support or build electronic health record systems, be involved in data analytics and be a part of interdisciplinary teams to facilitate improved healthcare outcomes. Health IT specialists must have basic knowledge of Microsoft Office software, as well as medical terminology, database management, and document imaging software.

Scientific Editor

The role of a scientific editor is to ensure that the peer-review process of a journal is fair and efficient and to carry out the production of journal articles after they are accepted for publication. Scientific editors work for specific journals and must be excellent at the critical reading of scientific literature, including literature in unfamiliar topics. Scientific editors must also be strong writers able to work under time pressure, as they may be asked to write news pieces or blog posts summarizing newly published papers.

Science Communication Officer

The role of a Science Communication Officer is to communicate recent scientific output of an institution, such as a research institute, to the general public by releasing press notes, blogging and social media activity. Science communication officers create the content in collaboration with the authors of the scientific work. This job is a form of journalism, which additionally requires an understanding of science and technology, as well as having strong communication skills.

Science Policy Analyst

The role of a Science Policy Analyst is to use their research experience to interpret how policy affects scientists. Every federal agency hires multiple PhDs working in policy. Almost all universities also have government-relations offices that employ policy analysts.

Project Leader in public institutions or large corporations

Public institutions such as the Ministry of Education usually have separate units dedicated to creating infrastructures around science, such as developing new directions in science education, working on behalf of gender and ethnicity diversity, or building open-source databases or computing clouds. As multitasking and communicative individuals, PhDs can also excel as Project Managers in the more general corporate culture.

Business Developer

Business development requires a profound understanding of the relevant market sector: a degree in business management might not be sufficient to help a highly specialized project survive on the free market. Therefore, if you have a general interest in developing projects, you can become competitive on the market by gaining additional competence in business management and finding a job as a business developer specialized in the sector of the market closest to your former PhD topic.

Entrepreneur

PhDs often have entrepreneurial talents, as the skills of a PhD candidate are not unlike those of successful founders, with resourcefulness, intrinsic motivation, independence, project management, commitment and passion being a few of the leading traits. Most PhD students are exceptionally good at thorough market research (i.e., the literature review). This might be more tailored towards understanding competitors rather than customers, but many skills are transferable. Whilst salesmanship is not natural to many, all academics need to learn it through writing grants, cover letters to journals, presenting scientific work, etc. Many PhDs also involve building Intellectual Property, i.e., patentable solutions. That kind of experience will put you well above a Bachelor of Business or similar in terms of running a start-up.

Academic / High school teacher

If teaching students was your favorite part of a PhD, you might consider pursuing a further career in teaching, either at the university, technical or community college or high school level. It is often the case that to pursue a career in education, you will need to get additional training in pedagogics after your PhD. For instance, in the US, all high school teachers must obtain edTPA qualification (https://www.edtpa.com/).

Freelance Writer / Content Writer / Copywriter

If writing is your favorite part of the daily research practice, you might consider freelance writing. This job allows you to choose the scope of topics and select your preferred forms of text from a broad range of possibilities: from blog posts, through essays and articles, to white papers and grant proposals. Typically, to become a freelancer, you need to register your business in the local Chamber of Commerce as a sole trader and manage your finances (pay taxes for yourself, choose a pension fund, etc.). It can be a good employment option if you are strong in self-management, you are fond of flexible working hours and you are prepared to negotiate your hourly rates with clients.

For more ideas, please check:

(1) https://cheekyscientist.com/top-10-list-of-alternative-careers-for-phd-science-graduates/

(2) http://curiousaboutscience.net/phd-job-options/

(3) Bielczyk (2019). The landscape of post-PhD career tracks. Amazon Digital Services, ISBN: 1675579660.