ISSN 222-7369

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YEAR 2012
VOL.24 NO.1

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TWAS newsletter

NEWSLETTER OF THE ACADEMY OF SCIENCES FOR THE DEVELOPING WORLD

Published with the support of the Kuwait Foundation for the Advancement of Sciences

THE PAST DECADE HAS EXPERIENCED A DRAMATIC CHANGE IN THE LANDSCAPE OF SCIENCE AND TECHNOLOGY. NEW POWERHOUSES HAVE EMERGED. IN FACT, A GROWING NUMBER OF DEVELOPING COUNTRIES ARE NO LONGER PERCEIVED AS DEVELOPING COUNTRIES. THEY ARE NOW REFERRED TO AS EMERGING ECONOMIES. BUT WORDS ALONE CANNOT CAPTURE THE SCOPE OF WHAT IS HAPPENING.

Building Partnerships

You no longer need to head North to access high-level scientific knowledge. China, Brazil, Malaysia, Mexico, South Africa, Turkey – to name just a few of a growing list of countries – offer alternative destinations. Poor developing countries now have access to new knowledge at an affordable cost. Equally important, they have increasing opportunities to use that knowledge in ways that will stimulate economic growth and curb brain drain – creating a virtuous circle of progress.

However, although it is certainly true that the landscape of science is changing, we must still not forget those countries that continue to be left behind in both technology and innovation.

The progress that has been made is undeniable but it has also been uneven. So as we congratulate ourselves for what has been done, we must remember that much more needs to be done if we are to reach our ultimate goal: to build scientific capacity in all countries in ways that enable science to become a global enterprise in the truest sense of the word.

That is why in my first full year here as executive director, I have chosen to focus on TWAS's wide-ranging capacity building programmes. The Academy's programmes are based on this abiding principle: scientists in all developing countries should be given opportunities to pursue productive and rewarding careers without having to leave their home countries.

CONTENTS

TWAS NEWSLETTER
Published quarterly
with the support of the
Kuwait Foundation for the
Advancement of Sciences (KFAS)
by TWAS, the academy of sciences for
the developing world
ICTP Campus, Strada Costiera 11
34151 Trieste, Italy
tel: +39 040 2240327
fax: +39 040 224559
e-mail: info@twas.org
website: www.twas.org

PRINTING
Stella Arti Grafiche, Trieste

Cover image:
MurdocSnook/deviantART

TWAS's strategy rests on three inter-related initiatives: doctoral training programmes *for students seeking advanced degrees, conducted in collaboration with scientific institutions in the South;* research grants *for scientists early in their careers to help improve their prospects for success; and* scientific mobility, *which promotes South-South scientific exchange by enabling researchers to visit other institutions to foster collaboration.*

CHANGING LANDSCAPE

As the 2010 UNESCO Science Report *observes: "Achieving knowledge-intensive growth is no longer the sole prerogative of the highly developed countries." Statistics presented in the* Report *tell the story. Between 2002 and 2008, the share of papers written by scientists from developing countries published in international peer-reviewed journals rose from 21% to 32%.*

Similar shifts occurred in the number of researchers and level of investments in research and development. For example, in 2002, scientists in developing countries accounted for 30% of the global scientific community; by 2007 the proportion was 38%. Meanwhile, the developing world's global share of gross domestic product spent on research and development (GERD) rose from 17.2% in 2002 to 23.7% in 2007. Notably, during the same six-year period, the GERD in the Least Developed Countries (LDCs) remained alarmingly stagnant at 0.1%.

A closer look at the statistics reveals that this dramatic shift has been profoundly uneven. In fact, just six countries in the developing world account for more than three quarters of the scientific papers published in peer-reviewed international journals authored by scientists from the South.

China alone has more than doubled its output in scientific publications in less than a decade and is now responsible for 10% of the world's output. It recently outpaced both Japan and Germany to become the world's second most prolific source of scientific publications behind the United States.

TWAS, on the other hand, has identified 81 developing countries that can be defined as scientifically lagging. The majority of these countries are in Africa and the Islamic region. These are the countries that have been left behind in this new landscape.

Moreover, even in those regions with limited scientific capacity, there are disturbing disparities in scientific output. Six countries in Africa, led by South Africa and Egypt, account for two-thirds of the continent's scientific output.

The stark reality is this: the North-South gap in scientific capacity is narrowing on a global scale. But the country-to-country gap remains as wide as ever. A bi-polar world in science has become a multi-polar world in science. The age-old problem of yawning disparities between scientifically advanced and scientifically lagging countries persists – only in a different configuration.

NEW CONTOURS

Policymakers in developing and emerging economies now ardently believe that science and technology are among the most important drivers of national economic growth and material well-being.

Listen to the policy speeches of the leaders of Brazil, China and India to hear how important science and technology have become. Examine the policies that have served as the foundation of their recent success. Scrutinize the plans they have presented for the future.

Equally important, a lengthening procession of nations – Argentina, Chile, Indonesia, Malaysia, Mexico, South Africa and Turkey, for example – have joined these emerging countries, sparking a historic global transformation that is re-ordering the world as we have known it.

The visions that the leaders in these countries have articulated, and the concrete measures that they have taken to transform their visions into reality, are infused with science and technology.

Nevertheless, no one would contend that science and technology alone are sufficient to spur the changes that we are currently witnessing.

There is the need for political reform and 'intellectual ferment'. There is the need for economic reform. There is the need to reform regulations and the rules under which trade takes place. And there is the moral imperative to improve the status of women and other marginalized members of society.

NAVIGATING THE NEW LANDSCAPE

One of the most significant factors for any country to consider when embarking on a long-range strategy for sustainable science-based development is the importance of strengthening a country's educational system, notably its graduate and postgraduate studies in scientific disciplines.

The most significant steps that developing countries can take to improve their prospects for sustainable development would be to expand opportunities for their young people to obtain batchelor's, master's and doctoral training in science and technology.

My own personal good fortune, for which I will be forever grateful, was derived from receiving a scholarship to attend the Catholic University of Louvain in Belgium at a critical stage in my life when I was in my twenties.

The good news is that a growing number of countries are engaged in educational reforms that promise to significantly raise the number of students pursuing not just undergraduate university degrees, but master's and doctorate degrees as well.

Equally encouraging, countries are pursuing a set of diverse strategies to achieve this goal. This provides other countries with a wide range of potential models to adopt.

- *China has sent nearly one million students abroad over the past three decades and has now built a world-class infrastructure to welcome them back.*

- *India, through its Innovation in Science Pursuit for Inspired Research (INSPIRE) programme, offers stipends to encourage students to enrol in science courses and pursue careers in science. And it now plans to build a nationwide fleet of central universities, institutes of technology, polytechnic and vocational schools, and skills development centres.*
- *Brazil has brought basic research and development closer together through the creation of innovative sectoral funds. The result has been greater economic returns from scientific knowledge and technical know-how. The effort has had significant pay-offs in advancing such fields as oil and natural gas exploration and production, microelectronics, pharmaceuticals, and energy from biomass and nanotechnology.*

I have been fortunate enough to see these policies at work during my visits to TWAS's Regional Offices over the course of the year. The results are more than impressive. They are inspirational.

WELCOMING THOSE LEFT BEHIND

In the midst of this dramatic transformation in global higher education and scientific research, what can an organization like TWAS do – both on its own and in collaboration with other international organizations?

Given the scope of what is occurring in terms of educational expansion and reform in many developing countries compared to the modest size of TWAS's budget, you might think the answer is: 'not much'.

But that would not be true. TWAS currently offers more than 300 postgraduate and postdoctoral fellowships each year to students living in developing countries. The initiative is implemented in partnership with Brazil, China, India, Iran, Kenya, Malaysia, Mexico, Pakistan and Thailand.

The programme, which enables students in scientifically lagging countries to study in centres of excellence in other developing countries, represents the largest South-South fellowships programme in the world. TWAS spends an estimated USD350,000 a year to cover the travel costs for grant recipients and to administer the programme. This investment, in turn, leverages an estimated USD3 million from the host countries to cover tuition, accommodation and living costs.

There are two things that are striking about this programme.

First, how inexpensive it is. Where else would it be possible to garner such a lasting return on an annual investment by TWAS of less than USD400,000? The investment will enrich the minds of some of the most promising young people in poor countries. It will also continue to pay dividends for decades after the training is complete and the degree is bestowed.

Beyond the research conducted by each of these individuals, think of the additional minds that are enriched by their *teaching and training. Hundreds of teachers teaching thousands of students each*

year. It's not hard to see how quickly the figures add up.

And this leads me to my final thought. I am convinced that we must substantially increase the supply of postgraduate and postdoctoral fellowships for young people in developing countries.

So here is my dream. It is a dream that calls for raising the number of fellowships offered by TWAS from its current figure of 300 to 1,000 by adding 150 additional fellowships a year over the next five years. By the time that TWAS celebrates its 40th anniversary in 2023, I hope that we have helped to train more than 5,000 PhDs across a broad range of fields in science and technology.

NEW HORIZONS

TWAS believes that the new global landscape in science has created new horizons for science-based development and innovation that will benefit the entire world. And the Academy is not alone. As Bill Gates recently noted in a report presented to the G20 leaders in Cannes, France: "Countries like China, Brazil, India and Mexico are in a great position to work closely with poor countries because they have recent experience in reducing poverty, as well as enormous technical capabilities. This unique combination gives them both the insights and skills to create breakthrough tools for development."

Gates went on to declare that: "I am convinced we can create a new era in development." He said the reason for his optimism was this: "The group of countries able to contribute resources to development is larger than ever before [and] the number of people who can spur innovations is much larger than in the past."

The current global financial crisis has cast a shadow over the prospects for economic growth, especially in Europe and the United States. But if we widen the lens and extend the time frame, we have ample reason to believe that the world is on a path to a better future – thanks, in large measure, to the rapid growth in scientific and technological capacity in the developing world.

This makes the work of institutions like ours more important than ever. As the new director of TWAS, I very much look forward to establishing partnerships with these emerging countries. Together we can advance our common goals – goals that I believe are closer than ever before. ■

This editorial is based on a speech presented by Romain Murenzi to the World Science Forum in Budapest, Hungary, 16-19 November 2011.

A NEW ERA OF GLOBAL CHANGE

RECOGNIZING THE GROWING INTERDEPENDENCE BETWEEN SCIENCE AND SOCIETY, THE HUNGARIAN ACADEMY OF SCIENCES (HAS), THE UNITED NATIONS EDUCATIONAL, SCIENTIFIC AND CULTURAL ORGANIZATION (UNESCO) AND THE INTERNATIONAL COUNCIL FOR SCIENCE (ICSU) JOINTLY ORGANIZE THE BIENNIAL WORLD SCIENCE FORUM (WSF) TO FACILITATE DIALOGUE BETWEEN SCIENTIFIC COMMUNITIES, POLICYMAKERS AND SOCIETY.

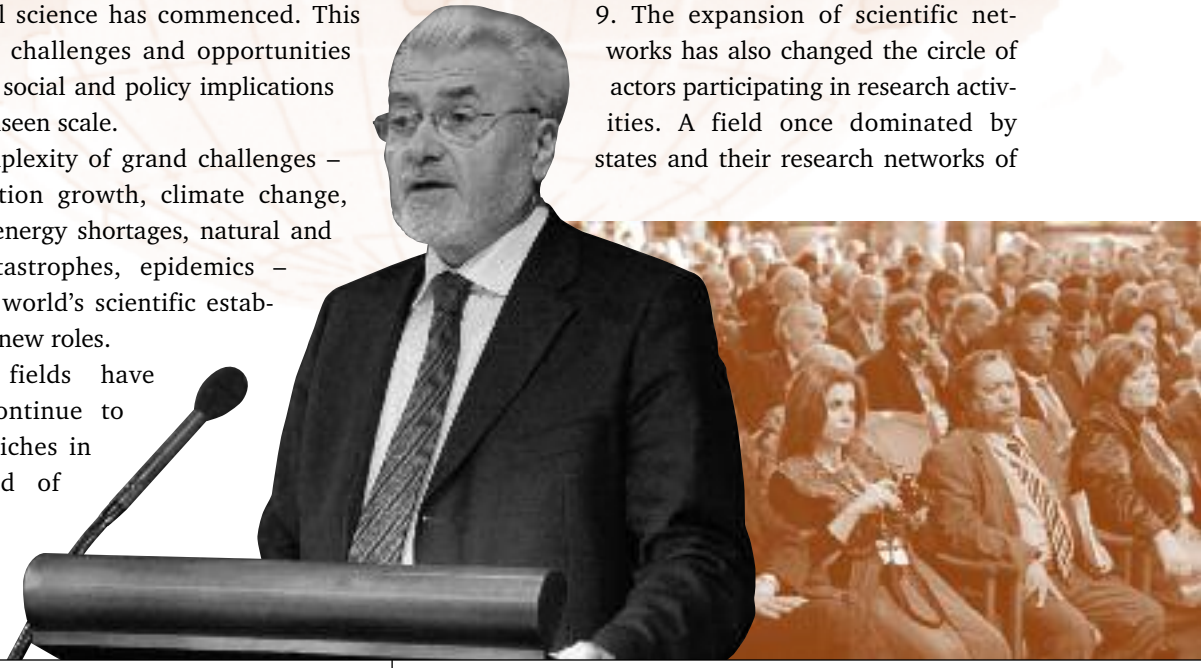
For many participants, the highlight of WSF 2011 was the closing event, which, for the first time since the Forum was initiated in 1999, endorsed a final statement. The 'Declaration on a New Era of Global Change' was read out by József Pálinkás, president of both HAS and WSF. In its recommendations, the Declaration identifies five areas for particular attention: responsible ethical conduct of research and innovation; improved dialogue with society on scientific issues; further promotion of international collaboration in science; collaborative policies to overcome knowledge-divides in the world; and the need for strengthening capacity building in, and for, science.

TEXT ADOPTED BY THE 5th BUDAPEST WORLD SCIENCE FORUM ON 19 NOVEMBER 2011

Preamble

With the encouragement and support of our partner organizations, the United Nations Educational, Scientific and Cultural Organization (UNESCO), the International Council for Science (ICSU) and all invited organizations and fellow scientists, we, the participants of the Budapest World Science Forum held from 17 to 19 November in Budapest, recognizing the relevance of the outcomes of the 1999 World Conference on Science (WCS) and taking into account the reports of the biannual World Science Forum (WSF), as well as the debates and the outcomes of this World Science Forum on the "Changing Landscape of Science: Challenges and Opportunities", adopt the present declaration.

