

Young researchers to tackle future *Grand Challenges*

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Grand challenges

We are all painfully aware that the future contains many challenges and threats that need to be addressed in order for humanity to survive. Areas requiring decisive action include food supply, climate, water, energy, healthcare and pandemics (Fig. 1). The term *Grand Challenges* was introduced in the late 1980s as a US policy term referring to goals in computing and communication, but has now shifted to include all major global challenges. During the Swedish EU presidency in autumn 2009, the Lund Declaration¹ was written, containing the recommendation that the EU research framework should focus on solving future *Grand Challenges*, changing from the previous themes that had been identified in the early 1990s. Global and national political discussions have become more focused on the need to join forces to attack the *Grand Challenges*, and research and science are often hailed as two of the most important tools to enable this. Some controversial questions exist however, such as: who should direct the research; in what areas is research needed or beneficial to attack the *Grand Challenges*; and are decision-makers better suited to identify global needs than scientific researchers?

We believe progress in solving the *Grand Challenges* will come through close collaboration between decision-makers and researchers. Furthermore, we particularly believe that young researchers are ideal partners in these discussions for

a variety of reasons. First, young researchers are the next generation of leaders and will play a dual role in influencing their own research as well as policy-makers over a long period of time. They are still active researchers and can, with the awareness of the *Grand Challenges*, drive their own research into new and unexpected fields. They will themselves live in and have to tackle the *Grand Challenges*. Second, we believe that young researchers are often more creative and unorthodox than their senior colleagues. Young researchers will look at the *Grand Challenges* with a new perspective and new ideas. Third, to solve the future *Grand Challenges*, a true interdisciplinary attitude and course of action is needed. We believe that young researchers are more adept at working in an interdisciplinary manner than their senior colleagues and interact more easily over the traditional scientific borders. This will be absolutely crucial to finding new solutions to new challenges and we anticipate that new, hitherto unknown, scientific disciplines will be created.

Young academies

Many of us agree that young researchers are crucial for the future, however they often struggle with unclear career paths, independency, and financing. In order to organize young researchers as a group and to make them more visible to policy makers and others, a number of so-called *Young Academies* have started throughout the world. More than 10 years ago, Die Junge Akademie² was created in Germany, by the initiative of two distinguished academies, the Berliner-

Brandenburgische Akademie der Wissenschaften³ and the Leopoldina.⁴ The purpose was to bring together outstanding young researchers within all disciplines to promote science and interdisciplinary collaboration, but also to give young researchers a policy platform.⁵ This became a huge success and since then a number of *Young Academies* have started in many countries, ranging from South Africa to Sweden. Last year a “Global Young Academy” was inaugurated, representing outstanding young researchers from around the world with the goal to become “the voice of young scientists around the world”.⁶ *Young Academies* are complementary to the older and distinguished scientific academies that exist globally. There is a need and an incredible enthusiasm among the young researchers themselves to join and interact across traditional scientific borders. Membership of a Young Academy is limited to 4–5 years and members can begin up to 10 years after completing their PhD dissertation (there is some variation between the *Young Academies*). The criteria for being selected are often scientific merit, proven engagement in interdisciplinary collaboration, or the ability to communicate scientific ideas and results to policy makers. Our experiences show that these interactions are easier for younger researchers, and they can be more effective than their more senior colleagues in influencing policies.

We have interviewed Professor **Bruce Alberts** (Fig. 2), Editor-in-Chief of *Science* magazine, who is a strong supporter of the Young Academy movement. “Through its connection to a prestigious national science academy, each

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Fig. 1 *Grand Challenges* include, for example, food supply, climate, water, energy, health and pandemics.



Fig. 2 Professor Bruce Alberts, Editor-in-Chief of *Science* magazine, is a strong supporter of the *Young Academies* concept.

Young Academy is empowered to exert national leadership in advancing science through projects that the young scientists themselves determine. These young scientists can often be more effective than their older peers in interactions with the society and with politicians. They also bring new energy to these interactions, with a better gender balance due to the advances that women scientists have made in recent decades". Furthermore he says "By bringing together outstanding scientists from many different disciplines, Young Academies catalyze the formation of multidisciplinary scientific collaborations that generate innovative new discoveries. Participation in a Young Academy also strengthens a nations' scientific enterprise by training the next generation of leaders. The work exposes them to important policy

issues while building networks of trusted personal relationships that can bridge disciplines for a lifetime". To sum up, he ends with: "We need to help the next generation of science leaders to network around the globe, so that science can become a much more central part of the input to decision makers in each nation. The Young Academy movement is well positioned to drive the creation of the tolerant, rational societies that the world so badly needs."

