



A N N U A L R E P O R T

2011



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 in 1983 by a group of eminent scientists under the leadership of the late Nobel laureate Abdus Salam of Pakistan, 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 over 90 countries. More than 80% of its members are from developing countries. A 13-member council directs Academy activities. A secretariat, headed by an executive director, coordinates the programmes. The Academy's secretariat is located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

TWAS's administration and finances are overseen by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in accordance with an agreement signed by the two organizations. The Italian government provides a major portion of the Academy's funding.

The main objectives of TWAS are to:

- Recognize, support and promote excellence in scientific research in the developing world;
- Respond to the needs of young researchers in science and technology-lagging developing countries;
- Promote South-South and South-North cooperation in science, technology and innovation;
- Encourage scientific research and sharing of experiences in solving major problems facing developing countries.

To help achieve these objectives, TWAS collaborates with a number of organizations, most notably UNESCO, ICTP and the International Centre for Biotechnology and Genetic Engineering (ICGEB).



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FOREWORD

Embracing Change

Jacob Palis

TWAS President

In April 2011, Romain Murenzi was appointed executive director of TWAS. Murenzi arrived with excellent credentials: a doctorate in physics, experience as a maths teacher, and eight years' service as minister of education, science, technology and scientific research in Rwanda, the last three years spent as minister in President Kagame's office. As the selection committee hoped, Murenzi has brought his unique blend of academic and political expertise, as well as his high-standing in the developing world, to bear on building new bridges for collaboration, particularly with ministers, governments and regional development banks. We are entering an era when science is inextricably tied to diplomacy, and these links will clearly play an increasingly important role in our organization. But importantly, too, Murenzi will continue to build on the strong foundations of the core programmes and activities that TWAS has been developing over nearly thirty years.

It is this balance between consolidating what we already have, and accepting and adapting to change that I think will be key to the success of the Academy in the years to come.

2011 has been a year of dramatic – and significant – changes, both globally and within TWAS as an organization. These changes have had, and will have, a direct impact on the ways and means that TWAS operates. The ongoing global economic crisis for some (particularly in the United States and Europe) coincides with an upturn in fortunes for others. My own country, Brazil, is enjoying unprecedented wealth; business in China continues to boom, and India is now well placed to compete on the world stage. Other countries, too, are undergoing rapid changes: Malaysia, Mexico, Pakistan and South Africa, for example, are now joining the ranks of the so-called 'emerging' countries. Still others, in time, will change their economic status, and thus their position in world affairs.

Where, then, does this leave TWAS? As an organization dedicated to building science capacity in and for developing countries, these changing definitions (which reflect changing realities) force us to stop and take a look around at the new landscape. The relationships between countries are continually evolving: there are new configurations, new centres of power, and new partnerships. TWAS, too, needs to re-examine its position in the world, and in relation to the countries whose scientists we support. We must not forget either, that within each of these emerging countries there are still massive discrepancies in wealth, and severe poverty affects many millions of their inhabitants. TWAS needs to respond to the changes that are occurring both *within* and *between* countries.



TWAS has had its own significant changes to adapt to in 2011. Mohammed Hassan retired after twenty-six years as our executive director. Perhaps more than anyone else, Hassan has shaped and defined what TWAS is, and his leaving this key role, even though he continues to participate as TWAS treasurer, certainly represents a change in contours.

Daniel Schaffer also retired this year, having spent fifteen years as the TWAS Public Information Officer. In his writing, editing and presentations, Schaffer too helped define what TWAS is, and how it is perceived by the scientific community, the public and, importantly, our funders.

TWAS's challenge for the coming year is to adapt positively to these changes – both within the organization and on the world stage. This means balancing consolidation with change. In consolidating, we should look back very thoughtfully over what has been achieved since TWAS began to support scientific excellence in the South almost thirty years ago. We can be proud, certainly, of the many challenges we have overcome and the real difference our programmes and activities have made to the lives of individual researchers, and to research teams, in their struggle to achieve excellent scientific results against the odds. With this knowledge behind us, we are well equipped to do more of what we have done best: we must expand the programmes and activities that have been so successful and continue to make a real difference in more of the 81 countries that TWAS has identified as still lacking in adequate scientific resources and input.

Looking forward, there are still more organizational changes on the way. At the end of 2012, I myself will stand down as TWAS president. My successor, most likely, will come from another country, with a different set of experiences – and will have his or her own set of opinions and priorities. Each of us – as president, or executive director, or member of the Academy, or fellowship recipient, or TWAS prize winner – brings our own perspective, and each of us will be missed for our unique contributions. But with new people come new ideas and new relationships – and with these too, new ways of working. On a local – and global – scale, it is true more than ever that “no man – or woman – is an island” – we all need to work together. No country can afford to be without the support of others, big or small, rich or poor, North or South.

I trust that TWAS will not just be open to change in the coming years, but will positively embrace it. We will continue to expand our programmes, our activities and our presence, both in the developing and the developed world. And we will introduce new activities, with new partners, and new themes. Because it is only in both expanding *and* adapting that we will make more difference to more people, and effectively implement science as a tool for social and economic change in the South.

The Year in Review

Romain Murenzi

Executive Director

TWAS

This Annual Report, which covers January to December 2011, overlaps with my first year in

office as executive director of TWAS: I took up the post in April. This transition year has been an opportunity for me to get to know TWAS, to take stock of the successful programmes that TWAS has been running so effectively, and to consider how we might continue to improve and expand these activities.