1. The treasure of scientific knowledge and its underlying research approaches are a common heritage of humankind. More than ever before, the world will be shaped by science.
2. The first decade of the third millennium has witnessed steady and fundamental changes in the global landscape of science. The scale and scope of these transformations are so robust that a new milestone in the history of science has been reached, and a new era of global science has commenced. This new era presents challenges and opportunities bringing political, social and policy implications on a previously unseen scale.
3. The growing complexity of grand challenges – including population growth, climate change, food supply and energy shortages, natural and technological catastrophes, epidemics – requires that the world's scientific establishments assume new roles.
4. New scientific fields have appeared and continue to carve out their niches in the general field of science.
5. The unforeseen spread of information and communication technologies, the inexpensive and instant access to information resources and databanks, and the fall of communication barriers between countries and communities have accelerated the accumulation and dissemination of knowledge.
6. The former triadic dominance of North America, Europe and Japan in global knowledge production has been seriously challenged, and a new multipolar world of science has emerged accompanied by the rise of new scientific powerhouses, which are now not only prominent actors in world economy but have become key players in cutting edge research and development activities.
7. In this new context of global science, science diplomacy is now an acknowledged tool to promote partnership among nations by fostering scientific cooperation.
8. Educational systems have received strong support from their respective governments to the extent that emerging countries currently produce more university graduates and PhDs than the developed world, thus rearranging the entire global 'knowledge map'. In spite of these new developments the US, EU and Japan are still leaders in scientific performance and continue to invest heavily in research and innovation. The competition is more intense and more open than ever before in the world arena of science.
9. The expansion of scientific networks has also changed the circle of actors participating in research activities. A field once dominated by states and their research networks of



national academies, learned societies, and universities is now complemented by a complex network of global companies, international organizations, and individual researchers who are attracted to the best available research infrastructure.

10. The accelerating 'knowledge economies' have generated new migration patterns for scientists and increasing mobility. Both the winners and losers of brain drain are facing the need for more intensive cooperation between universities, public research organizations, and industry in both graduate and post-graduate education and the elite training of scientists.
11. The advancements in science have also shed light on new and previously unforeseen concerns. Climate change, the large-scale and irreversible impact of human civilization on the world's fauna and flora, an overconsumption of natural resources, and their respective consequences require stronger involvement from both scientists and society. Developments in many research fields (e.g. genetics, biotechnology, neuroscience, nuclear physics, etc.) have considerable moral and ethical implications that require an urgent and global dialogue between scientists and the broader public.

In light of this declaration, we make the following recommendations:

1. RESPONSIBLE AND ETHICAL CONDUCT OF RESEARCH AND INNOVATION

In this era of global science, the scientific establishment needs to implement continuous self-reflection to appropriately evaluate its responsibilities, duties and rules of conduct in research and innovation. A universal code of conduct addressing the rights, freedoms and responsibilities of scientific researchers, and the universal rules of scientific research should be shared by the world's scientific community. Furthermore, these rules and policies should be respected by the states and adopted by their national legislations.

Scientists should strengthen their individual and institutional responsibilities to avoid possible harm to society due to ignorance or misjudgement of the consequences of new discoveries and applications of scientific knowledge.

It is the responsibility of those who promote science and scientists to maintain the primacy of moral and social concerns over short-term economic interest in the selection and implementation of industrialized research projects.

2. IMPROVED DIALOGUE WITH SOCIETY ON SCIENTIFIC ISSUES

In times of rapid and fundamental changes in the social environment, the sciences should be supported in their cooperative efforts to describe and evaluate with the best available methods the consequences of policy actions and explorations of both natural and social sciences.

Participation of societies should be promoted in order to make science more democratic and to build further trust in science. To this end societies must be prepared to knowledgably discuss the moral and ethical consequences of science and technology by strengthening policies to enhance awareness and public understanding of science and improving and broadening the scope of education.



3. INTERNATIONAL COLLABORATION IN SCIENCE SHOULD BE PROMOTED

Better international coordination is needed for science research projects focusing on global challenges. International cooperation is essential for decreasing the knowledge divide and regional disparities.

The free cooperation and movement of scientists should be promoted by the elimination of harmful bureaucracy and false regulation and by providing the funds to further international cooperation.

To avoid repetition, redundancy, and excessive expense in scientific research, the international scientific community should be involved in the development of an improved method to monitor past and present research activities and their results.

We, the participants of the Budapest World Science Forum, adopt the present declaration.

4. COLLABORATIVE POLICIES TO OVERCOME KNOWLEDGE DIVIDES IN THE WORLD

The rapid development and increasing cost of science combined with the expansion of patent policies and regulations have further widened the knowledge and economic divide between the developed and developing world. In a world where the best science and the best researchers are attracted only by excellent research infrastructures, developing countries should be supported in their efforts to build their research capacities. However, co-funded actions for building capacities can only be successful if support is provided in a socially responsible way and if it creates a win-win situation for both the promoter and the recipient. Brain-drain and brain-gain policies should be coordinated for the joint benefit of all affected countries.

5. CAPACITY BUILDING FOR SCIENCE NEEDS TO BE STRENGTHENED

Scientific discoveries are foundations for innovation and social and economic development. Investment in science provides a capacity for future development at a national level and an opportunity to face global challenges internationally.

It is primarily the responsibility of governments to increase support for science, and develop effective policies for technology and innovation.

Comprehensive actions should be taken to strengthen the role of women in science and innovation and to expand the participation of women in science and science policymaking.

The socio-economic impacts of science and scientific capacity are well-documented. National parliaments and governments are urged to declare their commitment to seek scientific advice during the decision making process. An institutionalization of such an advisory process is necessary; informed decisions result in great savings.

There is an urgent need to elaborate new, effective science policies at national, regional and global levels to better coordinate and monitor scientific research worldwide, to harmonize university education systems, and to facilitate global and regional scientific cooperation based on equity and participation. ■

The text of the Declaration *can also be downloaded from* www.sciforum.hu/declaration

TWAS MEETING IN TRIESTE

BETWEEN 21 AND 23 NOVEMBER 2011, TWAS HELD ITS 22ND GENERAL MEETING IN TRIESTE. MORE THAN 250 SCIENTISTS FROM 40 COUNTRIES, MAINLY TWAS FELLOWS FROM DEVELOPING COUNTRIES, ATTENDED THE EVENT. A REVIEW OF THE PROCEEDINGS FOLLOWS.

The 22nd General Meeting was officially opened by TWAS president, Jacob Palis, who confirmed that, in a world that is likely to experience unprecedented change in the years ahead, TWAS will continue to build scientific capacity and promote scientific excellence.

"In the face of the enormous impact of the global financial crisis", said Palis, TWAS will continue "to nurture a world where good science is done in all countries and where the fruits of scientific research create a more peaceful and prosperous community of nations."

One of the effects of the financial crisis is that several developed countries now find themselves in difficult economic circumstances, with austerity measures in place as they seek to get their financial houses in order. At the same time, emerging economies – most notably, Brazil, China and India, among others – have weathered the financial storm better than their wealthier counterparts. "Their economies continue to grow, their investments in science and technology continue to rise, and their trend lines in poverty reduction and wealth creation will likely continue to move in a positive direction", added Palis.

"But", he noted, "the need for South-South cooperation in science remains paramount as a large number of developing countries continue to lag far behind in scientific capacity.

"Similarly, the need for South-North cooperation in science has never been more important. The difficulties the world now confronts", Palis concluded, "require international scientific cooperation that transcends country borders and geographic regions."

Palis maintained that the Academy would work hard to navigate the rapidly changing world in which we live but that it would do so with its goals firmly set on helping to create good science in all countries.




OPENING CEREMONY

Among the other speakers at the opening session were a number of local and national dignitaries, including Alessandro Giacchetti, *prefetto* of Trieste; Roberto Cosolini, mayor of Trieste; Immacolata Pannone, representative of the Italian Ministry of Foreign Affairs, TWAS's main sponsors; Engelbert Ruoss, director of UNESCO's Venice Office; and Fernando Quevedo, director of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste.

A highlight of the opening session was the award ceremony.

The Ernesto Illy Trieste Science Prize is the Academy's most prestigious honour, carrying an award of USD100,000. The 2011 edition of the prize was dedicated to materials sciences. Anna Illy, president of the Illy Foundation, and Roberto Cosolini, mayor of Trieste, presented the prize to C.N.R. Rao (TWAS Founding Fellow and former president) for his life-time achievements in this field (see page 17).

The need for South-South cooperation in science remains paramount.

The opening award ceremony also saw the presentation of TWAS Medal Lecture plaques to Anthony Cheetham (TWAS Associate Fellow 1998) and Mohamed Najim (TWAS Associate Fellow 1998). The following day, both recipients presented their lectures, on 'Solid state lighting' and 'New trends in multi-dimensional model-based systems', respectively.

In addition, TWAS Prizes were presented to the winners of the 2010 edition of the awards. Of particular note were Carlos Gustavo Tamm de Araujo Moreira of Brazil and Gabriel Adrián Rabinovich of Argentina, who are the first TWAS Young Affiliates to be honoured with TWAS Prizes. Again, the following day, each winner presented a lecture on their work.

SYMPOSIA AND LECTURES

The first of three conference symposia examined the growing challenge of food security. Paul Christou and Roger Beachy (TWAS Associate Fellow 2009) laid out the case for the wider uptake of genetically modified (GM) crops. They noted that, while countries such as the United States and Canada, as well as developing countries such as Argentina, Brazil and China, were growing vast areas of GM crops, Europe and much of Africa are still resisting the technology – despite a series of reports by the European Union and other agencies that have failed to find significant environmental or health problems, and despite insect-resistant crops being responsible for reducing global insecticide use by more than 3 billion litres. In addition, herbicide tolerant crops save enough fuel, by promoting no-till farming methods, to fuel some 8 million vehicles per year.

Among the speakers of the second symposium, on materials science, was Ajay K. Sood (TWAS Fellow 2001), who described some of the properties of 'Amaz-

ing nanocarbon'. In recent years, noted Sood, the discovery of novel arrangements of carbon atoms has been rewarded with two Nobel Prizes. In 1996, for example, Robert Curl, Richard Smalley and Sir Harold Kroto were awarded the prize for their discovery of fullerenes, molecules composed entirely of carbon linked together in the form of hollow spheres, ellipsoids or tubes, such as the spherical buckyballs. Then, in 2010, Andre Geim and Konstantin Novoselov were awarded the prize for their "groundbreaking experiments regarding the two-dimensional material graphene" – a mono-layer form of carbon.

Thanks to their great strength and lightness, as well as their electrical properties, carbon nanotubes are now being increasingly used in consumer products, noted Sood, especially in composite materials used in mechanical structures, as well as electronics. Their use in other sectors, such as energy, is also increasing. Likewise, graphene is considered the strongest material ever tested and is likely to have applications in electronics – even to be able to move us from the age of silicon-based computer hardware to smaller and more efficient carbon-based devices.

The third symposium focused on 'Chemistry in the Year of Chemistry', while invited lectures by Michael Klein (TWAS Associate Fellow 2004), Jean-Christophe Yoccoz (TWAS Associate Fellow 2004), and Abdallah Daar (TWAS Fellow 2007), focused on 'Computer simulation', 'Mathematical billiards', and 'Global grand challenges in health', respectively.

In the latter talk, Daar noted that "a grand challenge is a specific critical barrier that, if removed, would help solve an important health problem in the developing world with a high likelihood of global

impact through widespread implementation." He then highlighted five key areas that are being supported through the Grand Challenges calls for proposals, including: point-of-care diagnostics; maternal, neonatal and child health; and the creation and strengthening of health enterprises. "The idea", confirmed Daar, "is to focus on the 'Grandest Challenge', that of taking life-saving science from the laboratory to the village."

Sandwiched between the symposia, TWAS Prize lectures and invited lectures were some 20 presentations by TWAS Young Affiliates. Among these, Santiago Ron provided evidence, based on DNA analyses, of 28 new species of frog found in just a small area of the Ecuadorian rainforest, while Roula Abdel-Massih provided evidence for the antimicrobial activity of selected Lebanese plants against antibiotic-resistant strains of two bacteria, *Escherichia coli* and *Klebsiella pneumoniae*. Meanwhile, in the parallel sessions dedicated to physics and chemistry, Amal Amin Ibrahim, Egypt, presented his work on highly-branched nanostructures, sometimes derived from natural materials such as rice husk waste, and their potential uses as additives to make concrete stronger, or adhesives for wood composites more water-resistant. Likewise, Partha Mukherjee, India, focused on the self-assembly of metallocages and metallacycles, nano-structures that are expected to find applications in a range of novel devices.

Once again, the research work presented by the Young Affiliates was much appreciated by the participants, while the Young Affiliates in turn, some 60 of whom attended, appreciated the opportunity to network with TWAS Fellows and other distinguished scientists.




OTHER HIGHLIGHTS

Among the highlights of the TWAS 22nd General Meeting were:

- the report, in the TWAS General Assembly, that the Academy's finances are in good shape and that its activities are increasing, both through an ever-widening network of partnerships and through the increasing influence of each of the five TWAS Regional Offices;
- a report from Romain Murenzi on his activities during his first eight months as executive director of TWAS, including visits to two TWAS Regional Offices, in China and India, and his efforts to lobby the governments of those countries to provide additional support to the Academy;
- the election of 45 new members (42 Fellows and 3 Associate Fellows) to the Academy, bringing the new total of members to 1,036. Among the newly elected Fellows were 13 women scientists, a new record for TWAS, as well as Fellows from such under-represented countries as Bangladesh, Benin, Colombia, Palestinian Autonomous Territories, Panama, Trinidad and Tobago, and Vietnam.
- the award of the 2011 TWAS Prizes to 13 scientists from seven countries. Among the winners in the field of Agricultural Sciences were two scientists (Zeyaur Rahman Khan from India, and Segenet Kelemu from Ethiopia) who live and work in Kenya, the first time either Ethiopia or Kenya has been recognized with a TWAS Prize;
- the announcement of the five winners of the TWAS Regional Prizes to individuals who have made outstanding contributions to the development of scientific educational material, including: Jayashree Ramadas from India, Liu Changming from China, Nadia Al Wardy from Oman, Peet van Schalkwyk from South Africa, and Patricio Felmer from Chile;
- the organization of a special ceremony to mark the induction into the Academy of the new members elected in 2010. In addition, certificates were presented to 18 Young Affiliates selected by the TWAS Regional Offices in 2011;
- the announcement of the establishment of the Atta-ur-Rahman Prize in Chemistry, made possible through the generosity of Atta-ur-Rahman (TWAS Fellow 1985), which will be awarded annually to a young chemist in a scientifically lagging country. In addition, C.N.R. Rao (TWAS Founding Fellow) confirmed that the prize he sponsors, designed to honour distinguished scientists from scientifically lagging countries who have made significant contributions to global science, previously offered every three years, will also be an annual award. Both prizes carry a USD5,000 cash prize;
- and the announcement by TWAS vice president Bai Chunli that the TWAS 23rd General Meeting and 12th

Among the newly elected Fellows were 13 women scientists, a new record for TWAS.

