

Nurture your scientific curiosity early in your research career

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Uncertainty makes scientific research challenging and at the same time exciting. Whereas curiosity and passion for uncovering the unknown drive future generations of researchers, the landscape of science has changed. We investigated whether the requirements for having a successful research career are changing, and whether junior researchers are aware of these requirements. Structured discussion with peers and more experienced researchers can point the way forward to an excellent career.

Are strategic decisions threatening to replace scientific curiosity?

Now one rarely encounters high-impact research without large-scale data generation, international collaborations and rapid data dissemination in highly ranked journals. This requires substantial monetary investment and tremendous management skills. Undoubtedly, the new scientific landscape supported by state-of-the-art technological development has brought considerable progress. But this has also brought new demands on researchers. Although the incentive to carry out research is still scientific curiosity, the reality of a career in research calls for many complementary skills. Intellectual and financial independence likely stimulate the risk-taking attitude necessary for scientific excellence, although not everyone would agree on the ways to achieve this. Lately, in many countries, there has been a trend of funding large consortia instead of individual innovative research.

Although the funding of consortia may reduce duplication of efforts and increase the transparency and reproducibility of ‘within paradigm’ research, the impact of this type of funding on the development and support of the next generation of researchers and those looking to overthrow paradigms is uncertain. These changes in the research environment raise an important question: is the present scientific

landscape threatening to replace scientific curiosity with strategic decisions? One of the main challenges that junior researchers face today is acquiring the necessary skills to take part in these decisions, often without a clear structure at universities that support the development of these types of skills.

Junior researchers on a quest

Junior faculty members at Karolinska Institutet and Nature Publishing Group recently organized a workshop entitled “An Excellent Research Career.” Its goal was to define what is required for an optimally successful research career today and what junior researchers should do to meet these demands. The workshop included lectures on sustaining funding throughout the research career; choosing a productive experimental system; postdoctoral research and changing fields; establishing and sustaining collaborative research; working with journals and peer referees; and choosing basic versus translational research. The invited speakers shared their experiences and perspectives with more than 100 highly motivated participants, including PhD students, postdocs, assistant professors and senior researchers. The combination of topics was selected to provide inspiration for subsequent group discussions that included: drafting a postdoc contract; fair collaboration between laboratories; practices that encourage integrity, credit for honesty and robust results; picking a productive experimental system;

and regular versus high-risk publications. A summary from each group then launched a general discussion about what it takes to have a successful research career in the current scientific environment. The workshop was followed up by a web-based survey that provided additional views and suggestions (on the basis of answers from 79 participants). Together, the lectures, discussions and survey questions highlighted challenges facing junior researchers today, and we discuss the key take-home messages below.

Perception of the ‘now’

Not to our surprise, the majority of participants were postdocs, and the second largest group attracted by this topic was PhD students. This suggested that there is already a need for the dissemination of this type of information during early career stages. The results of the workshop were that although junior researchers know what is expected of them in their current positions, they often do not know what the current career system is and when the next transition will occur (Fig. 1). It is thus not unexpected that less than one in five postdocs is optimistic about his or her career, lacking information about what path to follow. Junior researchers often focus on garnering a multitude of experiences and accolades in the hope of becoming competitive enough for the next stage, without actually knowing what this next stage entails.

Junior researchers are uncertain about the general trends in research funding and policy