I have made it a priority in these first nine months in office to familiarize myself with the work, members and staff of the TWAS Regional Offices. To this end I visited four of our five Regional Offices in 2011 and discussed projects with their respective coordinators: in Bangalore (TWAS-ROCASA), Beijing (TWAS-ROESEP), Rio de Janeiro (TWAS-ROLAC) and Alexandria (TWAS-ARO), with a visit to Nairobi (TWAS-ROSSA) planned for early 2012.

A second priority was to consolidate and expand our core funding. To supplement the Italian government's generous contribution, I have been contacting the ministers and scientific leaders of 'richer' developing countries (such as Brazil, China and India) and developed countries (such as Germany, Japan, South Korea and the United Kingdom) requesting their support for TWAS's activities. The reactions have been very positive and I foresee some very fruitful collaborations.

In November I was privileged to organize my first TWAS General Meeting as executive director and to see firsthand the enormous amount of work that the dedicated secretariat put in to ensure that members from all over the world arrived safely here in Trieste, and that their time spent throughout the three-day conference was productive and rewarding. These General Meetings are the annual occasion when we showcase the incredible scientific endeavours that are taking place in developing countries, and that TWAS supports. [see pages 12-17].

Any such high-profile event requires months of behind-the-scenes planning. But, in 2011, TWAS was not focused solely on the General Meeting. Indeed, over the past year, TWAS launched a number of initiatives, developed in collaboration with a variety of partners, and laid the groundwork for several more to be launched in 2012.

Those initiatives are outlined below, along with highlights of TWAS's core programmes and activities:

Membership

- The 22nd General Meeting in Trieste was attended by over 250 TWAS members and other invitees from some 40 countries; 45 eminent



scientists were elected as new members of the Academy, bringing TWAS membership to 1,035. I was particularly delighted that more than 30% of the members elected this year were women. This is a trend I will certainly encourage.

Prizes and Awards

- At the TWAS General Meeting, TWAS announced the names of the 13 winners of the 2011 *TWAS Prizes* (see pages 22-35).
- C.N.R. Rao was awarded the *Ernesto Illy Trieste Science Prize* for his “monumental contribution to materials science” (see pages 20-21).
- *TWAS prizes for young scientists* were awarded to 25 young scientists in 14 developing countries (see pages 36-40).
- In 2011, 15 *AU-TWAS Young Scientists National Awards* were presented at high-profile events in nine African countries (see pages 40-41).
- In September 2011, the *TWAS-Celso Furtado Prize in Social Sciences* was launched, with funding from the Brazilian government for the next four years. The first winner of the USD15,000 award will be announced in 2012.
- The *Atta-ur-Rahman Prize in Chemistry* was established to honour young scientists in S&T-lagging countries pursuing research in chemistry. The prize is an annual award of USD5,000, starting in 2012.
- In addition, the *C.N.R. Rao Prize for Scientific Research* was transformed into an annual award.

Fellowship and Exchange Programmes

- A total of 93 postgraduate and 48 postdoctoral *South-South Fellowships* were awarded (see pages 44-45 and 75).
- With support from the Swedish International Development Cooperation Agency (Sida), TWAS provided 16 *grants to research units in S&T-lagging countries*, 22 *grants to individual young scientists* (see pages 50-51, 52-53 and 75) and, under the TWAS-COMSTEC Joint Research Grants programme, an additional 23 *grants to young scientists in Organization of Islamic Cooperation (OIC) member states* (see pages 59 and 76).
- The *TWAS-UNESCO Associateship scheme* provides scientists in developing countries with opportunities to develop long-term links with centres of excellence in the South. In 2011, TWAS supported 35 associateship visits to institutions in developing countries (see pages 42-43 and 74).
- In 2011, 20 young African scientists were awarded the opportunity to travel to a host institute in Germany under the TWAS-DFG (German Research Foundation) Cooperation Visits Programme (see pages 59 and 76).

Regional Offices (see pages 62-67)

- In 2011, TWAS's five Regional Offices undertook their regular series of activities: appointing 24 *Young Affiliates*; announcing the winners of the TWAS

Regional Prizes; and also awarding a number of internships and prizes for young scientists.

- In addition, the offices organized six *Regional Conferences for Young Scientists* (RCYS) in 2011: in Brazil, China, Egypt, India, Kenya, and Trinidad & Tobago.

New programmes

In 2011, the ‘traditional’ core programmes of TWAS were supplemented by other activities:

- TWAS was one of seven consortium partners to secure European Union funding for *CATALYST*, a project on natural hazard risk reduction. TWAS is responsible for the communication aspects of this two-year project (see page 61).
- In June, TWAS hosted a *US National Academy of Sciences workshop* on ‘Developing a Framework for an International Faculty Development Project on Education and Research in the Life Sciences with Dual Use Potential’, with some 25 participants, mostly from the US and Egypt.
- In November 2011, TWAS and the American Association for the Advancement of Science (AAAS) agreed to collaborate on an *International Programme on Science and Diplomacy*. The signed agreement was preceded by a workshop, hosted by TWAS, involving representatives and experts from international institutions.
- Also in November, TWAS helped organize the Fourth Euro-Africa Cooperation Forum on ICT Research, held in Cape Town, South Africa (see page 57-58).
- TWAS, the Royal Society and the Environmental Defense Fund (USA) convened the *Solar Radiation Management Governance Initiative* (SRMGI), to open up the debate on how geo-engineering research should or could be governed in a way that is transparent, responsible and inclusive (see page 60).