General Conference will be held in Tianjin, China, in September 2012. The dates have since been confirmed as 18-21 September, with business meetings arranged for 17 September.

In addition, the international meeting that TWAS organized in Trieste didn't go unnoticed by the local and national media. The rich programme offered to the audience and the variety of themes addressed by the speakers – all scientists with an international reputation – gave the press a good chance to report on high-level science in the South, raising awareness about the quality of research being carried out in the developing world as well as the activities set in motion by the Academy.

TWAS's 23rd General Meeting and 12th General Conference will be held in Tianjin, China, in September 2012.

For example, the local office of RAI, the Italian state television, carried interviews with TWAS executive director Romain Murenzi and with TWAS president Jacob Palis, the first time that TWAS has showcased its activities through its Council members at a public event in Trieste. While Murenzi focused on the importance of TWAS's mission to grant educational and financial support to talented young scientists, Palis recalled the first years of TWAS's activity, and praised the results the Academy has achieved since its inception, noting that "each journey starts with one single step."

The local newspaper, *Il Piccolo*, and the second most important regional newspaper, *Il Gazzettino*, were also attracted by some 'green investigations' presented during the meeting. Both newspapers reported extensively on the genetic modifications of cotton, carried out by TWAS Prize winner Ibrokhim Abdurakhmonov of Uzbekistan, as well as the value of traditional medicine in Cameroon, presented by TWAS Young Affiliate, Simeon Kouam of Cameroon.

While following the event, several web portals focused on climate research, the sustainable use of biodiversity and – since 2011 was the International Year of Chemistry – also gave considerable visibility to presentations about chemistry.

Together, more than 40 newspaper articles, TV broadcasts, interviews and short web news items provided extensive coverage of TWAS and its activities.

The meeting – and the accompanying media coverage – certainly raised the Academy's profile, confirming its place among the scientific institutions in Italy's 'City of Science'. ■

TRIESTE SCIENCE PRIZE FOR RAO

C.N.R. RAO HAS RECEIVED THE ERNESTO ILLY TRIESTE SCIENCE PRIZE FOR HIS RESEARCH IN MATERIALS SCIENCE.

During the recent TWAS General Meeting in Trieste, on 21 November 2011, the immediate past president of TWAS, C.N.R. Rao, was awarded the Ernesto Illy Trieste Science prize for his "monumental contributions to the frontiers of materials science".

The prize, which is designed to give international recognition and visibility to eminent scientists in the developing world, is sponsored by the world-renowned coffee maker illycaffè (also based in Trieste), supported by the Ernesto Illy Foundation and administered by TWAS. It carries a USD100,000 cash award. The 2011 award was given in the field of materials science.

C.N.R. Rao, Linus Pauling research professor and honorary president of the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India, has a distinguished career that spans more than five decades. Rao has certainly left his mark on scientific research, education, administration and policy, both in his home country of India and throughout the world.

Rao's broad-ranging research, focusing on the characterization, synthesis and design of new materials, has enabled him to become one of the world's most respected scientists. Meanwhile, his passionate life-long commitment to strengthening scientific research and education in India has made him a revered and influential figure in his home country.

In the 1950s, Rao was one of a small group of pioneering scientists who propelled the emerging field of solid state chemistry to the forefront of global science. He is particularly noted for his research on metal oxides, nanomaterials and graphene.

From an intellectual perspective, he has been a key figure in the integration of chemical physics and materials chemistry. From a technical perspective, he has made innovative use of a wide variety of cutting-edge

ERNESTO ILLY TRIESTE SCIENCE PRIZE

Instituted in 2004 by TWAS and illycaffè, the Prize is designed to bring recognition and distinction to the developing world's most eminent scientists.
The award is jointly named: after Ernesto Illy, the late chairman of illycaffè; and after the city of Trieste. Ernesto Illy's passion for the sciences has made the award possible. Trieste, home to TWAS's headquarters, is known for its significant role in promoting science in the developing world.

technologies, ranging from photoelectron spectroscopy to electron microscopy to diffraction.

As a young, talented scientist with a PhD from Purdue University in the United States and postdoctoral research undertaken at the University of California, Berkeley, USA, Rao returned to his home country in 1959 to assume a position at the Indian Institute of Science (IISc) in Bangalore, India's oldest and most prestigious research institute. In 1963, he moved to the Indian Institute of Technology (ITT), Kanpur, where he became head of the chemistry department.

At the time, science in India was hamstrung by poor facilities, inadequate funding, low salaries and bureaucratic roadblocks that made the purchase of equipment and supplies a slow and tedious process. Yet Rao was determined to build a well-equipped laboratory for solid state and materials chemistry capable of competing with laboratories in developed countries.

Pursuing his dream, Rao returned to the IISc where he did indeed build a world-class laboratory and later served as director from 1984 to 1994. In 1989, he also became the founding president of the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) in Bangalore, serving in that position until 1999. Since his retirement, he has continued to pursue an active research agenda.

Over the course of his long career, Rao has published 45 books, and more than 1,500 articles. More recently, he has written several children's books designed to spur interest in science among young people.

Rao has received more than 50 honorary degrees from universities in India and abroad. He is a fellow of the Indian Academy of Sciences and the Indian National Science Academy, and a foreign member of numerous science academies worldwide, including the US National Academy of Sciences, the Royal Society in the UK, the French Academy of Sciences, the Russian Academy of Sciences, the Japan Academy, the Brazilian Academy of Sciences and the Pontifical Academy of Sciences.

In terms of science policy, he has been a driving force behind the success of TWAS, first as one of the founding members in 1983 and then as president from 2000 to 2007. He remains active in the Academy's affairs to this day. Rao has also played a central role in many governmental agencies and on committees in India, most notably chairing the prime minister's science advisory council since 2009.

In terms of scientific research, Rao has helped to shape the contours of materials science, lending his keen

intelligence, deep insights and well-honed technical skills to a discipline that is now recognized as one of the pre-eminent fields of 'science for development' in the 21st century.

Broad applications of materials science have had – and will continue to have – an impact on key aspects of society and the economy in both the developing and developed worlds. Effects range from improvements in communications and the generation and distribution of energy, to enhanced access to safe drinking water, to the more precise delivery of pharmaceuticals for treating disease.

RAO'S SIGNIFICANT CONTRIBUTIONS

1. Conducted an independent synthesis on the first liquid-nitrogen cuprate semiconductor;
2. Identified large-scale electronic phase separation in metal oxides;
3. Prepared Y-junction and metallic nanotubes;
4. Ascertained a simple method to separate semiconducting and metallic carbon nanotubes;
5. Formulated new methods for the synthesis of graphene;
6. Discovered new bifunctional oxide materials;
7. Created a strategy to determine the experimental charge densities of atoms in organic molecular crystals;
8. Determined how simple oxyanions and selenate can be used to build complex inorganic architectures.

In the 1970s and 1980s, Rao's groundbreaking research on non-organic transition metal oxides enhanced scientific understanding of high-temperature superconductivity. His novel research subsequently led to the identification of large-scale, electronic-phase separation in metal oxides and to the discovery of new routes for multiferroics.

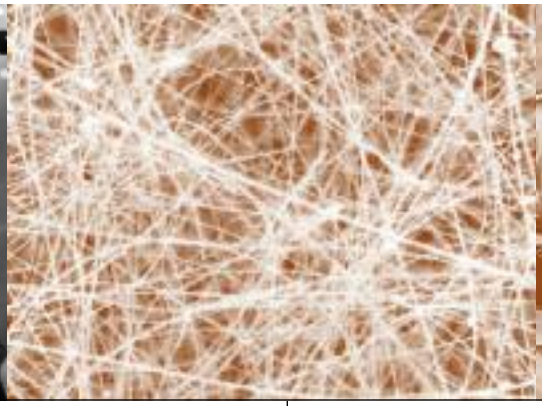
He then turned his attention to the intricate interface between organic and inorganic hybrid materials. More recently, he has focused his attention on nanomaterials, exploring, for example, the liquid-liquid interface to generate nanocrystals and uncovering a simple method for separating semiconducting and metallic carbon nanotubes.

Rao's research has been consistently multi-dimensional in terms of both the broad range of materials he has explored and the wide-ranging techniques he has tapped to examine these materials. He has developed new and novel methods of synthesis and design, prepared and characterized a number of new classes of materials and nanostructures, and dissected the formation of complex structures.

His work has crossed the once distinct boundaries between inorganic, organic and hybrid materials, and has cast revealing light on the relationship between simple one- or two-dimensional structures and more complex multi-dimensional structures – a relationship that plays a significant role in the bonding of materials.

For all of these reasons and more, C.N.R. Rao was selected as the 2011 recipient of the Ernesto Illy Trieste Science Prize in materials science. ■

C.N.R. Rao's presentation can be downloaded from the TWAS website: tinyurl.com/Rao-presentation. *A video interview is also avilable:* tinyurl.com/Rao-Prize-Interview



TWAS 22ND GENERAL MEETING

Trieste, Italy, 21-23 November 2011

Recent news from the TWAS Public Information Office on research and capacity-building activities

PHYSICS + POLITICS = THE BIG BANG?

TWAS Newsletter, Vol. 24 No. 1, 2012

In partnership with the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, TWAS supported a four-day Industrial Physics Forum (IPF) in April this year on 'Capacity Building for Industrial Physics in Developing and Emerging Economies', hosted by ICTP and the American Institute of Physics (AIP).

The goal of the IPF was to promote links between scientists and industry, leading to sustainable technological advancement. To reflect this, session topics had either a technical, policy or education focus, including, on the technical side, the physics of materials, solar energy, optics, lasers and microfluidics; workshops on inquiry-based physics education and educational technology; and a popular 'Frontiers of Physics' session, featuring scientists who are making seminal contributions to cutting edge research.

Highlights included a talk by UK physicist Martin Rees (TWAS Associate Fellow 2007), 'From Big Bang to Biosphere'. Rees's use of spectacular graphics and clear explanations of sophisticated results was a model of effective science communication in practice. William Colglazier, appointed science advisor to the US Secretary of State in 2011, gave a keynote presentation over dinner, sharing his insider's thoughts on how scientists can make an impact on policymaking. "For

every country I have dealt with in my new job, the one topic they always want to talk about, no matter whether it is a very rich country or a poor country or somewhere in between, is national science, technology and innovation", he confirmed.

Held for the first time ever outside the United States, this IPF certainly proved a productive arena, initiating a much-needed dialogue between physicists, industry, policymakers and educationalists. ■

SCIENCE AND DIPLOMACY

In November last year, TWAS and the American Association for the Advancement of Science (AAAS) jointly launched a new International Programme on Science and Diplomacy. The initiative got under way at the TWAS headquarters in Trieste in March 2012 with a seminar presented by Mary O'Kane. O'Kane is chief scientist and engineer for New South Wales, Australia, and also executive chairman of Mary O'Kane & Associates Pty. Ltd., a Sydney-based company that advises governments, universities and the private sector on innovation, research, education and development.

In her presentation, 'Productivity halos around top research centres', O'Kane made a strong case that governments should invest in high-level, high-quality research if they wish to increase economic productivity – even though

the links between the two may not always be obvious, immediate or direct. She provided pertinent 'real-world' examples where increased productivity was not the *intended* outcome of the initial research projects but was the *actual* outcome. Her examples spoke forcefully for investing in excellent research for excellent research's sake, rather than merely focusing on those applied areas that have traditionally been of more interest to industry and sponsors.

O'Kane described a number of exemplary Australian cases where government funding allotted to top-level Australian researchers has boosted high-tech productivity and fuelled a valuable process that has proven to be beneficial to the national economy.

"Examples of productive relationships between top-quality research and economic success can be found in fields as distant as solar photovoltaics, robotics or biotechnology, where they have triggered a domino effect on many other sectors", said O'Kane.

At Sydney University, for example, researchers from the Australian Centre for Field Robotics, in receipt of a research grant of USD16 million from the Australian Research Council (ARC), were keen to push the boundaries of robotics, building their automated machines on as large a scale as possible. This robotic technology was then taken up by major Australian companies such as Rio Tinto, who used it to create the first fully automated mine. The initial government funding clearly paid off in the long term.

Similarly, O'Kane described how research and innovation in solar energy was initiated by the Solar Photovoltaics Group at the University of New South Wales, headed by Martin Green. Back in the early 1980s, they produced a silicon cell with 20% energy conversion efficiency. Green's group were not able, however, to commercialize this success, although the technology was taken up and used extensively throughout Germany. It was Green's PhD student from China, Zhengrong Shi, who turned it into a profitable business enterprise. Using technology developed earlier by the Solar Photovoltaics Group – and no longer protected by patents – Shi founded Suntech Power, a multibillion-dollar solar-energy company and the first of its kind in China, which became the world's biggest producer of solar panels in 2010.

While many Australians are understandably aggrieved that technology developed by a government-funded national research centre has been exported for profit elsewhere, O'Kane argued that in addition to the (relatively small) amounts in licensing fees that Australia continues to accumulate from Shi's commercial success, there remain important long-term productivity gains for Australia. Shi, who is now the tenth richest man in China, evidently retains close ties with his *alma mater* and ex-supervisor and 'has been very generous'. But O'Kane stressed that the major gain for Australia is in terms of diplomacy. These close ties with one of China's richest men mean that O'Kane, and other members of the Australian government, have an open door to discussing issues of science policy with the Chinese. And these kinds of opportunities can be invaluable in the long term.

O'Kane enjoys tracing these indirect but convincing links between excellent research and increased economic productivity, and her refreshing 'outside-the-box' approach brought another example, this time in the field of biotechnology, where Australia has a strong international reputation. At Newcastle University in New South Wales, John Aitken, noticing a higher-than-usual incidence of male infertility in clusters around the Newcastle area, led his research group's investigations into DNA damage in human spermatozoa. As a result of this research, the centre developed an electrophoretic device for assisting conception. Clinical trials were successful and the device is now being sold commercially. In addition, the research was taken up by another important Australian institution – horse racing. Stud farms in Upper Hunter and Harness Racing are using results from these trials to increase the efficiency of the horse breeding industry – with clear economic gains for horse breeders and the national

MARY O'KANE

Mary O'Kane divides her time more or less equally between science and diplomacy. She spends three days a week as Chief Scientist and Engineer of New South Wales (NSW), Australia's largest state, where her many responsibilities include improving the quality and level of scientific activity in NSW, providing independent advice to the NSW Government on science and innovation issues, encouraging effective engagement between government, business and the research sector, and representing the state's science and research sector on the NSW Innovation Council. The other two days are spent as executive chairman of her company, Mary O'Kane & Associates, which advises governments, universities and the private sector on innovation, research, education and development. In addition, O'Kane is a trained computer engineer and an international authority on automatic speech recognition; and was the first woman Vice-Chancellor of the University of Adelaide.

economy as a whole, considering that horse-racing accounts for a significant part of Australia's revenue.