The Young Academy of Sweden

The Young Academy of Sweden (Fig. 3) was started by an initiative of the Royal Swedish Academy of Sciences.⁷ It held its inaugural meeting in May 2011. The purpose of the Young Academy of Sweden is to bring together some of the best young researchers in Sweden within all disciplines to encourage dynamic interactions. Interdisciplinary projects, science policy reports and activities towards society are expected, some of which have already happened. For example, two weeks after the inauguration, the Young Academy of Sweden was invited to an open hearing in the parliament together with research councils, unions and senior academies, regarding research and innovation questions. A statement in the open consultation arranged by the European Commission on "The Green Paper on a Common Strategic Framework for future EU Research and Innovation Funding"⁸ was produced and a workshop with the theme "Universities as creative environments?" was arranged, where

members from the Young Academy conversed with leaders from universities, research councils, and the ministry of research and education. The Young Academy of Sweden wants to engage in activities of all kinds, from organizing summer schools for young research-interested students, to participating in the debate on the next research bill in Sweden.

The 22 members are some of the most talented young researchers in Sweden and have been selected due to their proven enthusiasm to engage in something more than their own specific research projects. When meetings take place there is a fantastic dynamic in the discussions and there is a strong energy of wanting to participate and influence the current structures within, for example, the university or research councils.

Professor **Torsten Wiesel** (Fig. 4), Nobel laureate in Medicine or Physiology in 1981, is the Young Academy of Sweden's scientific patron. Professor Wiesel is a true spokesperson both for the potential of young researchers and for the importance of interdisciplinarity. Professor Wiesel said "*The creation of the Young Academy of Sweden is important in Sweden so that young researchers will be taken seriously by senior colleagues and authorities. I believe that the academy could be an effective instrument to stimulate outstanding research, which in turn will inspire the next generation to follow course... My hope is that the Young Academy of Sweden will formulate policies with clear programs requiring the attention and support from the leaders in government and universities. People tend to pay more attention to the voice of the younger generation than the older. We all know that the future lies in the hands of the young ones.*"

The role of lab on a chip technology in tackling the *Grand Challenges*

The role of lab on a chip technologies in tackling the future challenges was discussed with the Editor of *Lab on a Chip* journal **Harpal Minhas**. In summary, he indicated that lab on a chip technologies will certainly play a significant role as part of the solution to some of the *Grand Challenges* and problems that lie ahead in many areas. Lab on a chip application



Fig. 3 The logo of the Young Academy of Sweden.

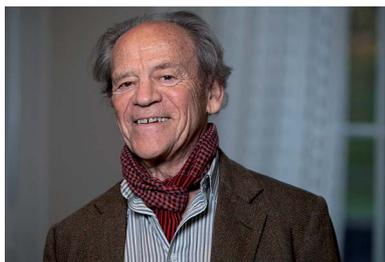


Fig. 4 Professor Torsten Wiesel, Nobel laureate in Medicine or Physiology in 1981, is the scientific patron of the Young Academy of Sweden.

areas are extensive and have included agriculture, water monitoring, food testing, fuel cells, quantum mechanics, cell culture & tissue engineering, cytometry, medical diagnostics, gene therapy and delivery, imaging, energy storage and neurology. It is clear that industry is now recognizing the value of lab on a chip and microfluidic technologies, as major instrument manufacturers are acquiring companies with microfluidic expertise (Perkin Elmer's acquisition of Caliper Life Sciences and Sony's acquisition of Micronics to name but two). Additionally, there are now dozens of microfluidic-based instruments entering the market. Some major instrument manufacturers already include microfluidic chip devices in their instruments to enhance performance and efficiency, but do not mention the technology in their literature.

Also, there is great movement into the point-of-care diagnostics field by many companies who believe they have the answers to some significant diagnostics issues. One example is Biocartis, who are working on a system to detect and quantify multiple DNA- or RNA-based biomarkers in a wide variety of patient sample types with truly minimal user

intervention. A second system has been built around disposable, microfluidic cartridges with digitally encoded micro carriers for the rapid and sensitive detection of a broad range and number of biomarkers. The first product from this technology will focus on protein-based biomarkers for the immunoassay market.

These successes in our own field and the buy-in of major manufacturers are a clear indication of the potential of lab on a chip technologies and it is inevitable that this will now start to permeate into other areas where microfluidics and lab on a chip can be a game-changer in helping to solve really difficult problems. In biology, for example, chip technologies and micro/nanofluidics are ideally suited to providing new insights on diseases and on cancer through experiments at the single cell and single molecule level. Lab on chip technologies may not be the whole answer to some of the *Grand Challenges* of the future, but we certainly believe that they will have a significant role to play.

