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viewpoint

Are you experienced?

Junior scientists should make the most of opportunities to develop skills outside the laboratory

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The life of a junior scientist—usually as a PhD student or postdoctoral researcher—is rarely easy. The job often involves relocating to another city or even another country, which can be difficult and can disrupt personal relationships. Long working hours, often extending into evenings or weekends, inevitably clash with the scientist's private life. Crucial experiments or research projects might refuse to yield results for weeks or even months. Moreover, even when results are forthcoming, a competing team might publish similar findings first—a particular problem for junior scientists who rely on quality publications to advance their scientific careers.

Notwithstanding these vagaries of private and professional life, the question of what comes next creates the biggest concerns for junior scientists. Although the reasons are manifold, the main problem is a scarcity of positions at the group-leader level and above, which means that few aspiring young scientists will achieve a tenured position. The lack of clear options and the small number of higher academic positions cause much unease when junior scientists think about their career prospects, particularly in the life sciences.

The typical training phase—comprising a PhD thesis and one or two postdoctoral positions—is often too short to acquire skills and experience beyond those necessary for research. Postdoctoral contracts generally run for 2 or 3 years, and do not provide enough time to broaden the professional horizon by changing research fields, moving to another country *and* producing significant results. In addition, the efforts of junior scientists are not sufficiently recognized or appreciated. Despite the fact that most of the research output is produced by junior scientists, they gain comparatively little stability and few career options or other rewards in return.

When comparing this situation with the career perspectives of non-scientists or those who go into industry, many scientists end up frustrated with academic research, regardless of the quality or quantity of their output. However, changing jobs after a PhD or a postdoctoral fellowship is increasingly difficult because most scientists who have spent years at the bench simply lack the general skills necessary for an alternative career.

We believe that these are sufficient and justified reasons for concern about the future prospects of junior scientists, and, consequently, of academic science itself if large numbers of skilled researchers leave. However, we will not further lament the postdoctoral researcher's plight here; rather, we will discuss a different point of view. Even under current conditions, junior scientists are largely responsible for their own professional success in research and elsewhere. Instead of waiting for national governments, the European Commission or some *deus ex machina* to solve the problem of academic career structures, junior scientists should take matters into their own hands, to increase their skills and chances in the job market.

The crux of the problem is that many junior scientists focus all their time and efforts on producing results, and do not consider how to acquire additional skills. Even more importantly, they communicate poorly or not at all with each other, with their superiors or with society at large. This is a crucial point. Good communication helps not only to obtain additional skills and experience, but also to share information and expertise with those who pursue activities outside research. In fact, there are junior scientists who engage in various extracurricular initiatives to expand their horizons and increase their skills. Others have succeeded in using this experience to find interesting, secure and well-paid positions outside science. Yet few PhD students or postdoctoral researchers are aware of this.

Moreover, by staying at the bench and not talking to each other, junior scientists lose the opportunity to build up networks and to learn from their peers or through interactions with society. We believe that communicating with society at large is particularly important for junior scientists. Such interactions not only benefit science and society, but also give individual scientists the much-needed skills to become a successful group leader or to find an alternative career.

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If we look at accomplished senior scientists as inspiring examples, we indeed find that much of their success is due to communication. They tend to have a broad network of peers, initiate and orchestrate research collaborations, organize symposia and conferences, write reviews, monographs or books, and sometimes appear on television or in newspapers. They are well-connected, both within science and with society, in contrast to many junior scientists who are often not aware of the alternative contacts and opportunities open to them (Aschwanden, 2006). These role models provide an example of how junior scientists can learn from their success, by developing skills in communication, organization and leadership from an early stage.