So, how to stimulate and reproduce successful research projects that then lead to pairings in industry with the resultant long-term productivity gains?

One way, said O'Kane, is through competitions and prizes. She gave the example of an Australian online company, *kaggle.com*. Kaggle is a platform for data prediction competitions that allows organizations to post their data and have it scrutinized by the world's best data scientists. In exchange for a prize, winning competitors provide the algorithms that beat all other methods of solving a data-crunching problem. O'Kane cited the example competition of predicting travel times on the M4 freeway from past travel time calculations. The competition was hosted by Australia's NSW Roads and Traffic Authority and sponsored by the NSW Department of Premier and Cabinet. Why? Forecasting travel times helps improve road safety and efficiency. Accurate predictions help commuters make informed decisions about when to travel and on what routes. This helps to lower intensity on problem arterial roads by encouraging motorists to use underutilized parts of the grid, and where possible, to select alternative times and modes of travel.

The competition only ran for 3 months, and was extremely popular, with research teams from more than 47 countries taking part. In the end, there were three winners, each of whom received a USD10,000 prize. Insights from the competition have improved the general efficiency of the road transport system in Sydney and increased functionality on the government's live traffic website. O'Kane estimates that the government spent a total of USD50,000 setting up and running the competition, rewarding three prize winners and implementing the algorithm. But they predict that an equivalent model sponsored through a private company would have cost upwards of USD100,000.

Another example of unexpected productivity gains through innovative research approaches is through what is now known as 'open research' to source solutions to world health problems. Matthew Todd, a young researcher from the University of Sydney, set up a massive worldwide searchable database that scientists and researchers can contribute to, inputting their own localized results. This database can sometimes provide solutions for chronic disease treatment that drug companies are often reluctant to invest in. Instead, argued O'Kane, improvements in treatments of diseases as widespread and destructive as malaria, for example, could again lead to incalculable long-term productivity gains in terms of a healthy working population, as well as the enormous revenue accumulated through reduced costs of treatment.

O'Kane's 'real-world' examples give refreshing and insightful proof that research in developing countries does not just need to be aimed at 'useful' applied research. As she argued, the long-term benefits of good research are not easily predictable. What makes far more sense, and what will make the biggest economic difference in the long term, she concluded, is investing in research excellence.

The TWAS-AAAS International Programme on Science and Diplomacy seminar series, which is aimed at increasing the impact that science can have on society, will continue. Among the activities being developed by the programme are lectures, seminars and workshops targeted at scholars, diplomats, public officials and journalists. The ultimate aim is to combine the forces of science and diplomacy to become a driving force which can inspire governments and decision makers in their efforts to sustain equitable growth and also promote peaceful relationships among countries. ■

EYES TO THE NORTH

Romain Murenzi, executive director of TWAS, made a successful partnership-building trip to Japan in March this year. The visit was jointly organized by TWAS and the Japanese Science and Technology in Society (STS) Forum, based in Kyoto.

Since 1983 TWAS has been highly effective in supporting South-South science collaborations and programmes and has developed a network that covers a large part of the science community in the developing world. TWAS is now turning to the North for additional collaboration and support, recognizing that developing countries' needs are global needs. In the same way, many countries in the North, and Japan in particular, have begun to recognize that the involvement of scientists from the developing world is essential for addressing many of the critical issues that the world now faces – including those relating to energy and food insecurity, the spread of infectious diseases, the loss of biodiversity, desertification and dwindling supplies of safe drinking water. Countries in the North wanting to cooperate with countries in the South in the most effective and sustainable way are turning to institutions like TWAS that have a proven track record in collaborating

with developing countries to build scientific capacity both locally and regionally.

TWAS and the STS Forum thus share a synergy of vision and mission. Koji Omi, chairman of the Forum, arranged a series of meetings in Tokyo with representatives from various scientific institutions, agencies and government bodies. These included a meeting with Honourable Hirofumi Hirano, the Minister of Education, Culture, Sports, Science and Technology (MEXT) and Sadako Ogata, president of the Japanese International Development Agency (JICA). Murenzi also met with: Machiru Nakamura, president of the Japan Science and Technology Agency (JST); Yurichuro Anzai, president of the Japan Society for the Promotion of Science (JSPS); Govindan Parayil, vice-rector of the United Nations University (UNU); and Takashi Onishi, president of the Science Council of Japan (SCJ).

This was also an excellent occasion for Murenzi to meet with TWAS Associate Fellow, Kiyoshi Kurokawa, who is currently professor at the National Graduate Institute of Policy Studies (GRIPS) in Tokyo.

On his return to Trieste, Murenzi noted that: "It was a very successful trip and we look forward to following up on a number of points discussed that have the potential to develop into TWAS programmatic activities with the support of Japan." ■

CATALYST THINK TANK LAUNCHED

TWAS is one of seven partners involved in CATALYST, a project – funded through the European Union Seventh Framework Programme (EU FP7) – that focuses on 'Capacity Development for Hazard Risk Reduction and Adaptation'. The project explores ways to more effectively assemble, analyse and use the rapidly expanding knowledge base of natural hazards and disasters in order to provide some guidelines for best practices both before and after such disasters occur.

In April this year, the partners launched a series of 'think tank' activities, including virtual meetings, discussion forums, downloadable reports for discussion and an information archive.

A central feature of this project is the 'think tank' which will bring together disaster risk reduction experts working in four particularly vulnerable regions (East and West Africa; Central America and the Caribbean; the European Mediterranean; and South and South East Asia). The think tank begins and concludes with a multi-regional process: all the groups work together at the beginning of the think tank before breaking up into regional sub-groups to discuss specific issues relevant to their areas. Afterwards, they will return to work together for the finalization of key recommendations, reports and an education module.

The think tank is comprised of 'core members' who are invited to participate in the whole range of activities planned for the think tank, as well as 'wider members' who are invited to observe the process. In each regional group there are up to 15 core members, and a similar number of wider members. The members come from a wide range of backgrounds, including non-governmental organizations, private enterprises and industries, humanitarian organizations, as well as the scientific community. They bring unique expertise and points

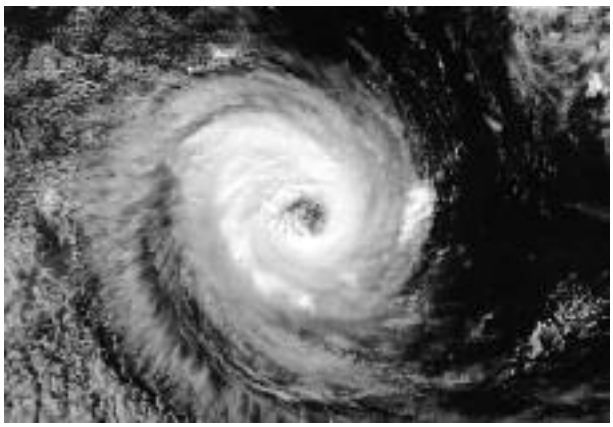
CATALYST
CAPACITY DEVELOPMENT FOR HAZARD RISK REDUCTION AND ADAPTATION

of view to the project, and their input will feed into improved natural hazard and disaster risk reduction strategies (NH/DRR) both locally and globally.

During the first online meeting in April, project partners presented the goals and themes of the project. This was the first of several online meetings which will take place over the life of the project. They are an opportunity for members to gather together at a pre-assigned time (amenable to all time zones) for two hours, in a virtual meeting room, to listen and comment on expert and project presentations and to support the preparation of activities which will then be carried out face-to-face in the regional workshops.

A discussion forum linked to the project website will ensure that members and project partners can follow up topics of interest raised during the virtual meetings. Draft reports will be available for members to download from the web. Again, any gaps can be addressed by local experts, and recommendations and additions can be discussed in the forum. Most importantly, the members will make sure that the final products are relevant to their work situations – and can be realistically implemented.

In addition to this ongoing online activity, an information archive of existing NH/DRR resources and research will be available on the website so that all the collated information is easily accessible to the research community. A series of four 'best practice reports' will be published, and made available on the website, based on the discussions and recommendations made at each of the virtual meetings and regional workshops. At the end of the project (September 2013), a 'best practices policy notebook' will summarize major findings and propose strategies for improving efforts to improve natural hazard and disaster reduction and adaptation, both at the programmatic and policy levels.



CATALYST project members are researchers, practitioners and policymakers working in HH/DRR who wish to pool their knowledge and analysis of natural hazards and disasters in order to create coherent strategies and policies that will have a direct impact on water resources management, land use planning and economic development. Natural hazard and disaster risk reduction and adaptation should then become critical components of the sustainable development agenda. ■

EVERY DAY SHOULD BE WORLD WATER DAY

22 March is 'World Water Day'. In 1992, delegates to the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro recommended the establishment of an international day to highlight problems of water scarcity and safe drinking water. In 1993, 22 March was officially designated World Water Day.

In the developed world it has become a health mantra to "drink two litres of water a day". Unfortunately, what is a recommended habit for the privileged, is in fact a major challenge for the almost 1.2 million people – one fifth of the world's population – who live in areas of water scarcity. According to *water.org*, 884 million people lack access to safe drinking water, and more than 3.5 million people die each year from a water-related disease – and 84% of these are children. Recent estimates suggest that while it is highly desirable that we each drink two litres of water a day, the actual amount of water needed per person per day (for washing, cooking, etc.) ranges from 25 to 100 litres. Without this 'blue gold', vegetables cannot be grown and animals cannot be fed; without clean water we cannot meet our basic sanitary needs, and the risk of infections is high.

Efficient water use and effective water management vary widely from one country to another and not all countries face the same challenges. African countries in general struggle to keep droughts at bay; China suffers from disastrous floodings; and South America strives to protect the precious biodiversity of wetlands.

Akiça Bahri (TWAS Fellow 2003) is currently Coordinator of the African Water Facility in Tunis, Tunisia, and is a soil scientist and agricultural engineer. Bahri is well aware of the

issues surrounding water management in Africa. "If water issues are not properly addressed, Africa will continue to be years away from meeting its development targets", she says. "The problem is not necessarily one of scarcity," she is quick to add, "it is also a matter of poor management."

Big cities top the list in this regard. At present, cities occupy less than 1% of most countries' land area, yet they account for 5-20% of the water used, and this percentage can only increase. Since 2010, 11 African cities have populations above 5 million, and some 720 others have populations greater than 100,000. Without proper management, today's acute situation will turn into tomorrow's emergency.

"We urgently need to revisit conventional urban water management, which is typically based on actions conceived as isolated services, without any kind of overview", says Bahri. She argues that we must ensure that high-quality water is used solely for drinking and culinary purposes, otherwise this precious resource will become even more scarce. Wastewater and sludge, but also surface water, groundwater and stormwater, on the other hand, need to be properly treated, according to their final destination.

"Wastewater management poses both technical, planning, management, institutional, economic and policy challenges, and requires strong leadership", says Bahri. "Wastewater plants often do not function or are overloaded, and the effluent is not suitable for irrigation." In Ghana, for example, only 8 or 9 of the 44 wastewater treatment plants are in use, but unfortunately even these are well below technical standards. Faecal sludge treatment plants are in a bad condition too: as a consequence, more than 60% of excreta go directly into the ocean.

"That's why we need to use a model of integrated urban water management, to address the problem within a consistent framework", Bahri insists. "This model would identify different water sources, consider their quality and attempt to allot each batch to a different usage." It's a model that links scientific expertise to political goodwill. "By doing so, storage, distribution and treatment, recycling, and eventually water disposal, become components of a more globally conceived management process."


Flickr/ikeablerodent

One virtuous example of wastewater reuse comes from Tunisia: industries pre-treat their effluents before discharging them into the sewer system, and then up to 40% of the treated municipal wastewater is recycled for agricultural and landscape irrigation. Some countries – for example South Africa and Namibia – have adopted successful wastewater treatment and management techniques. However, elsewhere in Africa, and especially in sub-Saharan Africa, the situation is far from acceptable: just 1% of wastewater is treated.

"Governments must be committed to water security both in mega-cities, as well as in coastal and rural areas", Bahri observes. Disease outbreaks and the spread of contagious illnesses stemming from poorly treated wastewater are common. The impact of providing clean water at all points along the chain can set in motion a flywheel effect: safe water means less disease, a healthier population means better yields from agriculture, which in turn provides more food for humans, and more fodder for livestock. Better water management can also have a direct impact on the quality of life for girls and women, who are traditionally involved in finding, fetching and carrying water.

Bahri's conclusion is clear: "We need to foster long-term planning that looks beyond the immediate problems and paves the way for those sustainable solutions which will be the legacy we leave to future generations." For now, these aspirations might as well be written on water. But let's hope that because of initiatives like World Water Day, and continuing research into water management practices, such statements will be carved in the stone of actual policies and practices. ■

AKIÇA BAHRI

Akiça Bahri, a water management expert, has been a TWAS Fellow since 2003. In 2009 she was selected as the recipient of the C.N.R. Rao Prize for Scientific Research, a prize instituted in 2006 to honour distinguished scientists from scientifically lagging countries who have made outstanding contributions to science and technology. Bahri received the prize in Durban, South Africa, on the occasion of TWAS's 11th General Conference and 20th General Meeting from 20 to 23 October 2009.

YOUNG WOMEN SCIENTISTS IN THE SPOTLIGHT

RECOGNIZING THAT, BECAUSE OF SOCIAL, CULTURAL AND ECONOMIC CONSTRAINTS, WOMEN OFTEN HAVE TO STRUGGLE MUCH HARDER THAN MEN TO BECOME SCIENTISTS, TWAS HAS A STRONG PARTNERSHIP WITH OWSD, THE ORGANIZATION FOR WOMEN IN SCIENCE FOR THE DEVELOPING WORLD. THE OWSD SECRETARIAT IS HOSTED AT THE TWAS OFFICES IN TRIESTE.