International outreach (see pages 54-55)

- This year the Academy’s activities have continued to attract international attention, including a feature story on *Nature*’s website and a lead commentary in *Nature* magazine.
- TWAS entered the ‘social networking’ era with a new Facebook page and updates on ‘Twitter’.
- Four more volumes in the TWAS series ‘Excellence in Science: Profiles of Research Institutions in Developing Countries’ were published. In addition, an agreement was made with Italy-based publishers *Scienza Express* to translate the series into Italian.

Looking back over this year, I feel immensely proud and privileged to be part of an organization that really does make a difference to scientists in developing countries. Now that I have this first year of listening and consolidating behind me, I look forward to working with partners – old and new – to build on these solid foundations, as well as exploring fresh opportunities to build science capacity in the South.

The TWAS 22nd General Meeting, which took place from 21 to 23 November 2011, included more than 250 scientists from 40 countries, mainly TWAS Fellows from developing countries. The meeting was held at the Abdus Salam International Centre for Theoretical Physics (ICTP), on the same campus where TWAS has its headquarters, in Trieste, northern Italy.

TWAS in Trieste



For the first time in five years, and for the seventh time ever, TWAS Members met in Trieste, Italy. The Academy's 22nd General Meeting had originally been planned to take place in Marrakech, Morocco, but due to the uncertain events unfolding in northern Africa at the time, the conference was relocated to the Abdus Salam International Centre for Theoretical Physics (ICTP), which hosts TWAS at its campus in Trieste.

Venues for past TWAS meetings and conferences have included Brazil (1997 and 2006), China (1987 and 2003), Egypt (2005), India (2002 and 2010), Iran (2000), Kuwait (1992), Mexico (2008), Nigeria (1995), Senegal (1999), South Africa (2009) and Venezuela (1990).

The Academy's general meetings and conferences provide an ideal forum for TWAS to articulate its purpose and goals by showcasing the progress that has been made in building scientific capacity in the South and discussing strategies for meeting the challenges that lie ahead. Holding this





year's event in Italy was, in the end, a fortuitous opportunity to show our major funders, the Italian government, the incredible scientific work that TWAS is supporting in developing countries.

Trieste, apart from being home to the Academy's secretariat, is an appropriate location for such an international scientific gathering. Trieste has a chequered history of changing national allegiances and identities. Once the centre of *Mittleuropa* and a powerful Austrian port, Trieste's mixed Slovene, Austrian, Istrian and Italian populations have had to struggle with a series of identity crises. More recently, Trieste has been forging a new identity for itself as a 'City of Science': several related institutions of international renown based in Trieste support science in the developing world.

The TWAS 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 keep aspiring to 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 global financial crisis, argued Palis, 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."

"But", added Palis, "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 that now confront the world", he concluded, "require international scientific cooperation that transcends country borders and geographical 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.





Highlights of the 22nd General Meeting were:

- *Brief speeches by representatives of organizations that support TWAS.* Speakers at the opening session included a number of local and national dignitaries, among them Alessandro Giachetti, *Prefetto* of Trieste; Roberto Cosolini, Mayor of Trieste; Immacolata Panzone, representative of the Italian Ministry of Foreign Affairs and TWAS's main sponsors; Engelbert Ruoss, director of UNESCO's Venice Office; and Fernando Quevedo, director of ICTP.
- *Ernesto Illy Trieste Science Prize.* This prize, the most prestigious of the Academy's prize schemes, carries an award of USD100,000 generously provided by the Trieste coffee company, *illycaffè*. Anna Illy, widow of the late Ernesto Illy and the current president of the Illy Foundation, presented the award together with the Mayor of Trieste. The subject area for the Prize changes annually, and in 2011 focused on materials science. The winner was C.N.R. Rao (TWAS Founding Fellow) from Bangalore, India.
- *Presentations of TWAS 2011 Medal Lectures.* Since 1996, TWAS has been awarding the 'TWAS Medal

Lectures' to some of its members, in recognition of important achievements in their fields of research. Plaques were presented to Anthony Cheetham (TWAS Associate Fellow 1998) and Mohamed Najim (TWAS Associate Fellow 1998) during the opening ceremony. The following day, both recipients presented their lectures: on 'Solid state lighting' and 'New trends in multi-dimensional model-based systems', respectively.

- *The award of the 2011 TWAS Prizes to 13 scientists from seven countries.* The winners in agricultural sciences were two scientists who live and work in Kenya, namely Zeyaur Rahman Khan from India and Segenet Kelemu from Ethiopia. This is the first time either Ethiopia or Kenya has been recognized with a TWAS Prize.