Taking the first tentative steps towards acquiring these skills is not as difficult as it might seem, and there are many examples of junior scientists who are engaged in various relevant activities, research-related or otherwise. Take, for example, junior scientists at Cancer Research UK (CRUK; London), the European Molecular Biology Laboratory (EMBL; Heidelberg, Germany), the Medical Genetics Centre South-West Netherlands (MGC; Leiden, Rotterdam) or the Netherlands Cancer Institute (NCI; Amsterdam), who organize their own annual retreats. An annual joint conference for the junior members of CRUK and the MGC, which began in 2000 as an initiative led by PhD students, helps them to establish international networks and scientific collaborations. Similarly, the European Council of Doctoral Candidates and Young Researchers (EURODOC) has organized an annual conference since 2001.

Of course, not every research institution can afford to let its junior scientists organize an annual retreat or conference. However, there are plenty of other opportunities to increase general skills. Lecturing or supervising undergraduate students, for example, can help to develop supervisory and educational skills. Organizational skills can be acquired by participating in institutional social committees or chairing departmental literature clubs. Similarly, junior scientists can assist their supervisors in organizing guest lectures or symposia. In the same way, helping visiting scientists in the laboratory can not only improve organizational skills, but also expand the scientific horizon.

Spending time in other laboratories to learn new techniques or novel methods for operating scientific instruments is a good way to improve skills and the *curriculum vitae* at the same time; it demonstrates initiative, benefits the laboratory in many ways and teaches organizational skills. Moreover, many short-term grants are available to cover travel expenses when visiting other laboratories; therefore, such an experience could also be a good lesson in how to write a grant proposal. This strategy would work for scientists at institutes with either large or small research budgets.

Even if many junior scientists prefer to stay in scientific research, whether at an academic institution or within industry, they still need to realize that interacting with society is as important for them as it is for those who pursue alternative careers. However, such interactions should not be regarded merely as a necessity; in fact, they are another great opportunity to improve communication skills while working for the benefit of science and society. Both the USA and Europe are in dire need of trained scientific personnel, and it is increasingly difficult to attract young students to the natural sciences. Furthermore, scientific research itself is playing an increasingly important role in meeting society's demands, even if many national governments have not yet realized its enormous potential to improve health, the economy and many other social factors.

Pursuing opportunities in education or politics—where scientists are most needed—is therefore a great opportunity both to acquire much needed communication skills and to improve society's attitude towards science. Education is the key for the future development of science. A greater involvement of scientists in politics means that they can achieve a larger stake in determining research budgets, shape future policies, and proactively inform society about scientific progress and developments. It is also advantageous for scientists to use a sabbatical period to interact with society or even to leave science—the more scientifically educated people who enter important fields, such as education and science policy, the better it is for science as a whole.

This implies that younger scientists should get used to promoting science, whether they plan to stay in research or to pursue alternative careers. Indeed, the rigorous training of scientists provides them with excellent tools for use in wider society, as analytical and problem-directed thinking supported by creativity and improvisation have great benefits if supported by other skills.

Becoming a biology or chemistry teacher, or a politician is also a good way to promote science, and can be possible even when working as a full-time junior scientist. An increasing number of universities and research institutes have science education and outreach programmes directed at high-school students. Volunteering some time to work for these is a first step towards acquiring additional experience. Interacting with school children is also one of the best ways to reach out to society. Talking to young people is less risky than engaging in public debates with activists, who are often better trained rhetorically. Young scientists are sometimes not much older than high-school students themselves, and are therefore better suited to pass on some of their enthusiasm about science.

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Other programmes aim to train high-school teachers or invite senior scientists to talk about their work in an ordinary venue, such as a public house or cafe. Interactions with different audiences require the development of different communication skills, and allow young scientists to build up networks that could become useful later in life. Examples of