OWSD, formerly TWOWS, is the first international forum uniting women scientists from the South with the objective of strengthening their role in the development process and promoting their representation in scientific and technological leadership. Here we describe the successful outcomes of two core OWSD programmes and schemes: postgraduate fellowships for promising young female scientists from developing countries; and OWSD Awards for Young Women Scientists to celebrate their achievements and encourage other women to follow in their footsteps.

OWSD POSTGRADUATE FELLOWSHIPS

OWSD's flagship programme provides fellowships to young female students from sub-Saharan Africa and other Least Developed Countries (LDCs), to enable them to pursue postgraduate studies leading to PhD degrees at centres of excellence (renowned research institutions or universities). These host institutes must be in a developing country other than the applicant's home country.

Each fellowship is offered for three years and covers travel expenses and a monthly living allowance.

If an applicant prefers, she can register as a PhD student at her home institute and choose a sandwich option, where part of the research programme is undertaken at a host institute in another developing country. The minimum period abroad is six months.

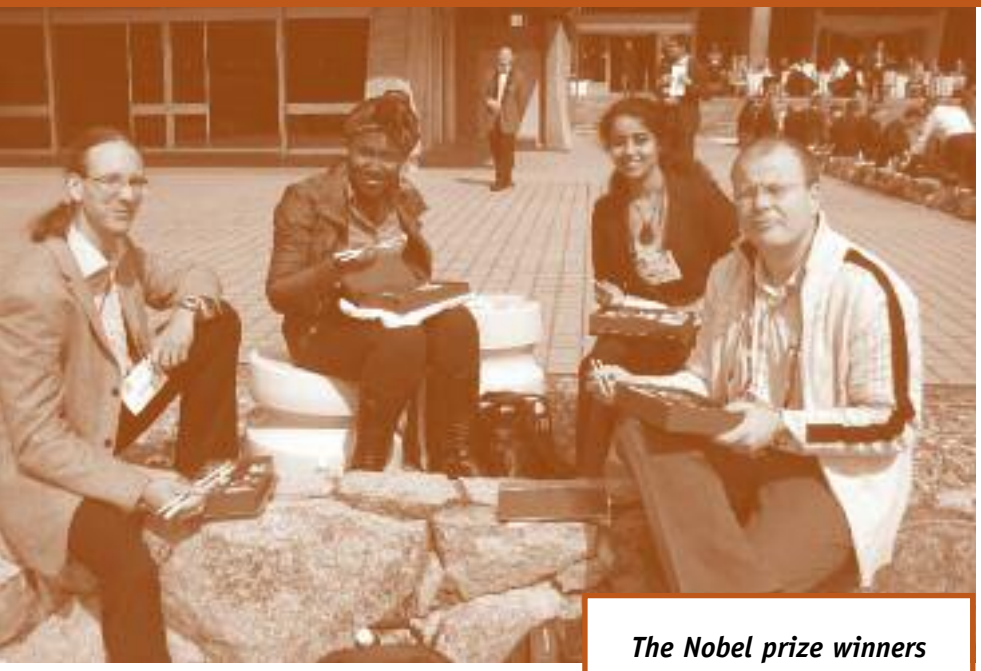
Hannah Ajoge, the subject of our case study, chose the sandwich option.

MY JOURNEY WITH OWSD

As a girl, says Hannah Ajoge, I was interested in medical research, partly because my father was a doctor. However, I was also very worried about the idea of working on dead bodies, which was an essential component of anatomy and physiology studies. This did not mean I was scared of disease, however. During the 1990s (when I was at high school), the stories and rumours about a lethal and incurable disease called AIDS or HIV stirred my curiosity. My father explained that I did not necessarily need to study medicine and surgery in order to work on the HIV virus, but that studying microbiology could be an option.

I took his advice and obtained my BSc in microbiology in 2003, even though I still couldn't study HIV. Finally, during my MSc programme, I was able to do a seroprevalence study on HIV among pregnant women in Ebiraland (where I was born) in Nigeria. The research was published in three peer-reviewed journals and three international conference papers.

Towards the end of my MSc studies, my supervisor, Professor Stephen O. Olonitola, encouraged me to apply for an OWSD postgraduate fellowship. I opted for the sandwich PhD course as it would enable me to work on samples from my home country. Fortunately, my application was successful, and I was able to follow part of my PhD training as a student of the HIV Pathogenesis Programme at the University of KwaZulu-Natal, in Durban, South Africa, supervised by Professor Thumbi Ndungu. There we looked at the molecular characterization of circulating HIV strains among pregnant women who attended antenatal clinics in north-central Nigeria. That research produced articles published in two high impact peer-reviewed journals, five interna-



The Nobel prize winners encouraged young researchers like me.

tional conference papers and an article which is currently under review.

In 2011, I was elated to be nominated by OWSD to participate as one of the young researchers at the 61st Meeting of Nobel Laureates in Lindau, Germany. Initially I thought of declining the offer because I was pregnant. As this was my first child, I was not sure how I would cope. Fortunately one of my supervisors, Professor Oladapo S. Shittu, was a gynaecologist and encouraged me to attend.

At the meeting, held in June 2011, there were 23 Nobel laureates and 566 young researchers from 77 countries. For me to be able to participate, too, was an amazing experience. I met and was inspired by the Nobel prize winners, who, drawing from their wealth of experience, encouraged young researchers like me, and explained how to do meaningful and productive research. I also learned about some of the latest scientific innovations. The most intriguing to me was the concept of 'personalized medicine', which suggests the possibility of a long-awaited health utopia. However, I was concerned that such innovations would never be accessible to people in the developing world.

The meeting was not all science: we were invited by the Elite Network of Bavaria to a Bavarian Evening; we went to a 'Grill & Chill: Connecting Cultures' dinner; and we relaxed on a boat trip to the Isle of Mainau, as guests of the German State of Baden-Württemberg. I was accompanied by my husband, and after the meeting we toured around Lake Constance.

My maternity leave became even more eventful when I was again nominated by OWSD, this time to attend the 8th Science and Technology in Society (STS) Forum in Kyoto, Japan, as one of 10 young researchers (referred to as 'Future Leaders') represent-

ing different parts of the world. The STS Forum encourages open discussions on the progress of science and technology for the benefit of humankind, while considering the ethical, safety and environmental implications. The Forum attracts top policymakers, business executives, scientists and researchers and media from all over the world. At the Forum, I was privileged to make contributions during the discussion sessions. I was also chosen to deliver a speech on behalf of the Future Leaders (see sidebar).

I have been able to come this far because of the availability of dedicated funding for my research from TWAS and OWSD, as well as nominations and travel funding from TWAS and OWSD to attend intellectual meetings. I am very grateful to both organizations. My family, on the other hand, really helped me make the most of these opportunities. During my visit to Lindau, my mother took care of our newborn baby with expressed breast milk, ensuring our baby thrived while my career forged ahead. Going to Kyoto to attend the STS Forum would be even more of a Herculean task, but my husband not only encouraged and supported me, he also single-handedly babysat our three-month-old for the week I was away. For women to make progress in science (and this is true also for men), the support and encouragement of their families (and especially partners) is essential.

In conclusion, it is possible for a woman to be a mother, wife, researcher, entrepreneur and leader if she is given the required support by her family, and by society.

FUTURE LEADERS

Hannah Ajoge was nominated by the Organization for Women in Science for the Developing World (OWSD) to attend the 8th Science and Technology in Society (STS) Forum in Kyoto, Japan, as one of 10 young researchers (referred to as 'Future Leaders') from around the world. The Forum attracts top policymakers, business executives, scientists and researchers, and media from all over the world.

At the Forum, Ajoge was selected to deliver a speech on behalf of the 'Future Leaders'. An edited version of the speech is printed below.

Science is full of lights and shadows, benefits and consequences, especially accidental consequences. Though some of the world's disasters are a result of research and technology, we should remember that our enhanced, modern society has its roots in scientific research.

It seems that the value of research is often not obvious to the general public or to policymakers, and governments are moving towards further cuts in budgets, while some are not even dedicating funds to research.

Please permit us, as representatives of the new generation of scientists, to convey our message.

Our message is this: scientific research is a global necessity and it should be all-inclusive.

Our collective responsibilities, just like the challenges we face, are not exhaustive. But as representatives of the next generation of scientists we would like to contribute the following points:

1. Governments and industries alike should stimulate high quality cooperative science, both fundamental and applied. This will enhance the education of the new generation of innovators and stimulate the development of high quality knowledge in diverse fields to effectively tackle new societal challenges.

2. Scientific, political and media information should be transparent and highly accessible. This can be achieved through the use of peer-reviewed publication models which are web-based. Also, the direct involvement of scientists in political discussions, planning and decision-making as well as the critical evaluation of mass media

coverage, will go a long way to fostering the transparency of this information.

3. As the new generation of scientists, we need to improve our communication skills in order to disseminate our research better within the scientific community. We should be able to explain the 'probabilistic' nature of scientific research to policymakers and the general public. Probabilistic because science includes both opportunities and risks. In particular, the risks of human and accidental errors. The training of scientists should therefore include soft skills: how to present our findings clearly, assertively and sincerely to the general public and policymakers. This should start in our training institutions.

4. On the other hand, policymakers should foster and utilize innovative technologies. They should consider innovative research such as reverse osmosis membranes which is one of the solutions to water shortages in mega societies. Many political management issues have to be addressed with regards to global health, food shortages and population growth, as well as renewable, sustainable energy from alternative sources like the sun and biomass.

5. Individual scientists, research groups, small companies or laboratories can make innovative breakthroughs. However, to bring them into the practical arena, communication and collaboration between governments, industries and scientists is essential.

6. We must bridge the gap between research in the developed and developing worlds, especially Africa. This can be achieved through core funding of research activities and international travel collaborations by developing countries, industries and non-governmental organizations. On the other hand, the governments of the affected developing countries should strive to invest in research and development. We all must move and forge ahead as a global community.

Those that cannot fly, they must run.
Those that cannot run, they must walk.
And even if you cannot walk, you must crawl.
Please, keep moving ahead.

7. Finally, and very importantly, we must increase the representation of women in scientific research, education and decision making because properly represented groups of people will create better results and will make better global decisions that affect us all.

Please remember our joint message: scientific research is a global necessity and should be all-inclusive. ■

HONOURING WOMEN SCIENTISTS: TWAS, ELSEVIER AND OWSD

With funding support from TWAS and the Elsevier Foundation, the Organization for Women in Science for the Developing World (OWSD) honours the developing world's leading young women scientists.

The following article was written by Matthew Reisz and published in the Times Higher Education *supplement (8 December 2011) under the title 'Worldwide acclaim for ground breaking local heroines'. It is re-printed here with kind permission of the author.*

In 2005, Lubna Tahtamouni completed a PhD at Colorado State University and joined the Hashemite University in Jordan as an assistant professor in the department of biology and biotechnology, where she was promoted to associate professor in August. She is currently chair of the department and works on the causes of male infertility and "the role of action-binding proteins during cell migration".

Her family was supportive of her decision to build a career as a research scientist, but Tahtamouni recalls that before she got married, "they kept reminding me that I needed to have a life outside my lab. Jordan is very permissive when it comes to women's education and work, but traditionally women's priorities are pre-defined: her husband, children and household."

Tahtamouni says that "many times over the years I thought of leaving academia because of the frustrations", but she has recently received an award that

OWSD AWARDS FOR YOUNG WOMEN SCIENTISTS

The Awards were established to recognize female researchers working and living in developing countries who have made significant contributions to the advancement of scientific knowledge. With funding contributed by TWAS and the Elsevier Foundation, one winner for each of three scientific fields – biology, chemistry and physics/mathematics – was selected from each of four regions of the developing world: Asia and the Pacific; sub-Saharan Africa; Arab countries; and Latin America and the Caribbean.

Each winner receives USD5,000 plus a certificate. In 2010, the 12 winners were invited to attend the award ceremony held during the opening of the TWOWS (now OWSD) Fourth General Assembly and International Conference held in Beijing, China. The 2011 winners were presented their awards at the International Symposium on Women in Science and Engineering (WISE) 2011, held in conjunction with the International Year of Chemistry 2011 and hosted by the Ministry of Science, Technology and Innovation, and the Institut Kimia Malaysia (IKM) in Kuala Lumpur, Malaysia, from 29 to 30 September. The Malaysian Minister for Women, Family and Community Development, Datuk Seri Shahrizat Abdul Jalil, personally presented the awards.

"made all the disappointments go away. It gave me a huge push forward to write research proposals, mentor new graduate students and spend more time in the lab."

Along with biologists from Bangladesh and Cuba, mathematicians and physicists from India and Mexico and chemists from Egypt and Nigeria, Tahtamouni was one of 11 winners of the prestigious 2011 OWSD Awards for Young Women Scientists from the Developing World.

Supported by a grant from the Elsevier Foundation, the awards are presented jointly by TWAS and OWSD. The winners are selected by OWSD's president and the regional vice-presidents.

The 2011 awards ceremony took place at the end of September during an international symposium, Women in Science and Engineering, held in Kuala Lumpur.

"It is important to highlight that women, even from developing countries, are doing great things: making breakthroughs, contributing to advances in medicine, science, chemistry and engineering - becoming leaders and experts in their fields," says one of the researchers honoured in this year's awards, Denise Evans from South Africa.

Change begins at home

But although the winners are obviously exceptional individuals, their stories also illuminate wider issues of funding, the support that such scientists receive and the obstacles they often have to overcome. While acknowledging the importance of foreign experience and contacts, several women express a strong desire to contribute to the development of their own nations and regions.

Tahtamouni, for example, has spent three months every summer since 2006 in US or Australian labs and



hopes to spend the academic year 2012-13 on sabbatical either in one of those countries or in Germany or the UK. Yet, although "the award has opened many doors for me", she says, her intention is to remain as a teacher and mentor in Jordan.

"If I can make a change or impact the life of one student (especially a female student), then my work in Jordan and 'sacrifices' are worth it." She also wants to focus some of her research efforts on topics of particular concern to her female compatriots, namely "the invasion signature of breast cancer among Jordanian females" and the appropriate therapeutic interventions.

Similar themes emerge in the career of Evans, a biologist at the University of the Witwatersrand, Johannesburg. She completed her doctoral degree and a postdoctoral fellowship in medical laboratory technology before moving into the HIV and infectious diseases arena as an epidemiologist and researcher in 2009.

Women express a strong desire to contribute to the development of their countries.

Family support and encouragement, she says, enabled her "to continue as a full-time student for more than 10 years... I was also very fortunate to receive postdoctoral fellowships hosted by two different institutions within South Africa. Most sponsors prefer that you do a postdoctoral fellowship abroad. In my case, I still obtained the necessary experience and mentorship without going abroad for two years."