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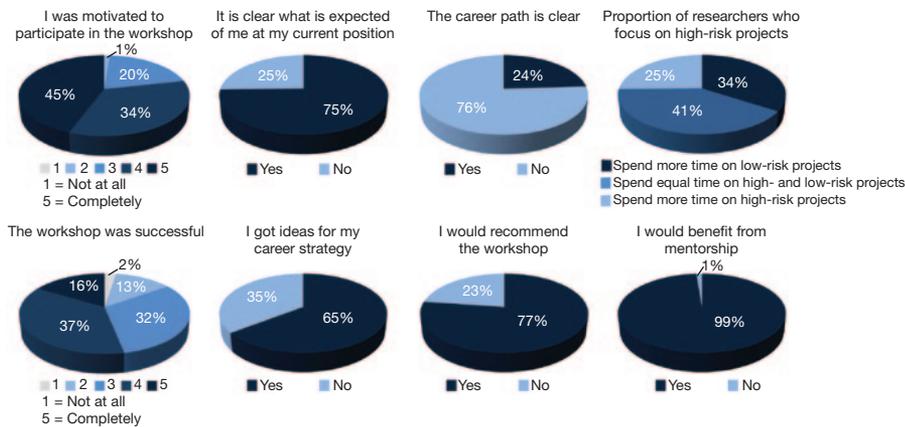


Figure 1 Attitudes and opinions of workshop participants. Pie charts illustrate the results based on a web-based survey from 79 workshop participants.

Even in a supportive environment, time constraints and the associated pressure influence the balance between regular and high-risk publications. Among the workshop participants, only a quarter believed that they focus their efforts on high-risk projects (Fig. 1). This illustrates that all the aforementioned factors lead to too much uncertainty, which in turn favors what some perceive as strategic thinking, potentially at the expense of creativity and scientific curiosity.

Wishing for a better future

Junior researchers need the explicit interactions practiced in a workshop format to learn the business of research. Not only did the participants find the workshop useful, but a majority developed ideas on how to improve their research career (Fig. 1). They seized the opportunity to share experiences, and discussion was lively. Interactions, both with experienced researchers and with peers, were highlighted as the most useful part of the workshop (Box 1). It was through these structured interactions that valuable information and practical advice were exchanged. The personal reflections of experienced researchers, editors and representatives

for the future and, more specifically, need to know whether there will be resources allocated for their as-yet mostly untested ideas. Such uncertainty stems from the often frequent changes in amount and type of funding available. Recently, the trend has been to invest in large projects and consortia, favoring well-established groups. Simultaneously, as many funders went through substantial budget cuts, many changes were made to the available career systems in a very short timeframe. On top of all these challenges, many junior researchers perceive a lack of clarity in recruitment and advancement criteria.

As discussed at the workshop, all these sources of uncertainty make it harder to plan one's career, and indecision is arguably taking its toll on motivation and creativity today. It is important to realize that truly novel findings often stem from serendipity. Exploring the unexpected should be encouraged and supported—meaning more weight should be placed on the potential of an applicant rather than focusing solely on the track record when evaluating junior researchers. Having a stable career system with transparent requirements would allow junior researchers to focus on scientific questions rather than on compliance with consensus strategies and unrelated survival skills.

In light of the demand to produce publications rapidly, junior researchers fear that every experiment must produce a figure for publication. Selecting the research environment has therefore become increasingly important. Successful research requires a supportive environment that fosters good ideas and provides necessary resources to enable one to follow those ideas. A productive experimental system should be novel, incorporate state-of-the-art technology and be flexible in response to changing trends. High-impact publications require not only risk-taking and a

novelty-seeking attitude but also demand more time to validate and defend, which often means an increased demand for financial and other support. In reality, this translates to the ability of junior researchers to select the environment that will support their development and their research. Practically, this means that one should be prepared to change fields and even location and to choose advisors carefully.

BOX 1 SELECTED COMMENTS FROM WORKSHOP PARTICIPANTS

What was most useful?

- Interactions with experienced researchers and with peers
 - Information about publishing, funding, networking and selecting a research topic
- “Both to get expert advice from veterans and to discuss with peers.”*
- “Realizing that other people have the same problems. Talking to experts in a more private setting.”*
- “Personal reflections from the speakers and interactions with other participants.”*
- “Keep these kinds of program[s] running.”*

What should be covered in more detail?

- The importance of good mentorship
- How to develop leadership skills (motivation, budget handling and time management)
- How to handle conflicts
- Practical tips
- Experience from successful junior researchers
- Alternative careers

“The importance of mentorship and scientific collaborations hasn't been outlined enough, maybe because the European research community lacks a strong mentoring culture compared to English/American [...] leadership skills in terms of self-motivation/motivation of others, teamwork and management skills, which become more important once you are setting up your own group/lab.”