Table 1 | National junior scientists' organizations across Europe

Country	Association	Web site
Armenia	Ecosocium	–
Austria	Österreichische Hochschüler Innenschaft	www.doktorat.at/en
Belgium	Focus Research	www.ulg.ac.be/obj-rech/
Croatia	Mreža Mladih Znanstvenika (MLAZ)	www.mlaz.net
Czech Republic	Studentská komora Rady vysokých škol (SK RVŠ)	www.skrvs.cz
Denmark	Danske Ph.D.-stipendiaters netvaerk	www.phd-nettet.dk
Estonia	Eesti Noorte Teadlaste Akadeemia (ENTA)	www.enta.ee
France	Confédération des Jeunes Chercheurs	http://cjc.jeunes-chercheurs.org
Germany	THESIS e.V.: Interdisziplinäres Netzwerk für Promovierende und Promovierte e.V	www.thesis.de
Greece	Hellenic Association of Doctoral Researchers (HelAsDR)	www.elepetyd.gr
Hungary	Doktoranduszok Országos Szövetsége (DOSZ)	www.phd.hu/phd
Ireland	Union of Students in Ireland (USI)	www.usi.ie
Italy	Associazione Dottorandi e Dottori di Ricerca Italiani (ADI)	www.dottorato.it
Latvia	Latvijas Jauno Zinātnieku Apvienība (LJZA)	–
Lithuania	Lietuvos Jaunuju Mokslininku Sajunga (LJMS)	http://ljms.lt
Moldova	Pro-Stiinta	www.pro-science.asm.md
The Netherlands	Promovendi Netwerk Nederland (PNN; for PhD candidates) Landelijk Postdoc Platform (LPP; for postdoctoral researchers)	www.hetpnn.nl www.vawo.nl/lpp
Norway	Stipendiat-organisasjonene i Norge (SiN)	www.stipendiat.no
Portugal	Associação dos Bolseiros de Investigação Cientifica (ABIC)	www.bolseiros.org
Russia	All Russia public institution "young researchers of Russia"	http://aeer.cctpu.edu.ru/winn/mir.phtml
Slovakia	Asociácia Doktorandov Slovenska (ADS)	www.ads.sk
Slovenia	Društvo Mladih Raziskovalcev Slovenije (DMRS)	www.drustvo-dmrs.si
Spain	Precarios: Federación de Jóvenes Investigadores (FJI-precarios)	www.precarios.org
Sweden	Sveriges Doktorander (SDok)	www.sdok.se
Switzerland	ACTIONUNI	www.actionuni.ch
UK	National Postgraduate Committee (NPC)	www.npc.org.uk
Europe	European Council of Doctoral Candidates and Young Researchers (EURODOC)	www.eurodoc.net/index.php?lng=en

such activities are co-organized by junior scientists at the Alfred Wegener Institute (Bremerhaven, Germany), EMBL, CRUK, the Erasmus Medical Centre (Rotterdam, The Netherlands), the MGC and NCI, and the Karolinska Institute (Stockholm, Sweden).

Interestingly, there are inspiring examples in poorer countries where young scientists learn teaching and mentoring, coaching and organizational skills. Croatia's Višnjan Observatory and Serbia's Petnica Science Centre have been running science projects aimed at high-school students for more than 25 years. The large number of scientists who volunteer to organize and run these programmes contributes a great deal to their success. If scientists in southeast European countries can organize such activities, larger and richer western European countries could do so as well.

We believe that communicating with society at large is particularly important for junior scientists

Science policy is another key area in which there is great demand for scientists' input. Critics arguing for more European science funding often point to the large US budgets as an example, but usually overlook the fact that there are more scientifically trained advisors in the USA. Consequently, US policy makers have gained a better understanding of the needs and mentality of scientists, which is important for creating and supporting a productive research infrastructure. Furthermore, junior scientists in the USA are more likely than their European colleagues to consider science policy as an alternative career. This is also possible because prestigious scientific organizations, such as the American Association for the Advancement of Science, provide support for young scientists to obtain experience as advisors to politicians and other decision-makers (Sirica, 2000; Leshner, 2002).

Junior scientists—and science itself—have a lot to gain by becoming more involved in policy. Acting as the representative for junior scientists in a department or institute provides the opportunity to engage in local politics outside the laboratory, and to participate in discussions about scientific education and funding. At a higher level, representatives can get involved in the boards of local or national young scientists' associations. This entails learning the highly sought skills of leading and organizing, as well as different facets of communication, such as interviewing and being interviewed, writing articles for newspapers or reports, submitting grant proposals to funding bodies and getting involved with science policy. This is much more than a scientist can acquire by working at the bench. Young scientists' organizations and EURODOC are always looking for new members (Table 1; Urani *et al*, 2004).