While pointing out that "HIV is an international problem and not confined to Africa", Evans also stresses that "many of the other resource-limited settings share the same challenges that we do", and she seems most interested in building collaborations within this sphere.

Her current research interests, she says, include "HIV and nutrition, low-cost monitoring of HIV for resource-limited settings and improving treatment outcomes in paediatric, adolescent and adult HIV-positive patients on antiretroviral therapy. I would like to continue analysing observational data from a large cohort of HIV-positive patients to monitor treatment and patient outcomes. I will also continue to provide statistical and methodological support to academic staff and students."

Launching careers

Two of this year's winners have been able to use their experience in leading Western universities as a launch pad for impressive careers in their own countries.

Silvina Pellegrinet studied chemistry at the National University of Rosario, her home town in Argentina, graduated in 1995 and was awarded a PhD fellowship by CONICET, Argentina's national research council. This included a period at the University of Seville in Spain, where she worked on the synthesis of antibacterial, antiviral and antifungal agents from sugars.

After completion of her PhD in 1999, Pellegrinet embarked on a postdoc at the University of Cambridge,

where she was also a research fellow at Lucy Cavendish College. She returned to Rosario in 2001 and, the following year, obtained a CONICET-funded position as assistant research scientist.

Pellegrinet was later promoted to adjunct research scientist and then independent research scientist in 2010. To date, she has published 32 papers in peer-reviewed journals and been invited to deliver lectures at American Chemical Society conferences.

In achieving all this, Pellegrinet stresses the support of her family, and particularly the "strong influence" of her engineer father. She also acknowledges the government support she received, "because I always attended public (and therefore free) educational institutions and because the national research council funded my PhD, my postdoc and my career as a scientist."

Yet her future career development is also likely to depend on "collaborations with groups in world-leading institutions such as the one I have maintained with my postdoc supervisor at the University of Cambridge for more than 10 years now."

Continuous support

On the other side of the world, Farzana Shaheen obtained her MSc and MPhil at Quaid-e-Azam University in Islamabad before moving to the University of Karachi's HEJ Research Institute of Chemistry, where she and her supervisors worked on the isolation of anti-epileptic natural products from the medicinal plants of Pakistan.

She acquired a basic training in combinatorial chemistry at the University of Southampton after becoming the first Pakistani to win a L'Oréal-UNESCO Fellowship for Young Women in Life Sciences in 2004. She developed her skills further through a Fulbright Scholarship for the academic year 2008-09 at the University of California, Davis.

Shaheen says she has enjoyed "continuous support from my mentor, teachers and family, due to which I could continue my research work even after my marriage", but she highlights the challenges she has faced as a mother of two young children in keeping "a balance between my professional and family life and also to perform high-quality research work."

She has now returned to the HEJ Institute as a tenure-track assistant professor, where she focuses on research on medicinal plants and on "new lead compounds against microbial infections."

Shaheen already has 50 publications in international journals and two patents to her name – and, like her 10 fellow OWSD award-winners, seems more than likely to continue "doing great things". ■

For additional information about the Organization for Women in Science for the Developing World, see www.owsdw.org

AFRICA, EUROPE AND ICT: BUILDING BRIDGES

TWAS'S FOUR-YEAR INVOLVEMENT IN THE EUROAFRICA-ICT PROJECT, FUNDED THROUGH THE EUROPEAN UNION'S SEVENTH FRAMEWORK PROGRAMME (FP7), HAS COME TO AN END. HERE WE REVIEW THE ACHIEVEMENTS OF THE PROJECT AND ITS LEGACY AS IT EVOLVES INTO A NEW FORMAT, EUROAFRICA-P8.

Europe and Africa share a long, often chequered, history. However, in the modern era of globalization, increasing international trade, and competition for new markets, there are many valid reasons for Europe to reach out to Africa. If nothing else, sharing a common time zone removes some of the physical constraints that working with other regions such as the Far East or the Americas imposes. One of the ways Europe is reaching out to Africa is through the support of a number of projects designed to promote scientific collaboration between scientists from the two continents. One such mechanism, supported by the European Union, is the EuroAfrica-ICT initiative, in which TWAS has participated as a partner.

Some lucky participants of the 4th Euro-Africa Cooperation Forum on ICT Research who landed at Cape Town airport on 13 November 2011 were greeted with a spectacular bird's-eye view of Table Mountain. The majority, however, only saw the more typical covering of cloud. Only when transferring from the airport to the conference venue, the Cape Town International Convention Centre (CTICC), would they see the mountain itself in all its grandeur: Table Mountain has served as a beacon for this forward-looking city since the first European explorers sailed into its protecting bays.

On reaching their hotels, observant participants might also have noticed that day's newspaper headline

Flickr/John Connell

announcing that, through an online poll, Table Mountain had been selected as one of the provisional 'New7Wonders of Nature'. While perhaps not reaching the heights of other claimants, such as Mount Kilimanjaro, for example, the inclusion of Table Mountain on the list was a triumph of Cape Town's information and communication technology (ICT) network.

The 4th Euro-Africa Cooperation Forum on ICT Research took place on 14-15 November 2011. The Forum was organized under the aegis of the European Commission (DG INFSO: International Relations) and the African Union Commission, in the framework of the Africa-EU Strategic Partnership and with the significant support of the South African Department of Science and Technology (DST). During the Forum some 250 participants from 30 countries gathered to discuss potential collaborations between Europe and Africa in ICT research, development and innovation.

250 participants from 30 countries discussed Euro-African collaboration in ICT research.

The Forum was opened by Karine Valin, managing director of Sigma-Orionis – a private company based in France that supports collaborative research and global innovation in the field of ICT – and coordinator of the EuroAfrica-ICT project. Valin outlined what she saw as the three main challenges facing the Forum participants:

- To investigate and analyse the progress made so far in building EU-Africa collaboration in ICTs;
- To identify any impediments to enhancing this collaboration and to find the right instruments to overcome them; and
- To ensure that tangible benefits and win-win outcomes are delivered.

Among the high-profile opening speakers, Harry de Backer, minister counsellor for the EU Delegation to the African Union in Addis Ababa, Ethiopia, highlighted the development of African-based innovations to solve Africa's problems, such as the mobile phone-based banking system 'm-Pesa' in Kenya. He remarked that there is the space and opportunity for locally grown applications that can be adapted elsewhere, such as Europe. These ideas were backed up by Nezaam Joseph, director of the Department of Environmental Affairs and Tourism at the Provincial Government Western Cape in South Africa, who promoted the role of local innovation in training and building local skills, mainly amongst the unemployed youth. Meanwhile, Laurens Cloete, executive director of the Meraka Institute of the South African Council for Scientific and Industrial Research (CSIR), confirmed that South Africa's economy is largely driven by traditional primary industries such as mining and agriculture, but that there is government commitment to developing a

knowledge economy. A 10 year innovation plan, for example, focuses on ICTs such as wider access to broadband internet and digital inclusion strategies. Cloete also noted South Africa's commitment to the global research community, through the development of infrastructural facilities such as the nearby Centre for High Performance Computing (see box, page 40).

ICTS FOR INNOVATION

Innovation – and how to promote it – was a key theme throughout the Forum's presentations and discussions.

One model that has its origins in Europe and is now expanding throughout Africa is the Living Labs model.

"Living Labs", explained Marlien Herselman, chair of the Living Lab network in Southern Africa (LLiSA), "are all about people who come together with a specific focus in multi-disciplinary teams to tackle community challenges. All the stakeholders play an equal role, be they from academia, the private sector, non-governmental organizations, or government."

The European Network of Living Labs (ENoLL), noted Alvaro Oliveira, president of the ENoLL council, has 274 members, some 238 of whom are based in the EU while others are located in Africa, China and in North and South America. In total some 25,000 organizations are involved, including universities, companies, and small- and medium-sized enterprises (SMEs).

South Africa's 10-year innovation plan focuses on information and communication technologies.

"Trust is a major driver within Living Labs", he added, "and the labs must also actively support the skills development of members and the communities with which they engage."

In Africa, unlike Europe where the movement began, Living Labs often focus on the challenges of rural communities. In support of Living Labs and local innovation, Danie Kok, head of SAP Research–Internet Applications and Services Africa, noted that Europe has a richness of knowledge and skills, but that these need to be adapted to Africa's challenges. "You can't take a solution from somewhere and try to force it into a problem when we haven't identified the problem", he said.

As an example, Jessica Colaco of iHub in Kenya introduced *Ushahidi* (which means 'testimony' in Kiswahili), an innovation developed in Kenya that is rivalling the m-Pesa banking system. Originally used to map reports of violence and unrest after Kenya's contentious 2007 presidential election, *Ushahidi* attempts to crowd-source information by email, text messages, smart phone apps, Twitter and other applications in an attempt to get an overall picture of what is happening in real time. It has since been used in post-earthquake Haiti and in the 'Snowmageddon' website set up to

EUROAFRICA-ICT OVERVIEW

With the conclusion of the 4th Euro-Africa Cooperation Forum on ICT Research, TWAS's four-year participation in the EuroAfrica-ICT project has come to an end. During this time, TWAS took the lead – along with Sigma-Orionis in France, the overall project coordinators – in organizing the 1st and 3rd Forums in Brussels in March 2009 and in Helsinki in December 2010, respectively. The Academy also assisted Sigma-Orionis and the Meraka Institute of South Africa's Council for Scientific and Industrial Research (CSIR) with the organization of the 2nd Forum in Addis Ababa, Ethiopia, in February 2010 and with the most recent event in Cape Town.

These four years have also seen the project partners organize four one-day concertation meetings in Brussels and one in South Africa that involved a series of presentations and networking opportunities. In addition, the consortium organized six workshops in Africa (in Benin, Mauritius, Rwanda, South Africa, Sudan and Uganda), as well as one in Jamaica for the Caribbean region, designed to guide local researchers in developing their proposals and applying for EU funding.

Finally, a database of centres of excellence in ICT research in Africa has been developed and made freely available online. The database, which will be continually updated, is designed to help European and other researchers find suitable project partners in Africa and thus facilitate the development of joint proposals and projects.

help people dig out of New York's February 2010 blizzard. Ushahidi has now been translated into 18 different languages and has been used in 132 different countries. It was also used to stimulate the establishment of the Nairobi iHub, described by Colaco as a catalyst and enabler for the technology community to help get their ideas "out there". iHub members, whose average age is just 23, expect their ideas to make an impact in the community within just five years.

In another example of using the new social media, Brent Williams described the Cape Town-based RLabs initiative that is rapidly turning into a global movement. A self-confessed reformed criminal, Williams uses the RLabs and social networking media to create an inter-linked online community of reforming criminals, addicts and others and has created an environment where people are empowered to make a difference in the lives of others. An example would be instant support in times of emotional crisis for members of the network.

It was Williams, too, who boasted that information about the vote for Table Mountain (as one of the seven natural wonders of the world) was disseminated through his social network projects. Thanks to his mobilizing the local community through ICTs, therefore, thousands of additional tourists are likely to flood into Cape Town, boosting the city's economy.

Forum participants also analysed the role of public-private partnerships (PPPs) in ICT development. In particular, Joseph Nsengimana, INTEL Africa's director of Corporate Affairs Group and Strategic Alliances, defined a PPP as "the working together of two groups where each partner has a particular reason or interest to collaborate and both have a share in the result." He



LAB VISITS

A feature of the EuroAfrica-ICT project has been the organization of visits to relevant ICT labs whenever workshops or the Cooperation Forums have been held.

For example, following the 2nd Forum in Addis Ababa, some 30 delegates visited EthERNet, the Ethiopian Educational Research Network, a National Research and Education Network (NREN) that has expanded to include 21 Ethiopian universities and research centres, and that aims to ensure that partner institutions have efficient and affordable bandwidth for their ICT activities such as tele-education, tele-medicine and a digital e-library. That was followed by a visit to the Information and Development for Persons with Disabilities Association's (IDPDA) ICT centre, which provides support to the visually impaired, deaf and other persons with disabilities (PWDs) based in communities around Addis Ababa through basic computer training to increase access to and awareness of ICTs, as well as create employment opportunities for PWDs. Finally, delegates visited the Computer Refurbishment and Training Centre (CRTC), located 20 kilometres from the centre of Addis Ababa. The centre imports high-quality, pre-used computers donated by developed countries and refurbishes them for use in schools and universities. It has distributed more than 20,000 computers throughout Ethiopia. The centre also provides a venue for training in computer refurbishment and maintenance.

During the lab visit that followed the November 2011 Cape Town meeting, some 50 delegates got an overview of the facilities and activities of the Centre for High Performance Computing (CHPC).

The infrastructure developments required to install and host Africa's first supercomputer, as well as details of the machine itself and the analyses that it runs were highlighted. Internationally, such machines are ranked according to their performance when running the High Performance Linpack (HPL) benchmark and then tracked on a list referred to as the Top500. The CHPC cluster is currently ranked 329 in the Top500 list and achieved 61.33 teraFLOPS (one teraFLOP equals 10^{12} floating-point operations per second). The calculations are performed by 6,336 computer cores operating in parallel. This massive computing power has been used in such projects as aeronautics, astronomy, electronic engineering and oceanography. Two projects in particular involved modelling the biomechanical behaviour of the human heart and the simulation of the complex microstructure of lithium manganese oxide for potential use in high-capacity composite electrodes in rechargeable batteries for cars. The CHPC caters to academic users and has over 450 individual users across a wide spectrum of research disciplines.

added that "it is important, early in the partnership, to define clearly what the goals and objectives of the partnership are and to create a shared vision which is clearly articulated."

However, Aidan Baigrie, head of Business Development at Seacom Ltd., a private company that is developing the internet in Africa, cautioned that PPPs, just like other vehicles, can go wrong. Innovation resulting



from PPPs also tends to be different from the grassroots innovation coming from initiatives such as Living Labs. "PPPs are most efficient when they involve the core infrastructure of a country", said Baigrie, and advised that PPP projects could be centralized within government to facilitate access by the private sector and to provide security through a suitable legal and regulatory framework.

CAPACITY BUILDING

In a parallel session organized during the 3rd Euro-Africa Cooperation Forum on ICT Research held in Helsinki in December 2010, a workshop on 'Building and Strengthening Capacities in ICT Research in Africa', co-chaired by TWAS programme officer, Peter McGrath, and Venansius Baryamureeba, vice-chancellor of Makerere University, Uganda, reviewed the current landscape of ICT training programmes and other ongoing initiatives in Africa. Participants concluded that there is still a great need across large parts of the continent for improved capacity to carry out research in different areas of ICT. In particular, the need for a critical mass of trained researchers was highlighted, along with institutional capacity building so that these scientists have the necessary facilities and equipment that would allow them to compete with and participate in global ICT research initiatives.