LECTURE HIGHLIGHTS

- 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 from 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 power some eight 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 'Amazing nanocarbon'. In recent years, noted Sood, the discovery of novel arrangements of carbon atoms has been rewarded with two Nobel Prizes. In 1996, for



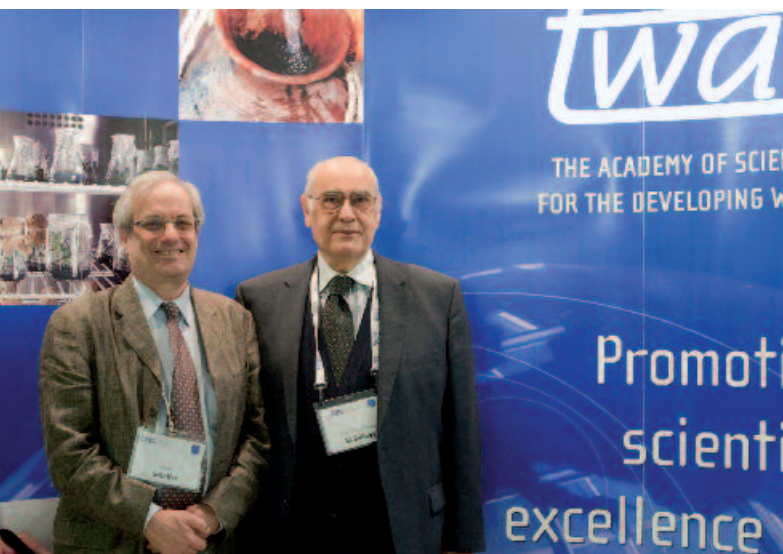
example, Robert Curl, Richard Smalley and Sir Harold Kroto were awarded the prize for their discovery of fullerenes, molecules composed entirely of carbon linked together in the form of hollow spheres, ellipsoids or tubes, such as the spherical buckyballs. Then, in 2010, Andre Geim and Konstantin Novoselov 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 capable of moving us on 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’, and 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.”

- *Presentations by TWAS young affiliates.* Interspersed among 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, from 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, from India, focused on the self-assembly of metallogages 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 other highlights of the three-day event were:

- the report, presented during the TWAS General Meeting, 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 months as executive director of TWAS, including visits to 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 announcement of the five winners of the TWAS Regional Prizes awarded 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 new members elected in 2010 who were able to attend. 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;

- the announcement by TWAS vice president, Bai Chunli, that the TWAS 23rd General Meeting and 12th General Conference will be held in Tianjin, China, in 2012. The dates have since been confirmed as 18-21 September, with business meetings arranged for 17 September.

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 of the quality of

research being carried out in the developing world as well as the activities set in motion by the Academy.

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 granting educational and financial support to talented young scientists, which is part of TWAS's mission, 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 on the value of traditional medicine in Cameroon, presented by TWAS Young Affiliate, Simeon Kouam.

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

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

This publicity has helped raise the profile of TWAS, placing the Academy firmly among the institutes that Italians have in mind when they refer to Trieste as the ‘City of Science’.



PROGRAMMES

The **Ernesto Illy Trieste Science Prize**, instituted by *illycaffè*, TWAS and the Ernesto Illy Foundation, is an annual prize given to a scientist in a developing country for outstanding contributions to science and scientific innovation, especially in relation to sustainability. The prize, now in its seventh year, includes a cash award of USD100,000. The 2011 Ernesto Illy Trieste Science Prize, in the field of materials science, was given to C.N.R. Rao, past president of TWAS, for his “monumental contributions to the frontiers of materials science.” The award ceremony took place at the opening session of the TWAS 22nd General Meeting in Trieste, Italy, held on 21 November 2011.

Ernesto Illy Trieste Science Prize



C.N.R. RAO AND MATERIALS SCIENCE

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

As a young, talented scientist with a PhD from Purdue University in the United States and postdoctoral research undertaken at the University of California in 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, when he returned to the IISc, and later served as director there from 1984 to 1994, Rao was determined to build a well-equipped laboratory for solid state and materials chemistry capable of competing with laboratories in developed countries. In 1989, he also became the founding president of JNCASR in Bangalore, serving in that position until 1999.

Over the course of his long career, Rao has published 45 books and more than 1,500 papers. 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 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.

As a research scientist, Rao has helped to shape the contours of materials science, lending his keen intelli-

gence, 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 made a difference to key aspects of society and the economy in both the developing and developed worlds – ranging 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.

In the 1970s and 1980s, Rao's ground-breaking 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 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, C.N.R. Rao was selected as the 2011 recipient of the Ernesto Illy Trieste Science Prize in materials science.

TWAS Prizes for scientific excellence, awarded annually in the fields of agricultural sciences, biology, chemistry, earth sciences, engineering sciences, mathematics, medical sciences and physics, rank among the highest scientific accolades given to scientists in developing countries. Each prize carries a cash award of USD15,000. This year's prizes, announced during the Academy's 22nd General Meeting held in Trieste, Italy, will be presented at the 23rd General Meeting in Tianjin, China, in September 2012.

TWAS Prizes



AGRICULTURAL SCIENCES

Segenet Kelemu, Biosciences eastern and central Africa Hub, International Livestock Research Institute, Nairobi, Kenya

For her discovery of beneficial endophytic fungi and bacteria in the tropical forage grass Brachiaria and for her contributions to our understanding of their roles in plant development and environmental fitness

Brachiaria is a predominantly African genus of tropical forage grass comprising about 100 species. Nevertheless, several species of *Brachiaria* have also become widespread and economically important forage grasses in tropical America. In Brazil alone, *Brachiaria* species have transformed some 45 million hectares of infertile, highly acidic savanna soils into valuable grazing lands that can be used even during the critical dry season periods.

Ethiopian-born Segenet Kelemu discovered the beneficial role that endophytic fungi and bacteria play in protecting *Brachiaria* species from pathogens that cause leaf spot disease. Her research has contributed to understanding how such endophyte-infected grasses can possess the desirable agronomic properties of improved survival, growth stimulation and drought tolerance.

Commercial *Brachiaria* species are persistent, can grow in a variety of habitats ranging from waterlogged to semi-arid areas, and, having evolved in the



African savannas – unlike native American grasses – are highly tolerant to grazing by large herbivores.