We also asked Harpal Minhas how he sees the role of young researchers in the lab on chip field compared to other fields?

"I am hugely impressed by many of the young researchers in our field as they must have a multitude of talents and knowledge of a diverse range of subject areas to be successful. They have to have engineering skills, and knowledge of physics principles and fluidics; knowledge of chemistry and biology to handle biological materials, as well as some knowledge of materials. At the Lab on a Chip journal we are very aware of these demands and this is why we have produced features such as Chips & Tips to help with the tips and tricks required to make things work—things that are not published in any paper. Seeing microfluidics in action is probably one of the most motivating factors influencing new young

researchers to our field and this is why we feature LOC videos on YouTube free of charge for all. We are also currently running a series of articles on education and learning, to help future young researchers gain knowledge of the tools and principles required when entering this field.

The motivation to file patents and set up companies differentiates young researchers in our field the most from other areas of science. The upside of this is that now young researchers are very aware of the commercial requirements of their research as well as the academic requirements, which makes for a more rounded and informed world-view. This has certainly come across when I have visited academic institutions or attended conferences."

Enforcement of young researchers in Europe

In 2007, the European Research Council, ERC, started as a new initiative by the European Commission in the 7th framework programme.⁹ From the beginning, the ERC scientific council showed great support for young researchers by initiating the ERC Starting Grant, a grant aimed at making young researchers independent. As of 2011, almost 1500 young researchers (up to 12 years after completing their PhD dissertation) within all scientific areas have received substantial grants for up to 5 years in order to be independent and start their own research groups. This has made an enormous impact on the scientific landscape and one of the unique characteristics of the grant is that funding is given to the researcher and not to the university. This has strengthened the position of young researchers in Europe enormously and has given them a chance to make demands from the universities. The number of ERC grantees is becoming a quality indicator, almost like the Shanghai ranking,¹⁰ for universities. The ERC has furthermore been a strong advocate for inter-disciplinarity, something that has been specifically requested in their calls. We are strong supporters of the ERC and in what they do to strengthen the role and possibilities for young researchers in Europe. We asked Professor **Helga Nowotny** (Fig. 5), the president of ERC, some questions regarding young researchers, young academies and the *Grand Challenges*: "Young researchers are the next



Fig. 5 Professor Helga Nowotny, the president of ERC.

generation of leaders in science. Personally, I have always tremendously enjoyed working together with young researchers, because they are full of curiosity and enthusiasm; they have a fresh view on how things can be done. The future Grand Challenges offer many opportunities, but perhaps the greatest challenge within the Grand Challenges is to come up with novel perspectives and approaches. In my view, this is the biggest contribution that younger researchers can make.”

What is the status of young researchers in Europe today? “It is a common understanding nowadays that one of the problems for the European Research Area lies in the still far too hierarchical organization of scientific research institutions. Thus, younger researchers have to wait longer to reach a position that really fits their capabilities and ambition. From the perspective of the young scientist, there are often only two options: either to move abroad, or to deal with the situation and stay in positions that do not really fit their ambition and competence. Clearly, both options are not

ideal for the European Research Area. In this regard, I think the ERC Starting Grant provides an excellent third option, namely the opportunity for the young researcher to enjoy independence in his or her research. It also helps to raise the visibility of their work not just at national, but at European and international level. For the ERC this means an unbroken continuation of rising application numbers as with every call there are more talented young scholars and scientists who apply for funding. This gives a clear indication that for those who have finished their training and are now eager to prove their independence and excellence in research, there is a real need for this third option. It is important that European universities learn how to better nurture the next generation of scientists.”

What role could Young Academies play? “Young academies could play a vital role in making young researchers more visible, but particularly, to give more weight to their struggle for earlier scientific independence and respect within their national research community and beyond. But let us not focus exclusively on national contexts: In my opinion, a truly European outlook and understanding of how the European research system works becomes more central for all kinds of research policy decisions. Young academies – where they already exist – should therefore be ready to also engage on the European level. The shift to European engagement in research is extremely important, and also a great chance to overcome national patterns of research organization. If the role of academies is to make the voice of science heard both in society and among policy makers, the role of young academies is to bring in a view of the future which may differ – and

may be more adequate – to help shape what will actually happen.”

Taken together, there is currently a large and energetic force for the establishment of young academies worldwide and we hope and believe that this force will be considered as a helpful tool for policy makers in decision-making. We hope that the energy of young researchers will be used to attack the urgent questions summarized by the Grand Challenges. Young researchers are prepared to take responsibility for these important questions, and as evidenced by the responses of highly distinguished researchers, there is a strong belief that young researchers hold the key to the future. We are ready to participate and you know where to find us. Welcome!

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