There is a need across the continent for capacity to carry out research in ICT.

These themes were taken forward in the Cape Town forum, where a session on 'Building and Strengthening Capacities in ICT Research' was also chaired by Peter McGrath.

In this case, with a different series of speakers and different audience participants, additional recommendations emerged, most notably regarding the need to develop and promote more connections between individuals: between researchers in Europe and Africa; between researchers in different African cities and countries; and between researchers, entrepreneurs and the private sector. Key to bridging these gaps, participants confirmed, is to either obtain advanced training in developed countries and then return home (so-called 'brain circulation') or – perhaps more cost-effective – to develop programmes that would allow experts from developed countries to spend time working with a number of students and researchers *in situ* in Africa. The need to train students and young researchers in entrepreneurship skills was also highlighted, perhaps through the organization of workshops and summer schools.

FORUM CONCLUSION

During the closing session of the forum, the chair, Laurens Cloete, highlighted that the event had confirmed

the importance of the EuroAfrica-ICT project in bringing together African and European researchers and policymakers to share experiences, hold dialogues on joint agendas, and build networks. Its successor, EuroAfrica-P8 (see box, page 43) must continue to do the same, he added. A unique combination of researchers and policymakers had attended the forum, including the European Commission, the African Union Commission and member states. African researchers had been able to meet and discuss the important engineering and technical challenges that must be overcome before the information society and knowledge economies fully take hold in Africa. In many cases, specific topics of joint interest, such as the 'Future Internet' and 'Trustworthy ICT', were explored to the point where research topics unique to Africa and relevant to Europe were identified, together with current and future funding opportunities. As Cloete summed up: "It is now up to the researchers to make use of every available opportunity for collaborative research and to turn them into benefits for both continents."

It is now up to the researchers to make use of every available opportunity for collaborative research.

LOOKING AHEAD

This fourth forum, along with the other events organized within the framework of the EuroAfrica-ICT project (see box, page 39) also enabled EuroAfrica-ICT consortium partners to hold a series of discussion sessions with key figures in the ICT research field. Together with a preliminary online questionnaire, a series of telephone and face-to-face interviews, and a final, targeted online questionnaire, these sessions provided detailed input for a report to the European Commission on key areas for future ICT research collaboration between the two continents.

Following the first surveys and series of interviews, it emerged that the three main areas for consideration should be e-Health, e-Education and wireless networks. A second online survey and a more targeted round of interviews allowed a more in-depth analysis of these three areas.

Among the themes identified in the field of e-Health are the installation of integrated clinical and administrative health information systems and data management; disease surveillance systems; and remote diagnostics, telemedicine, tele-surgery and homecare applications. With regard to e-Learning, participants identified the need to evaluate and provide technical support for e-Learning technologies, software and applications; to develop e-Learning course content and validate its delivery and effectiveness; and to develop e-Libraries for improved access to information

8TH STRATEGIC PARTNERSHIP

Although TWAS's direct involvement in the EuroAfrica-ICT project is over, the project itself is continuing with a further two-years' support from the EU and a new consortium of 11 partners, including six from Europe and five from Africa. For the first time, the initiative also formally involves countries from north Africa, represented in the consortium by the Egyptian Ministry of Communications and Information Technology and the Tunisian Centre d'Etudes et de Recherches de Telecommunications.

The new project, designated 'EuroAfrica-P8', builds on the achievements of previous projects dating back to 2006 (TWAS came on board in 2008). The 'P8' in the project title refers to the '8th Partnership on Science, Information Society and Space' between the European Union and the African Union, which was adopted at the 2nd EU-Africa Summit held in Lisbon, Portugal, in December 2007.

The next major event to be organized by the EuroAfrica-P8 consortium will be the 5th Euro-Africa Cooperation Forum on ICT Research, to be held in Lisbon on 6 and 7 November 2012.

Because of the obvious benefits such initiatives provide to African researchers, TWAS will maintain close links with the project, cooperating actively and participating in its events whenever possible.

For additional information on EuroAfrica-P8, see www.euroafrica-ict.org.

resources. Concerning m-Applications, or the provision of services via mobile platforms, participants highlighted the need for training and accreditation for mobile application developers; better links between researchers and developers for scaling-up and replicating successful models like m-Pesa; and the need for interoperability between mobile operating languages and even local African language versions of different applications.

Across these and other areas, survey and workshop participants were also supportive of problem-oriented, project-driven capacity-building efforts aimed at integrated development and learning, and that such efforts should involve multi-stakeholder partnerships, including local entrepreneurs, and focus on such basic public-sector services as healthcare, education and governance.

A final recommendation to emerge from this series of questionnaires, interviews and discussion sessions is that both African and European stakeholders see significant mutual benefits in Euro-African cooperation and would welcome Africa being specifically mentioned in future iterations of the European Framework Programme for research funding.

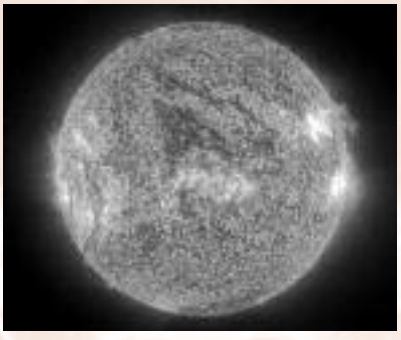
With the EU's FP7 funding programme ending in 2013, it is hoped that such recommendations will make it into its successor, the so-called 'Horizon 2020' that is currently being formulated. If so, then the EuroAfrica-ICT initiative can surely claim to have played a role in garnering EU funding support for Euro-African research collaboration. ■

For additional information on the EuroAfrica-ICT initiative, see www.euroafrica-ict.org



IT'S TIME TO DISCUSS SOLAR RADIATION

THE CONCEPT OF DELIBERATELY REGULATING THE EARTH'S CLIMATE IS BECOMING DISCUSSED MORE AND MORE FREQUENTLY. BEFORE ANY INTERVENTIONS ARE UNDERTAKEN, HOWEVER, RESEARCH IS REQUIRED. BUT EVEN THIS RESEARCH IS CONTROVERSIAL. WHO SHOULD DECIDE IF SUCH RESEARCH GOES AHEAD – AND UNDER WHAT MECHANISM? IT WAS TO DISCUSS ISSUES SUCH AS THESE THAT, IN MARCH 2010, TWAS TEAMED UP WITH THE UK'S ROYAL SOCIETY AND THE UNITED STATES-BASED ENVIRONMENT DEFENSE FUND IN THE SOLAR RADIATION MANAGEMENT GOVERNANCE INITIATIVE (SRMGI).



Current efforts to reduce and eventually reverse the effects of global climate change can be regarded either as mitigation*, i.e. techniques that would reduce the amount of greenhouse gases released into the atmosphere, or* adaptation*, i.e. ways in which humankind can begin to live with the changes that are already beginning to affect our planet. Now a third option is being discussed more and more frequently:* geoengineering.

Geoengineering, which can be described as 'the deliberate large-scale manipulation of the planetary environment to counteract anthropogenic climate change', was the subject of a Royal Society report, *Geoengineering the climate: Science, governance and uncertainty*, published in September 2009.

Geoengineering methods, says the report, can be divided into two categories:

- Carbon dioxide removal techniques, which would address the root cause of climate change by removing greenhouse gases from the atmosphere; and
- Solar radiation management techniques, which would attempt to offset the effects of increased greenhouse gas concentrations by causing the Earth to absorb less solar radiation.

Comparing these techniques, the removal of carbon dioxide from the atmosphere would require the development of new technologies that are decades away, would act very slowly, and would be relatively expensive.

Reducing the amount of solar radiation reaching the Earth's surface, on the other hand, could be achieved relatively cheaply by adapting existing technologies to spray seawater droplets into the air to whiten clouds, or to disperse sulphur aerosols in the upper atmosphere. The effects would also be rapid.

Reducing the amount of solar radiation reaching the Earth could be achieved relatively cheaply.

On the other hand, solar radiation management techniques would not reduce all adverse effects of climate change such as the acidification of the oceans and the subsequent predicted die-off of a large proportion of marine life. Moreover, by their very nature, their effect would be felt across national borders and – as we still don't have suitable ways of predicting their impact – there would be winners and losers on the ground as regional weather patterns are altered. In addition, because the techniques are relatively cheap and simple, it could be envisaged that a single nation could use solar radiation management to alter the climate to mitigate problematic climate impacts. The international community would surely not sanction such a move, but does it have the power – or even the mechanisms – to respond?

And there is another issue. Some scientists have predicted that the thawing of the Earth's permafrost regions, for example, could start releasing massive amounts of methane – a gas with a much greater global warming potential than carbon dioxide – leading to run-away climate change. Under this and other so-called 'tipping-point' scenarios, we would need to deploy something to counteract these effects quickly and effectively. But how will we know when we have reached a tipping point and whether a proposed intervention is effective if we do not carry out the research?

And there's the rub.

If we do carry out the research (and already some people consider that to be taboo and the first step on the slippery slope to deployment), what kind of research should be allowable? Certainly not large-scale releases of substances into the upper atmosphere that could have cross-border and weather- and climate-changing implications, but what about smaller-scale experiments, or even computer-based 'in-silico' simulations?

And who should decide, for example, when a small-scale field trial could have wider implications, or a large-scale trial could be considered as actual deployment?

It was to discuss such issues that the Solar Radiation Management Governance Initiative (SRMGI) was set up, with TWAS and the United States-based Environment Defense Fund (EDF) joining the Royal Society as co-conveners.

SRMGI UNFOLDS

The SRMGI project kicked off with the appointment of an expert steering committee of representatives from the three co-convening organizations: John Shepherd, School of Ocean and Earth Science, University of Southampton, UK, and chair of the Royal Society working group; Steve Hamburg, chief scientist at EDF; and Carlos Nobre (TWAS Fellow 2006). During the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STRANGE NEW IDEAS THAT COULD HELP OUR BRAVE OLD WORLD

An opinion piece by John Shepherd, Fellow of the Royal Society; Steve Hamburg, Chief Scientist for the Environmental Defense Fund; and TWAS Fellow Paulo Artaxo was released during the United Nations Framework Convention on Climate Change (UNFCCC) 'COP17', held in Durban, South Africa, from 28 November to 9 December 2011 and coincided with the release of the SRMGI report, 'Solar radiation management: The governance of research'.

As the latest round of climate change talks at Durban continue and some countries still resist further cuts to emissions, individuals, organizations and even governments are beginning to look at a surprising Plan B. They all recognize that climate change continues to threaten our planet and is getting worse every day: the latest figures show that worldwide emissions of greenhouse gases are rising faster than ever, and evidence of serious impacts is mounting. So, as they hope for progress on cuts in global emissions, they ask whether we could intentionally alter our planet's climate too.

Serious discussions of large-scale manipulations of our climate to counteract the effects of climate change are now taking place around the world. These techniques are collectively called 'geoengineering', and they range from simple strategies (like painting roofs white to reflect sunlight and heat) through injecting small particles into the upper atmosphere to reflect sunlight back into space, to measures that seem to have come from a science fiction movie, like positioning giant 'sun shades' in space.

Remaining ignorant is usually the most dangerous course of action and currently we have little information on the potential impacts – both beneficial and detrimental – of these techniques. In this case there is also a risk of unregulated use of these technologies – or even unregulated research into them – and that could be the worst option. We can't risk a cure that's worse than the disease. That's why we have to start discussing geoengineering and debating how to proceed, not just burying our heads in the sand until someone, somewhere, actually tries to tinker with the climate.

Deliberate intervention in the Earth's climate system is a scary prospect. One area of geoengineering raises particular concerns. Solar radiation management (SRM) tech-

course of SRMGI, Nobre was appointed to a high-level post in the Brazilian government, so Paulo Artaxo (TWAS Fellow 2009), Institute of Physics, University of São Paulo, was appointed to represent the Academy.

At the same time, a working group was being brought together featuring experts from diverse disciplines, including science, ethics and law. Among the working group members, for example, were geologist Sospeter Muhongo (TWAS Fellow 2004), recently appointed energy minister in Tanzania, and Laban Ogallo (TWAS Fellow 2002), head of the Intergovernmental Authority on Development Climate Prediction and Applications Centre (ICPAC) in Nairobi, Kenya.

SRMGI did not seek to achieve a consensus, but to explore and record different viewpoints.

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niques would cool the Earth by reflecting a small percentage of inbound sunlight back into space. These techniques would be fast-acting and, as some of them are relatively inexpensive, they could conceivably be deployed unilaterally by individual nations, corporations or even wealthy individuals. However, they are not a long-term solution to increasing concentrations of greenhouse gases in the atmosphere, and would probably have unexpected and undesirable side effects.

Without research, we will never know if these sunlight-reflecting methods represent a viable option in the case that we back ourselves into a climate crisis. But even large-scale research on some of these methods may be risky. To make matters worse, national and international systems for managing such potentially risky environmental research are mostly lacking, and existing international treaties only cover this sort of research in a piecemeal way. That's where our SRM Governance Initiative (SRMGI) comes in. The project, and its new report, are a collaborative venture by an international group of non-governmental organizations (NGOs), co-sponsored by the Royal Society in Britain, TWAS, and the Environmental Defense Fund in the United States. None of the sponsoring organizations either supports or opposes geoengineering. However, we are all committed to seeing that any research should be undertaken in a safe, transparent and socially acceptable way.

This is just the beginning of a journey into unknown territory. One thing is clear, however: nothing we currently know about geoengineering provides any justification for easing efforts to mitigate climate change by reducing greenhouse gas emissions, or to cease making plans to adapt to its effects. We must not heed the siren voices that say they can foretell what impact geoengineering will have, whether it be disaster or salvation.

SRM has the potential to be either very useful, or very harmful, for people and the planet. It is impossible to know at this stage whether the technology will be feasible or whether its consequences would be acceptable. International conversations about the governance of SRM need to be continued and broadened to include more countries and more sectors of society. Our project is a start, but we have much more work to do – and we expect there will be many more strange and surprising ideas to deal with if our leaders do not get a grip on global emissions, and soon. ■

Working group members met at the Kavli Royal Society International Centre outside London on 10-11 November 2010 to plan the way ahead for the project and, in particular, to determine the threads of three background papers that would eventually become discussion resource documents for a final SRMGI conference.

This conference, also held at the Kavli Centre, took place on 22-24 March 2011 and featured some 50 participants representing a diverse range of 'stakeholder partners', including climate scientists, organizations representing civil society, environmental groups such as Greenpeace and WWF, as well as other organizations such as the Red Cross/Red Crescent Climate Centre, the Canada-based Center for International Governance Innovations, and IAP, the Trieste-based global network of science academies.