Growing up in a small village 500 kilometres from Addis Ababa, Segenet Kelemu experienced first-hand the challenges faced by farmers in Ethiopia. Determined to improve their conditions, Kelemu became one of just a handful of women to study agriculture at Addis Ababa University's Alemaya College of Agriculture, graduating in 1974.

After some time teaching plant protection and conducting research on cereal disease resistance in Ethiopia, Kelemu went on to earn a Master's degree in plant pathology and genetics from Montana State University (USA). She remained in the USA to complete a doctorate at Kansas State University, and to work as a postdoctoral research fellow at Cornell University. Subsequently Kelemu spent fifteen years at the International Centre for Tropical Agriculture (CIAT) in Colombia, where she was appointed leader of crop and agro-ecosystem health management.

Since 2007, Kelemu has been director of the Biosciences eastern and central Africa Hub at the International Livestock Research Institute (ILRI) in Nairobi, Kenya, a leading institute in Africa for research and capacity building in biosciences that addresses major challenges in food and nutritional security.

Zeyaur R. Khan, International Centre of Insect Physiology and Ecology (*icipe*), Nairobi, Kenya

For his discovery and wide-scale implementation of the Push-Pull technology – a pro-poor innovation for enhancing food security and environmental sustainability in Africa

Zeyaur R. Khan's work is a vivid example of how innovative problem-oriented scientific inquiry can contribute to socio-economic development by promoting food security and providing sustainable livelihoods.

Indian-born entomologist and agricultural scientist Khan is responsible for the discovery and wide-scale implementation of the so-called push-pull technology, a biologically-based technology that benefits cereal-livestock smallholders in Africa.





The technology seeks to reduce the harvest loss due to weeds, pests and degraded soils in sub-Saharan Africa through an innovative integrated approach. On the one hand, the technology makes use of so-called trap crops that lure borer pests away from fodder crops; on the other, it employs fodder legumes that, in addition to repelling borers, attract the pests' natural enemies and have strong allelopathic effects on *Striga*, a parasitic weed.

Currently some 47,000 smallholding families in East Africa benefit from the push-pull technology, enjoying better nutrition and purchasing power. A report commissioned by the United Nations' General Assembly in 2011 refers to the push-pull approach as a 'sustainable agro-ecosystem'.

The backbone of Khan's successful strategy is cutting-edge science. More than 100 publications in various international peer-reviewed journals, including *Nature*, *Annual Review of Entomology*, *Annual Review of Phytopathology*, *Proceedings of the Royal Society* and *Biology Letters*, form the basis for the technology that applies findings from entomology to chemical ecology, from organic chemistry to ecosystem analyses, including socio-economics, and from agronomy to weed science.

After obtaining his PhD in agricultural entomology from the Indian Agricultural Research Institute in New Delhi in 1980, Khan spent time as a postdoc at the International Rice Research Institute in the Philippines and at the University of Wisconsin at Madison, USA. Presently, he is principal scientist and programme leader with the International Centre of Insect Physiology and Ecology (*icipe*) in Nairobi, Kenya, and visiting professor of entomology at Cornell University, USA. In 2012, *icipe* named him the first Thomas Risley Odhiambo Distinguished Research Fellow in recognition of his outstanding achievements in the advancement of agricultural science.

BIOLOGY

Ana Belén Elgoyhen, Institute for Research in Genetic Engineering and Molecular Biology, Buenos Aires, Argentina

For her contributions to the understanding of the molecular basis of hearing

One out of every 1,000 newborn children is profoundly deaf, and in half the cases the underlying cause is genetic.

Although Ana Belén Elgoyhen is the only basic auditory researcher in Argentina, she has become a resource for several clinical otolaryngologists



in Latin America. In fact, her seminal research has helped to understand the molecular bases of hearing, in particular those efferent signals that descend from the brain to modulate cochlear signalling. Elgoyhen deciphered the molecular code of the inner ear sensory hair cell's cholinergic receptor, establishing that it is a ligand-gated ion channel and not a G-protein coupled receptor as originally thought. She has since made use of her basic research to establish the molecular genetic diagnosis of deafness in her country.

Elgoyhen's discoveries have been published in prestigious scientific journals. She is the only Latin American woman to have been appointed Howard Hughes Medical Institute International Scholar in three consecutive competitions, 1997-2001, 2002-2006 and 2007-2011. Moreover, she was the 2008 Latin American laureate of the L'Oréal-UNESCO Awards for Women in Science, a distinction that identifies exceptional women in science as role models for future generations.

Elgoyhen is also a founding member of the Tinnitus Research Initiative Foundation, an organization that searches for novel approaches to treat this debilitating condition affecting 10% of the general population and she is one of the inventors of a recent patent for a novel treatment of tinnitus.

Elgoyhen studied at the University of Buenos Aires, School of Pharmacy and Biochemistry, where she obtained a PhD in biochemistry in 1989. After her postdoctoral studies at the Molecular Neurobiology Laboratory at the Salk Institute for Biological Studies in California, she returned to Buenos Aires in 1994 to establish her own research group, first at the Pharmacology Institute of the Argentine Research Council and then at the Institute for Genetic Engineering and Molecular Biology. She is currently adjunct professor of pharmacology at the University of Buenos Aires in the School of Medicine and principal research scientist at the Institute for Genetic Engineering and Molecular Biology (INGEBI-CONICET), also in Buenos Aires.