“Most presentations only showed how ‘the old guys’ made it, but they forgot to mention what are the pitfalls during your career and they didn't acknowledge the tremendous competition that there is nowadays compared to when they were young.”

“Success stories are motivating but not always reflective of the vast reality—so more hands on from folks who have faced tough situations and have tips.”

“It was nice to hear some stories of people that made it but really how many people having a similar strategy did not.”

of funding agencies gave junior researchers insight into how their work is evaluated and how it can be improved. This was augmented with practical information, gained through personal reflections of peers. One aspect of research that emerged as imperative was the need for complementary collaborations that are becoming crucial for high-impact, often interdisciplinary, and breakthrough research. Most long-standing collaborations are initiated during junior research years and are sustained by trust, mutual respect and an attitude of giving more than taking.

Some feedback for improvement was also obtained through the survey. Participants overwhelmingly agreed that they would recommend this workshop to their colleagues but were also eager to suggest complementary topics for future workshops. We were alarmed by our findings of mentorship failure and a dearth of continuous dialog with experienced researchers. There is an overwhelming need for leadership training in scientific management and ethics already during early career stages (Fig. 1 and Box 1). Today, scientific skills are not sufficient for a successful research career. Equally important are the abilities to recruit and train lab personnel, motivate students and postdoctoral colleagues to do their best work, obtain funding and handle both budgets and time. Preparing postdocs and newly established researchers for the transition to managerial career positions should be the collective responsibility of the universities and affiliated subsidiary institutions. Accordingly, this should be in the interest of funding bodies and thus also should be their responsibility to ensure that their successful candidates receive leadership training and mentoring.

In addition to the benefits for junior researchers, this workshop provided an opportunity for established researchers to reflect on how the research climate has changed since they embarked on their careers. This is important because established researchers influence future career opportunities but often do not fully take into consideration the

Table 1 Template for the early-career workshop

Topic	Questions	Speakers
Research career	Career paths Key steps Alternative careers	Experienced researchers Successful junior researchers Recruitment specialists
Future of funding	Projections for future funding Funding opportunities and sources Funding individuals versus networks Criteria for a successful application	Representatives from funding bodies (governmental and private agencies) Experienced reviewers
Selecting field and experimental system	Selecting a productive model system Adopting and developing novel methodologies Balance between high- and low-risk projects	Experienced researchers Innovation experts
Collaborations	Types of collaborations How to initiate successful collaborations Key aspects of successful collaborations Networks and consortia	Experienced consortia coordinators Junior researchers in consortia
Publication strategy	Quality versus quantity High-risk versus low-risk publications Key aspects of successful writing Publishing procedure Importance of impact factor Scientific integrity	Editors Senior and junior researchers Writing consultants
Leadership and management skills	Recruitment Mentoring Time management Budget management Communication Conflict management	Academic leaders Leadership program manager Experienced researchers Successful junior researchers Career coaches

extensive changes that have taken place in the way research is conducted today. The last decade has witnessed the impact of large constellations compared to lone investigators. However, the interpretation and the assessment of intellectual contribution and independence are not evolving as rapidly.

Concluding remarks

On the basis of our experience, we recommend other junior researchers to organize similar workshops. To facilitate this, we present a template based on our workshop and suggestions from the participants (Table 1). Junior researchers at different stages of their careers face different challenges, and this template can be modified to address the specific needs of the participants. Personal reflections and practical advice from both successful junior and established researchers are the key to awakening researchers to the need to take the strategic decisions that lead to success. The strength of

the workshop format is that it allows junior researchers to benefit from the experiences of others while transcending levels of seniority and competence to formulate a personal career strategy that preserves the unequivocal role of scientific curiosity.

URL. Junior Faculty at Karolinska Institutet, <http://www.ki.se/juniorfaculty>.

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COMPETING FINANCIAL INTERESTS

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