It is not necessary to look only to the USA, as European scientists have inspiring

examples too. Many national associations across Europe are much older than their US counterparts—for example, the Dutch PhD Student Council (PNN, formerly LAIOO) was officially registered in 1987, and EURODOC is one year older than the US National Postdoctoral Association (Kennedy, 2001; Tan, 2002). This is remarkable, given the different academic systems and cultures across Europe. Many European countries were stimulated by EURODOC to establish their own national associations. Croatia, Estonia and Lithuania have national junior scientists' associations that have recently founded science outreach programmes for children. For some time, group leaders and senior scientists in Europe have understood that it is good for the future of European science to allow their junior staff to devote part of their time to communicating with each other and with society.

One obstacle, however, might be a group leader's unwillingness to allow junior staff to spend time on non-research activities, even if it broadens their general experience. Some supervisors also dislike the idea of junior scientists engaging in science policy, because they fear that their students might eventually leave science, or believe that outreach activities should not be part of their training. However, although such activities might imply a reduction in working hours, they offer many benefits. Having more scientifically educated people in key positions in society would be advantageous for science in the long term (Kinderlerer, 2004; McComas, 2004). In addition, many young scientists inevitably leave science anyway, owing to the limited number of tenured positions. Furthermore, a former scientist who works in science policy might stay in contact with his or her former supervisor for advice or opinions. Equally, a scientist who returns to the bench after a year away might be asked for advice by former colleagues. Generally, we think that junior scientists should be allowed to take time off from science to undertake extracurricular activities, both during their training and as a sabbatical. In fact, few scientists will invest time and effort in gaining extra skills if this means that they cannot return to science.

In the end, as we have pointed out, it is up to junior scientists to engage in extracurricular activities that broaden their horizons and improve their skills. In this regard, there are many junior scientists in Europe whose activities remain unnoticed, and who could share their experiences and serve as inspiring examples. Junior scientists themselves must prevent this loss by improving their communication skills. Ideally, an international non-commercial 'scientists for scientists' organization could provide young researchers with the means to improve this type of communication. For example, a web portal could list available courses, lectures and activities at European research institutes run by and for junior scientists, and could be updated by one representative at each participating institute. This individual could search for relevant information, get acquainted with the entire scope of research, educational and extracurricular activities at the institute, and look for ideas and representatives at other institutes, thereby providing an infrastructure for more networking among junior research staff.

A network of campus representatives throughout Europe, or the world, would also make it easier for a host organization to mediate Europe-wide initiatives, such as the aforementioned activities in science-outreach programmes for school children, and the longstanding well-coordinated programmes in eastern European and Balkan countries. Promoting science by stimulating young students is contagious, not only for society but also for the junior scientists involved. Even those who have become disillusioned with research might remember their old ideals, and transfer them to the next generation of scientists or society.

The current generation is lucky. The need for scientific advice to solve global problems is increasing. Sabbaticals are becoming more common, and there are more institute-based and young scientist-initiated courses and activities than a decade ago. A large number of senior scientists will retire during the next decade to make way for the next generation (Enserink, 2000; van Vucht Tijssen, 2000). More young scientists are emigrating to western Europe and the USA to study, and then returning to stimulate scientific research in their home countries. The strict distinction between academic and pharmaceutical research is becoming blurred, thereby giving more scientists the chance to move from one to the other (Gannon, 2003, 2006; Steele, 2005). The increased mobility of junior scientists not only improves their chances for professional advancement, but also provides them with many opportunities to broaden their horizons. Taken together, there are plenty of opportunities for individuals to increase their skills and experience, and to eventually find a satisfying job. Junior scientists just need to be aware of these openings and to communicate them more widely.

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