Neuron
NeuroView

The Hitchhiker's Guide to a Neuroscience Career

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Neuroscience is an exciting and vibrant field, but building an academic career is not always easy. What are critical success indicators? Which tools help talented young neuroscientists conquer the challenges? In this *NeuroView*, we discuss instruments and steps that can help people progress through the ranks.

The field of neuroscience is an attractive discipline for many young scientists. And no wonder, its importance is highlighted by a total of 29 Nobel Prize awards, collectively amounting to roughly one-third of all awards given in the field of Physiology/Medicine (https://faculty.washington.edu/chudler/nobel.html). The recent start of large-scale projects on the brain, both in Europe (the Human Brain Project) and the U.S. (the Brain Initiative), holds great promise for solving many mysteries of the brain, through the development of new technologies and computational brain models (Reardon, 2014).

Throngs of aspiring scientists move into the field each year, at the Bachelor's, Master's, or PhD level. A recent report (http://www.elsevier.com/__data/assets/pdf_file/0003/236730/ElsevierBrainScienceReport2014-web.pdf) showed that no less than 1.7 million individual scientists worldwide were actively publishing on the brain and behavior since 1996. Since 2010, brain and neuroscience researchers collectively produced close to 1.8 million publications, amounting to 16% of the world's scientific output, and in some countries more than 20%.

It is, of course, wonderful to be immensely attractive as a field. We welcome the brightest minds to help us understand the inner workings of the brain in health and disease. The ever increasing societal costs of brain disorders (Gustavsson et al., 2011) attest to the urgent need for progress in our understanding of, and treatment for, such disorders. Having the most promising junior scientists on board is an enormous asset. But clearly, not all of these young researchers can make an academic career in neuroscience. The absorbance of the academic system has reached its limits (Alberts et al., 2014): if so, many people enter the field, inevitably many of them will have to exit too. This is not necessarily a bad thing to happen; it can be seen as an example of positive cross-fertilization between different working environments, as the many neuroscientists that now work in industry—or elsewhere—all benefitted from their years in academia (Bonetta, 2007; Ehlers, 2012). Still, it may not be the future setting students dreamed of when they entered the field.

So what *are* critical success indicators for a career in academic neuroscience? Which steps are useful in facing the fierce competition for a limited number of available positions? In this *NeuroView*, we—two established scientists and two mid-career scientists—discuss some of the instruments and initiatives that we feel can help people progress through early- and mid-career steps. We will specifically focus on issues and opportunities for European researchers, although many of these principles are likely to apply universally.

Mobility

Neuroscience moves at a fast pace. Keeping up with the latest technologies and concepts requires exposure to the work of others. Given the time-lag between the emergence of a new idea and the eventual publication, trying to keep up with the field by just reading scientific journals is bound to fail. One has to have access to new trends at the earliest stage. Of course, attending international conferences helps, but interactions at such events are only cursory and don't suffice to get hands-on experience or build a lasting network. Instead, spending time in leading labs has proven to be a useful step in the career of nearly all successful investigators.

An experience abroad is exciting for anyone, both at a personal and scientific level. Career-wise it is one of the best pieces of advice we can give. Don't get stuck to your seat but go to the best places! The quickest way to learn new approaches is via labs that perform excellent research. Go where the money flows. These are the places where innovative techniques are being developed and applied, where one can become involved in large and exciting projects that need many hands. Labs and countries that have extensive collaborative networks are known to produce highly cited publications (http://www.elsevier.com/__data/assets/pdf_file/0003/236730/ElsevierBrainScienceReport2014-web.pdf).

One would expect that young scientists from financially less privileged countries would seize the opportunity. Surprisingly, while some do, many don't. Comparative benchmarking of European and U.S. researchers' mobility revealed that—in the 15-year period tested, between 1996 and 2011—on average nearly 57% of all European researchers with an active author profile listed institute affiliations within a single country (http://www.scienceeurope.org/uploads/PublicDocumentsAndSpeeches/SE_and_Elsevier_Report_Final.pdf). Countries with a high percentage of sedentary scientists were not those with favorable science

infrastructure—like Switzerland, Germany, or the Netherlands—but rather countries in the east or south, like Turkey, Croatia, Lithuania, Italy, and Greece. These are exactly the countries where one would expect junior scientists to profit most from a postdoctoral fellowship in more affluent regions. Interestingly, the pattern in the U.S. was quite dissimilar; here the highest percentage of sedentary scientists (i.e., researchers listing institute affiliations within a single state) was found in states with large research institutions, such as California, New York, or Pennsylvania. Even so, the U.S. state with the highest number of sedentary scientists—California, with approximately 25%—had more mobility than nearly all European countries.