Given the controversial nature of the subject, conference rules were laid out to stimulate discussion and not to stifle it. Therefore, the so-called 'Chatham House rule' was applied, whereby any viewpoints expressed were not attributable to any particular person or organization. In addition, the conference did not seek to achieve a consensus, but to explore and record different viewpoints.

Following the conference, these viewpoints were combined with those parts of the working group documents considered most relevant to produce the final report, 'Solar radiation management: The governance of research', which was released on 2 December 2011 – a date chosen to coincide with the international climate change negotiations then being held in Durban, South Africa. The publication of the report was supported by a media campaign, which included the opinion piece 'Strange new ideas' by the three expert steering committee members, reproduced on pages 46-47.

A major aim of the SRMGI project has been to open up the debate to the widest audience possible.

SRMGI PHASE 2

Since the beginning, a major aim of the SRMGI project has been to open up the debate to the widest audience possible. Indeed, one criticism that could be made of the SRMGI project is that the majority of the inputs in the discussions came from experts in the North and little was heard from the developing world, women's groups or minority groups.

To ensure this is not the case moving forward, SRMGI is entering a second phase whereby the document published at the conclusion of the initial stage is used as a basis for discussion among more diverse groups. To date, workshops have been held in such countries as China, India and Pakistan.

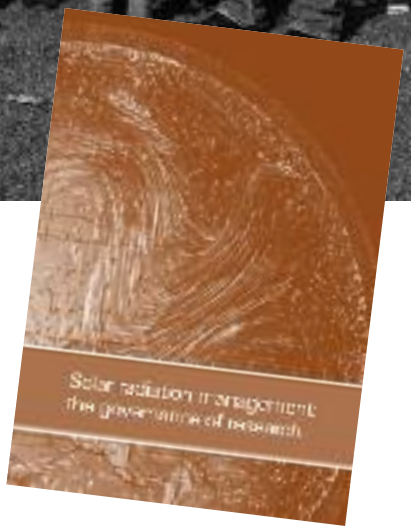
The events were organized by local NGOs, and held in partnership with SRMGI. Participants included local policymakers, civil society representatives and academics, and discussions were wide-ranging. In particular the neutral stance of SRMGI on SRM governance issues, and the fact that sessions were designed to

Flickr/ARM Climate Research Facility

solicit local opinion, not influence it, were particularly well received.

Moreover, an additional collaborative project led by the African Academy of Sciences has been funded by IAP under its science communication programme. The proposal includes the three SRMGI convening organizations, and will see the solar radiation management discussion rolled out across the African continent.

In addition, the team is targeting major science conferences as well as climate change and sustainable development conferences to broaden the number and type of constituencies that are contributing to the discussions. Presentations were made, for example, during the 'Planet Under Pressure' conference that brought together some 3,000 researchers and policymakers in London in March 2012. There are also plans to hold a side event at this year's United Nations Conference on Sustainable Development (the so-called 'Rio+20' event) to be held in Brazil from 20 to 22 June 2012.



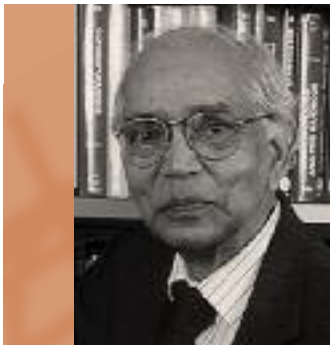
One thing is certain: as international agreements on climate change continue to be dogged by disagreements and snail-paced discussions, the voices raised in the geoengineering debate will be increasingly loud. Already, for example, the Intergovernmental Panel on Climate Change (IPCC) has discussed the issue and will include information on solar radiation management in its fifth Assessment Report.

Building on the strength of its partnership with the Royal Society and EDF, TWAS is ready to broker this debate which, in the words of EDF's Steven Hamburg, involves a 'growing spiral' of interested parties. ■

For more information on SRMGI, see: www.srmgi.org

MULTIPLE HONOURS

• **C.R. Rao** (TWAS Founding Fellow) received three honorary doctorate degrees within three months between December 2011 and February 2012: from the University of Colombo, Sri Lanka; from Karanatak University, Dharwad, India; and from the International Sanskrit University, Tirupati, India. These are in addition to 33 honorary degrees he has already received from universities in 19 countries for his contributions to the field of statistical science. Rao is currently professor emeritus at Penn State University and research professor at the University of Buffalo in the United States. He was the director of the Indian Statistical Institute and founder of the C.R. Rao Advanced Institute of Mathematics, Statistics and Computer Science (CRRAO AIMSCS), at the University of Hyderabad where he continues to work for the advancement of research in mathematics, statistics and computer science. In 2009 he started the Statistics Olympiad programme to encourage the study of statistics. Rao has received numerous prestigious national and international awards, including most recently, the India Science Award in 2010, and the Guy Medal of the Royal Statistical Society (Gold) in 2011. In addition, several awards have been established in his honour to advance research and innovation in the theory and practice of mathematical statistics, including the C.R. and Bhargavi Rao Prize from the Department of Statistics at Penn State University and the National Award in Statistics established by the Ministry of Statistics and Programme Implementation (MoSPI), Government of India. Rao is a Fellow of the Royal Society, UK, and a member of the US National Science Academy.



C.R. Rao

ENERGY MINISTER, TANZANIA

• **Sospeter Muhongo** (TWAS Fellow 2004) was appointed energy and minerals minister of Tanzania on 5 May this year in a reshuffling of parliament. Muhongo is professor of geology at the University of Dar es Salaam and editor-in-chief of the Journal of African Earth Sciences, which specializes in natural resources in Africa and the Middle East. Tanzania is quickly becoming of great interest to investment by international firms since, like its neighbour Mozambique, large deposits of natural gas have been discovered offshore and the country also has extensive mining interests, including gold, coal and iron ore. Muhongo's appointment means that an expert scientist is now in a key position in government to make informed decisions in collaboration with policymakers about the way forward for energy and minerals in Tanzania.

Sospeter Muhongo

US AND NORTH KOREA

• TWAS executive director Romain Murenzi was among 19 high-profile delegates invited to attend a meeting aimed at encouraging and supporting scientific collaboration between the United States and the Democratic People's Republic of Korea (DPRK). The intimate gathering discussed 'Advancing US-DPRK Relations through Science Engagement and Cooperation' at the Bellagio Centre in northern Italy for three days in April this year. The US-DPRK Scientific Engagement Consortium was established in 2007 and has held numerous meetings over the past four years. TWAS already makes a concrete contribution to the capacity building in DPRK through its South-South fellowships programme: there are currently 22 North Koreans who have benefitted – or are benefitting – from TWAS fellowships. In addition, there are two TWAS Fellows from DPRK. Murenzi concluded that TWAS was in a good position to offer support and that the meeting and collaborations proposed were "a great example of science diplomacy" in action.

ENTREPRENEUR WORKSHOP

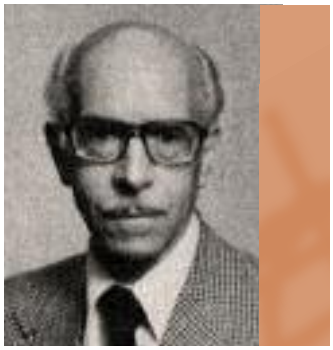
• TWAS co-sponsored a five-day 'Workshop on Entrepreneurship for Physicists and Engineers from Developing Countries' held at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste in April this year. The workshop gave participants valuable step-by-step advice on how to convert their research innovations into mar-

ketable products. More than 40 scientists from 20 developing countries attended. This was the fourth edition of the series to be held in Trieste (eleven workshops have been held in total since 2006). The series is a joint initiative of ICTP, TWAS, the UK's Institute of Physics (IOP) and the American Physics Society (APS). The course covered a broad spectrum of topics ranging from the relationship between scientific research, inventions and products, to the concept of intellectual property and its significance in developing countries. Audience participation was guaranteed, since participants were required to work in small groups to produce a full business plan by the end of the week, and to present their imaginary-but-possible products to a panel of judges made up of the course tutors.

Workshop participants

IN MEMORIAM

• **Luis Vargas Fernandez** (TWAS Fellow 1989) died on 29 September 2011 at the age of 99. Vargas was dean of the School of Biological Sciences at the Pontifical Catholic University of Chile from 1973 to 1982, where he previously held the positions of director of the School of Medicine and head of the Department of Cell Biology. During his career, Vargas Fernandez made a number of distinguished contributions to the study of diabetes. As a Guggenheim Fellow in the United States, and as a Rockefeller Foundation Fellow at the University of Cambridge, UK, in the 1940s and 1950s, he made significant progress in the study of the role of stress and hormones in tumour development which led to research on the use of insulin in the control of diabetes and endocrine responses to stress. In 1985, he was presented with the National Science Award for his studies in the area of renal physiology and his analysis of hormone-related tumours. Vargas Fernandez was also president of the Chilean Academy of Sciences from 1986 to 1991 and a member of several international scientific academies. Throughout his career, he actively promoted the exchange of information between his university and the academies of which he was a member, thereby strengthening the activities of each.



Luis Vargas Fernandez

• **Mu Guoguang** (TWAS Fellow 1993) died on 12 April at the age of 81. Mu was an academician at the Chinese Academy of Sciences and director and professor at the Institute of Modern Optics, Nankai University where he earned his degree in 1952 before being employed as a lecturer and professor. He became the fifth president of Nankai University in 1986. As president of the Chinese Optical Society and vice president of the International Commission for Optics, he actively promoted academic exchanges with many international optical societies, including the Optical Society of America and the International Optical Engineering Society (SPIE), of which he was a fellow. Mu is recognized for his distinguished contributions in the field of applied optics, optical information processing, optical pattern recognition, and vision science. In particular, he pioneered the use of black and white film to refract color images. This, along with his design of novel optical instruments earned him three national scientific and technological prizes as well as the honorary title of National Expertise Scientist with Outstanding Contributions in 1986 and the Ho Leung Ho Lee Foundation Technological Sciences Prize in 1988.

Mu Guoguang

WHAT'S TWAS?

TWAS, THE ACADEMY OF SCIENCES FOR THE DEVELOPING WORLD, IS AN AUTONOMOUS INTERNATIONAL ORGANIZATION THAT PROMOTES SCIENTIFIC CAPACITY AND EXCELLENCE IN THE SOUTH. FOUNDED AS THE THIRD WORLD ACADEMY OF SCIENCES BY A GROUP OF EMINENT SCIENTISTS UNDER THE LEADERSHIP OF THE LATE NOBEL LAUREATE ABDUS SALAM OF PAKISTAN IN 1983, TWAS WAS OFFICIALLY LAUNCHED IN TRIESTE, ITALY, IN 1985, BY THE SECRETARY GENERAL OF THE UNITED NATIONS.

TWAS has more than 1,000 members from 90 countries, 73 of which are developing countries. A 13-member council is responsible for supervising all Academy affairs. It is assisted in the administration and coordination of programmes by a secretariat, headed by an executive director and located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. The United Nations Educational, Scientific and Cultural Organization (UNESCO) is responsible for the administration of TWAS funds and staff. A major portion of TWAS funding is provided by the Italian government.

The main objectives of TWAS are to:

- Recognize, support and promote excellence in scientific research in the South.
- Provide promising scientists in the South with research facilities necessary for the advancement of their work.
- Facilitate contacts between individual scientists and institutions in the South.
- Encourage South-North cooperation between individuals and centres of science and scholarship.

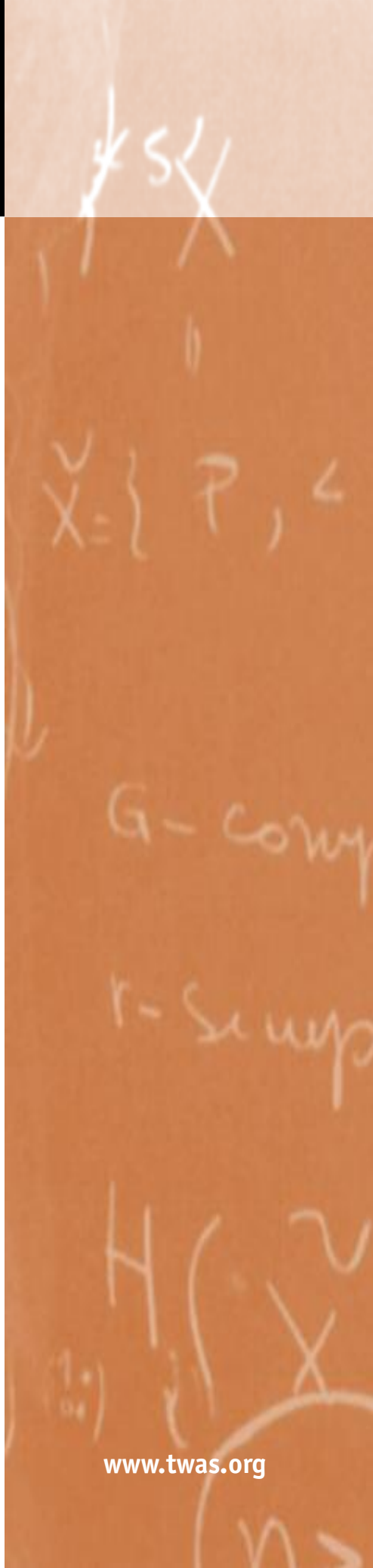
TWAS played a key role in the establishment, in 1993, of the Organization for Women in Science for the Developing World (OWSD, formerly the Third World Organization for Women in Science, TWOWS). Some 3,200 women scientists from more than 90 countries in the South are members of OWSD, making it the largest organization of women scientists in the world. Its main objectives are to promote the leadership of women in science and technology in the South and to strengthen the participation of women in science-based development and decision-making. The secretariat of OWSD is hosted and assisted by TWAS.

www.owsdw.org

Since 2000 TWAS has provided the secretariat for IAP, the global network of science academies. IAP, which was established in 1993 as the 'InterAcademy Panel on international issues', unites more than 100 science academies worldwide; provides high-quality independent information and advice on science and development to policymakers and the public; supports programmes on scientific capacity building, education and communication; and leads efforts to expand international science cooperation.

www.interacademies.net

Since 2004 TWAS has also hosted the secretariat of the InterAcademy Medical Panel (IAMP), an association of the world's medical academies and medical divisions of science academies. IAMP is committed to improving human health worldwide through the coordinated action of its 69 members. **www.iamp-online.org**



www.twas.org