Valakunja Nagaraja, Department of Microbiology and Cell Biology, Indian Institute of Science, Bangalore; and Jawaharlal Centre for Scientific and Advanced Research, Bangalore, India

For his fundamental contributions to understanding the mechanism of action and cellular function of DNA transaction proteins



Valakunja Nagaraja has made crucial contributions to our understanding of DNA transaction processes that are critical for cellular function. He pioneered research on DNA topoisomerases, the regulation of gene expression and the biology of restriction modification (R-M) systems. Elucidating the distinctive properties of topoisomerases from mycobacteria resulted in the design of a new class of inhibitors with novel mechanisms of action. Several chromosomally encoded gyrase inhibitors were characterized and their *in-vivo* function shown to be protecting gyrase from other poisons and toxins.

After investigating the molecular biology of host-virus interaction for his PhD in 1981 at the Indian Institute of Science (IISc), Nagaraja held research assignments in Switzerland and the USA, returning to India in 1989 as assistant professor at the IISc. He immediately joined the newly formed Centre for Genetic Engineering where he initiated research on protein-DNA interactions.

Back in India, Nagaraja's elucidation of the novel mechanism of transcrip-

tion activation has led to the design of regulatory circuits useful for the expression of toxic genes. His structural, functional and evolutionary studies of R-M systems have resulted in patents and the commercialization of products, and formed the basis for further protein engineering to generate enzymes with altered specificities.

Nagaraja is currently professor and chairman at the Department of Microbiology and Cell

Biology of the IISc, and honorary professor at the Jawaharlal Nehru Centre for Scientific and Advanced Research in Bangalore. He is a recipient of several major Indian science awards, and a fellow of all three Indian national academies of science.

CHEMISTRY

Jairton Dupont, *Instituto de Química, Universidade Federal do Rio Grande do Sul (UFRGS), Porto Alegre, Brazil*

For his pioneering and fundamental contributions to the synthesis of non-aqueous ionic liquids and their applications





Jairton Dupont is one of the pioneering scientists who has worked on the synthesis and applications of non-

aqueous molten salts that are air- and water-stable. These salts – known as ionic liquids – provide a plethora of applications in various fields of science and technology such as chemistry, physics, medicine and materials science. In particular, these fluids are considered one of the best candidates for ‘green’ solvents and have been used in synthesis, catalysis and separation processes.

Dupont proposed a nanostructured model to explain the properties of these salts – a model that is now being used successfully by various groups to design and prepare new families of tailor-made ionic fluids. Dupont’s group was among the first to take advantage of the virtual non-volatility of these fluids and investigate materials and processes in solution using techniques requiring a high vacuum, such as transmission electron microscopy. This has created opportunities for studying processes in solution with techniques that were previously only used for solid states.

The impact of Dupont’s contribution to the field of ionic liquids can be judged by his more than 200 publications that have received over 12,000 citations. In particular, one of his papers has received over 1,300 citations in the last six years. Furthermore, Dupont is co-author of two of the four most-cited science papers published by Brazilian authors in the last 12 years.

Dupont graduated in chemistry from the *Pontificia Universidade Católica do Rio Grande do Sul* (PUCRS), received his PhD from the University of Strasbourg, France, and undertook postdoctoral research at the University of Oxford, UK. In 1990 he returned to Brazil and became professor of the Institute of Chemistry, *Universidade Federal do Rio Grande do Sul* (UFRGS), where he started to work on organometallic catalysis in molten salts.

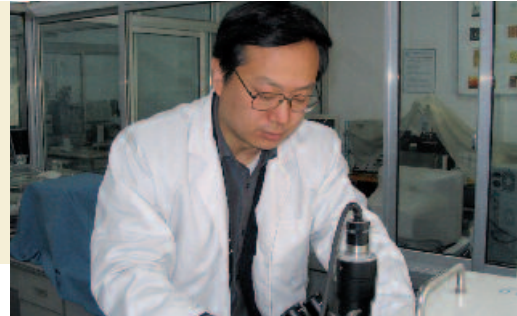
Lei Jiang, Institute of Chemistry, Chinese Academy of Sciences, Beijing, China

For his significant contribution to our understanding of the design of bio-inspired, smart, multiscale interfacial materials, especially for the control of surface wettability

Numerous mysterious properties in nature that have evolved over millions of years are key to developing novel functional materials. Learning from nature, Lei Jiang has focused his scientific interest on: the structural effect of wettability on natural materials; the design and fabrication of bio-inspired surfaces with special wettability; the construction of bio-inspired, smart interfacial materials; and the building of biomimetic ion channels.

Lei Jiang found that a super-hydrophobic surface needs the cooperation of both micro- and nanostructures. To come to this conclusion he studied the





surface structures of a water-strider's legs, and 'emulated' them in a series of superhydrophobic surfaces. Studying these insect-inspired structures, he noticed that, under certain circumstances, surface wettability can switch between superhydrophilicity and superhydrophobicity.

To expand the 'switching' concept of the smart surface, Lei and his group looked at how the silk produced by a spider, *Uloborus walckenaerius*, is able to collect water, and then prepared artificial spider silk that appears to have promising applications in water collection efforts.

Most recently, Lei and his group developed a superoleophobic and controllable adhesive water-solid interface which opens up a new strategy for controlling self-cleaning properties in water.