Some of the reasons for the differences between the U.S. and Europe are obvious, such as the lack of language barriers and smaller inter-state cultural differences in the former as opposed to the latter. But other reasons may be more hidden and have to do with discouraging European regulations, such as obstacles for obtaining a work permit, lack of pension transferability, or unvoiced preference (by employers) for students educated in northwest European universities. Inadequate funding is another major obstacle for those that would like to leave the country but cannot afford to do so. In most countries, financial support for academics while on sabbatical is absent. For the younger scientists, Marie Curie Fellowships are in principle available, but these are on average granted in only 20% of cases (http://ec.europa.eu/research/mariecurieactions/funded-projects/statistics/index_en.htm) and certainly not easy to acquire by students from southern or eastern Europe. This is amplified by national funding policies where, again, funds are most accessible to students from countries that already have a favorable starting position, for instance Switzerland, with a 60% funding rate for early postdoc mobility grants (http://www.snf.ch/SiteCollectionDocuments/doc_mobility_statistics_2013.pdf).

In our view, investments in fellowships allowing mobility for this young generation are of paramount importance. Fear of "losing them for the country" seems a bad guiding principle; these migrants are invaluable for their home country with knowledge gathered elsewhere. They can stimulate aspiring scientists "at home" from their position abroad. More importantly, given incentives to return home, these young scientists may greatly help the advancement of research in their country of origin via the transfer of state-of-the-art techniques and new knowledge learned abroad.

Networking

Working in different labs helps tremendously to increase one's level of science but is also an easy way to start building a network. Academic research is about science but also about investing in good personal relationships with other colleagues. Influential senior scientists are just the right people to notice a talented junior researcher and propose him or her as speaker in a symposium or candidate for a prize, both of which are necessary ingredients for a competitive CV. Equally important is networking among peers. Future leaders are part of such networks and it certainly helps your own future if you shared a lab bench with one of these emerging leaders.

Good ties are a wonderful investment in the future. Such ties are of course often established at a personal level. But collaborative networks between different neuroscience disciplines, e.g., at a European or global level, can also help. Large neuroscience societies should and do take their responsibility to facilitate the formation of networks. For instance, the International Brain Research Organization (IBRO) in collaboration with the Kemali Foundation organizes so-called Kemali-IBRO Colleges exactly in this spirit, to provide top-level education in neuroscience on the one hand and reinforce a network of collaboration between the most promising young neuroscientists from the Mediterranean area on the other hand. The Society for Neuroscience runs—among many other activities—their Neuroscience Scholars Program, offering an important network for graduate school and postdoc-level scientists from underrepresented minority groups, an initiative funded by NINDS (http://www.sfn.org/careers-and-training/diversity-programs/neuroscience-scholars-program). Social networking works best when neuroscientists do what they enjoy most—perform experiments. For example, the Marine Biological Laboratory in Woods Hole has a strong reputation for bringing young neuroscientists together by exposing them to challenging 8-week laboratory projects. The hands-on practical work allows students not only to receive firsthand training but also to set up a strong social network for future collaborations. This approach also forms the background for the CAJAL Advanced Neuroscience Training Programme, which offers state-of-the-art hands-on neuroscience training in Europe (http://www.fens.org/Training/CAJAL-programme/).

Another example is the FENS-Kavli Network of Excellence (http://www.fens.org/Outreach/FENS-Kavli-Network-of-Excellence/). This program is meant to be a European Young Academy in Neuroscience, following the successful model of Young Academies of Science that were initiated over the past decade in several European countries, usually in association with the countries' National Academies of Science. In this first round, 20 excellent mid-career neuroscientists from all over Europe were elected as FENS-Kavli Scholars for a period of 4 years. The network of FENS-Kavli Scholars is intended to grow to 30 members in the coming years, with new members being elected and former members rotating off. Apart from their scientific excellence—many of these Scholars have successfully obtained personal grants from the European Research Council—FENS-Kavli Scholars were also selected for their keen interest in, and past experience with, outreach to the lay public or engagement with science policy. We know from the example of Young Academies that science policy views expressed by these networks can be very influential. With the FENS-Kavli Network of Excellence, both FENS and the Kavli Foundation offer this generation of gifted neuroscientists a platform to interact and develop into the future leadership of European neuroscience.

Build a CV and Seek Advice

Working in strong research groups for a while is extremely useful but of course only as an intermediate step toward scientific independence. But how to obtain that first grant, the ticket to starting your own lab?

First and foremost, it is critical to develop one's own ideas, to ask important and relevant questions that have a clear urgency to be explored and eventually answered. This urgency can have its origin in the intrinsic scientific problem but in many cases there is also a societal or medical need. Nowadays funding agencies not only often ask that the potential relevance to societal stakeholders is explicitly clear, but seriously consider this issue when ranking proposals. As long as this is done in a balanced manner, allowing room for funding of both fundamental and applied scientific questions, we see no problem. However, the balance is shifting increasingly toward questions that have a potential for short-term translation to the clinic or innovation, as has become painfully evident from recent budgetary discussions in Europe (http://news.sciencemag.org/europe/2015/01/european-commission-reveals-details-proposed-cuts-science; http://www.researchresearch.com/index.php?option=com_news&template=rr_2col&view=article&articleId=1349251).