Lei Jiang received his BSc in solid state physics in 1987, and his MSc in physical chemistry in 1990 from Jilin University, China. From 1990 to 1994, he studied at Tokyo University as a China-Japan joint course PhD student. After working as a postdoctoral fellow at Tokyo University, he moved to the Kanagawa Academy of Sciences and Technology, also in Japan. In 1999, he returned to China. Since then, he has been professor at the Chinese Academy of Sciences' Institute of Chemistry (ICCAS). In 2009, he was elected a member of the Chinese Academy of Sciences.

Lei Jiang has published two books, three book chapters, and more than 400 journal articles. His work has been cited more than 14,000 times.



EARTH SCIENCES

S.K. Satheesh, Centre for Atmospheric & Oceanic Sciences, and Divecha Centre for Climate Change, Indian Institute of Science, Bangalore, India

For his outstanding contributions to our understanding of the impact of atmospheric aerosols on the radiation balance of the Earth-atmosphere system and climate

Sreedharan Krishnakumari Satheesh has made invaluable contributions to the science of atmospheric aerosols, examining their impact on the radiation balance of the Earth-atmosphere system and their implications for climate change. He demonstrated that the radiative impact of aerosols can alter the natural hydrological cycle and hence cloud properties, and unravelled the significant, but overlooked, role of natural aerosols in controlling the climate of the Afro-Asian region.

After obtaining his doctorate from the University of Kerala, India, Satheesh moved to the University of California's Scripps Institution of Oceanography in 1998. Two years later he returned to India, where he

joined the Bangalore-based Indian Institute of Science (IISc) where he now works as assistant professor at the Centre for Atmospheric and Oceanic Sciences and at the Divecha Centre for Climate Change.

At IISc, Satheesh established an aerosol laboratory in 2000. In collaboration with laboratories of the Indian Space Research Organisation (ISRO), his group designs satellite sensors and develops laboratory-based instruments for studying aerosols. Satheesh has led several field experiments in remote environments across India and adjacent oceans that employed mobile observatories such as research ships and aircrafts as well as a network of ground-based observatories. Between 2006 and 2008, Satheesh served as the chief mission scientist in a series of national aircraft campaigns under the ISRO-sponsored Integrated Campaign for Aerosols, Gases and Radiation Budget. This led to the discovery of elevated absorbing aerosol layers over India and strong meridional gradients that may have a strong influence on the Indian monsoon system.



Satheesh has a long list of publications and professional honours, including the young scientist awards he received from START in 2001, the World Meteorological Organization in 2003, SCOPUS in 2007, and the Asian Aerosol Research Assembly in 2007. At the national level, Satheesh was the recipient of the 2002 Indian National Science Academy young scientist medal.

Wu Fuyuan, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China

For his outstanding research on petrogenesis of granite and lithospheric evolution in eastern China, and his development of techniques for isotopic analysis by laser ablation

Wu Fuyuan earned his PhD in petrology from the (now) College of Earth Sciences, Jilin University, in Changchun, China, in 1990. After two years



of postdoctoral research, he became full professor of petrology at his *alma mater*.

He began his career as a geochemist studying the granites in northeastern China, using radioactive dating to provide hundreds of precise ages for the area's approximately 300,000km² of granite rocks. His results demonstrated that this huge area of granite was mostly emplaced during the Mesozoic era, thus dramatically shifting the point of view that had been held for decades by the scientific community. Based on isotopic data, he proposed that these granites represent a significant continental growth in the Phanerozoic – the current era of which the Mesozoic is a part – on our Earth.

From 2000, Wu focused on the evolution of the Earth's crust, or lithosphere, of the North China Craton. Using osmium isotopic data, he found that the present lithospheric mantle in the area is young, and proposed that the crust was in direct contact with the asthenosphere (the viscous layer of molten rock found immediately beneath the lithosphere) during the Late Mesozoic after lithospheric foundering, which resulted in the lithospheric thinning of the North China Craton.

In 2003, Wu joined the Institute of Geology and Geophysics in Beijing, becoming deputy director in 2007. There, he built an impressive multi-collector inductively coupled plasma mass spectrometry (ICP-MS) laboratory for *in situ* radiometric dating and isotopic analyses. The protocol he established is now applied by many other laboratories in China and elsewhere.

Wu has published more than 200 papers and, according to the *Web of Science*, his papers have been cited some 5,000 times during the last decade, which makes him the 13th most cited geoscientist in the world. Wu has supervised 17 MSc and PhD students from China, Australia and the Sudan and he was honoured with the inclusion of his research work in the Chinese Academy of Sciences' '100 Talent Program' in 2002, and with a National Young Scientist Award in 2003.

ENGINEERING SCIENCES

Yi-Bing Lin, Department of Computer Science and Information Engineering, National Chiao Tung University, Taiwan, China

For his significant contributions to the design and modelling of telecommunications networks



Yi-Bing Lin received his Bachelor's degree from the National Cheng Kung University, Taiwan, in 1983, and his PhD from the University of Washington, USA, in 1990. From 1990 to 1995 he was a research scientist at the Bellcore

laboratories, also in the USA. He subsequently joined the National Chiao Tung University (NCTU) in Taiwan, where he became lifetime chair professor in 2010, and vice president in 2011.

From 1985 to 1990, Lin's research focused on parallel and distributed simulation (PADS), a methodology for performance evaluation. He was the first to formally prove the optimality conditions of PADS. In 1990, he used PADS to evaluate the performance of large-scale mobile telecommunications networks. Shortly afterwards, he invented the Laplace-Transform-based analytical model to accommodate general mobile user movement and voice/data call holding time distributions, a model that relaxes the exponential time restrictions imposed in previous studies.