While one can argue that this is a rather short-sighted policy, it is a situation that many neuroscientists—juniors and seniors alike—must deal with. At the very least, it helps to be aware of the situation, to be educated and prepared to "bend" research questions such that they might fulfill the criteria. Such education is the responsibility of graduate schools but basically of anyone serving as a mentor or tutor to gifted neuroscientists at the brink of independence. Of course, there are still pots of money where scientific content and merit is the only leading principle for funding, and fortunately so. Grants of the European Research Council (ERC) are great examples of such curiosity-driven awards, and so are other personal granting systems at the national level in Europe, the U.S., or elsewhere. But funding rates of these programs are notoriously low. For example, the ERC Starting and Consolidator Grant success rates in 2013 were both ~9% across Europe and much lower in eastern or southern European countries like Greece or Cyprus (http://erc.europa.eu/projects-and-results/statistics). Of course, it is good to realize that the absorbance of the academic system is bigger than the few percent of applicants that are fortunate (and brilliant!) enough to receive such prestigious grants.

Getting a grant funded is not a matter of luck. Apart from defining a fascinating question, proposing an adequate and/or daring approach to solve the problem and writing the story in a gripping manner, past performance, and credentials play a major part, especially in personal granting programs. There is even a certain tendency toward reverberation. If a person graduated with honors and wrote a thesis that received distinction, it is easier to get that first prestigious grant; having received that grant may cause the jury of a junior career award to celebrate this candidate, etcetera. This is an understandable course of thinking, but the potential danger is that people who (for whatever reason) missed the essential first step will never get back on track. This artificially amplifies the gap between the haves and the have-nots. In our view, if talented junior neuroscientists leave academia due to reverberation hurdles in funding and career recognition, this is a loss to the field. It is an essential duty of more established investigators to have a keen eye for these "hidden jewels" and to provide extra mentoring so they can overcome the initial obstacles.

Clearly, junior scientists can also help fate by being less "hidden." It is important to be aware that steps taken even at the earliest stage of one's career cast their shadow. Competing for (and obtaining) travel grants or other small prizes; organizing and speaking at symposia; training in exciting labs, as outlined above; all of these are choices that are important for a future career and help build a competitive CV. Of all of these steps, however, pro-actively seeking a good advisor or mentor may be the most important. Good advisors—not necessarily the individual with whom you've trained, but anyone who has paved his or her own successful path in academic research—don't pop up spontaneously; one will have to actively seek such a person. Having an inspiring mentor or role model is extremely important. Ideally, a mentor is close to daily neuroscience research and can help at different career stages: selecting a lab for postdoctoral training; hiring people when you are in the position of a starting group-leader; developing research projects; balancing science and social life. These are crucial steps where good advice is invaluable. Mentors can also advise on trends in neuroscience and help choose research directions, such as studying new fundamental concepts or focusing on brain diseases and drug development. Advisors and mentors are particularly important for young female scientists, who not only have to find their way in the competitive world of neuroscience but also wonder if that is possible when raising a family at the same time (Joëls and Mason, 2014). Good advice saves a lot of time, bruises, and "stepping out of the system for the wrong reasons."

Enjoy Neuroscience and Engage the Next Generation

As children we all loved doing science. In many ways, our time as youngsters is the most scientist-like time of our life! But learning doesn't have to stop once a PhD degree is secured. It requires a flexible attitude, inquisitive mind, and continuous professional development. This is the basis for maintaining your enjoyment of science throughout an entire career. This is not something someone else can do for you; one needs to have an innate curiosity and intrinsic drive to study the brain. At the end of the day, in the face of many disappointments and perhaps even frustrations—scientifically or career-wise—it is the sheer fascination for the question at hand that gives "survivors" the stamina to pursue and try again. There is no such thing as an easy ride, not even for the most accomplished of scientists. This was poignantly illustrated by Roger Nicoll in his lecture at the SfN meeting in 2014, touching on how to overcome dyslexia and low self-esteem (Esch, 2014).

Drive and fascination are invaluable tools, not only to inspire oneself but also the next generation. Many junior neuroscientists spend time reaching out to the lay public or students interested in the brain. They are active in the Brain Awareness Week, engage in TED Talks, as well as other activities. These are messages without borders; messages that can be heard even in countries where the scientific infrastructure is currently under pressure. Partaking in such initiatives is rewarding and a necessary ingredient to keep up the spirit. Sharing one's

fascination drives home the message: I can spend my life doing what I enjoy. Follow your dream … and enjoy it! That is ultimately the best advice we can give.

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