Lin's scientific engineering contributions have greatly helped Taiwan to deploy large-scale mobile telecom services. For example, Lin's work was applied to dual-band mobile network capacity planning to establish the largest 900/1800MHz dual-band GSM network in Asia, and was used to



investigate and deploy the first prepaid mobile phone services in Taiwan. This prepaid service resulted in a significantly increased subscriber base and led to one of the most important and successful business models ever.

Lin also contributed to the development of the first General Packet Radio Service (GPRS) system in Taiwan. His pioneering research in number portability eventually led to its introduction by the Taiwanese government in 2004. Later, in 2010, he played a crucial role in conducting the world's first trial to connect high-definition conference calls between Taiwan and Shanghai via Hong Kong.

Lin, who has authored three books that have been used as textbooks or reference books in over 70 universities worldwide, was one of five chief advisors to the Ministry of Economic Affairs in charge of deploying the first roadmap for wireless telecom development in Taiwan, his specific responsibility being the planning of a wireless internet.



MATHEMATICS

Patricio L. Felmer, *Departamento de Ingeniería Matemática, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile, Santiago, Chile*

For his outstanding contributions to Hamiltonian systems, singular perturbations theory and non-linear elliptic equations

Patricio Felmer has made outstanding contributions to the study of non-linear differential equations, to Hamiltonian systems, singular perturbations theory and non-linear elliptic equations. His results in the area are deep, rich in methodology development and provide ample scope for further applications.

Felmer's most important contribution is in the study of singular perturbation and concentration phenomena in partial differential equations. In recent years, he has contributed to the study of equations involving fully non-linear elliptic operators, and has studied critical exponents, Liouville type theorems and the existence of solutions in a domain (ball) for the Emden-Fowler equation involving Pucci's operator.

Felmer has also made important contributions to mathematics education in Chile. With other talented mathematicians, he produced a collection of 15 mathematics monographs for pre-service high school teachers. Similarly, he led a group of mathematicians and educators in a project funded by the Ministry of Education to create 'Standards for the formation of elementary and high school mathematics teachers' for use in all Chilean universities. This work was rewarded with the TWAS-ROLAC Regional Prize (see page 67).

Felmer began his career by studying engineering at the University of Chile in Santiago. After graduation, he joined the Mathematical Engineering Department, and then pursued doctoral studies at the University of Wisconsin, USA. He returned to Chile in 1989 and became professor at the University of Chile in 1998.

Felmer has served as director of the Mathematical Engineering Department of the University of Chile, president of the Chilean Mathematical Society, and member of the Superior Council of CONICYT, Chile's National Commission for Scientific and Technological Research. He has also been elected a corresponding member of the Chilean Academy of Sciences and is a recipient of the National Prize of Exact Sciences.



Shun-Jen Cheng, *Institute of Mathematics, Academia Sinica, Taipei, Taiwan*

For his work on super duality that led to a complete and novel viewpoint of the representation theory of classical Lie superalgebras

Shun-Jen Cheng obtained his PhD from Harvard University, USA, and after spending one year at the Max Planck Institute for Mathematics in Bonn,

Germany, he joined the Department of Mathematics at National Cheng-Kung University in Tainan as an associate professor in 1994. He became full professor in 1998, and then professor at the National Taiwan University in 2000. Since 2006, Cheng has been a research fellow at the *Academia Sinica's* Institute of Mathematics.

Shun-Jen Cheng's research focus is the representation theory of Lie superalgebras. His thesis and related papers dealt with finite-dimensional semi-simple and infinite-dimensional locally compact Lie superalgebras. His interest then turned to the representation theory of finite-dimensional simple Lie superalgebras, in particular the finite-dimensional irreducible character problem, studying Howe dualities to obtain character information for Lie superalgebras. Cheng showed that there is a possible deep connection between the two representation theories, classical Lie algebras and Lie superalgebras.

Cheng made important progress towards obtaining all finite-dimensional irreducible characters for type A Lie superalgebras in 2004. Together with co-



workers, he formulated a connection between the representation theory of type A Lie algebras and that of type A Lie superalgebras, referred to as super duality. Super duality conjectured that certain categories of representations of type A Lie algebras and Lie superalgebras are equivalent. This conjecture and a substantially more general version, which also dealt with many infinite-dimensional representations of type A Lie superalgebras, were proven in a crucial 2010 paper co-authored by Cheng.

The notion of super duality, besides providing a new and conceptual approach to representation theory of Lie superalgebras, turned out to be quite fundamental and versatile: it is applicable to a wide class of Lie algebras and Lie superalgebras. In addition, it gives information on many finite- and infinite-dimensional representations. Indeed, in 2011, Cheng and co-authors extended the notion of super duality to other types of Lie superalgebras, including the ortho-symplectic Lie superalgebras.

MEDICAL SCIENCES

Alberto R. Kornblihtt, Department of Physiology, Molecular and Cell Biology, IFIBYNE-UBA-CONICET, *Universidad de Buenos Aires*, Argentina

For his seminal contribution to our understanding of the regulation of alternative pre-mRNA splicing, an essential feature of gene expression that explains how a single gene can generate multiple proteins



Alberto R. Kornblihtt (PhD in biochemistry, 1980) is full professor at the Department of Physiology, Molecular and Cell Biology (DFBMC) of the *Facultad de Ciencias Exactas y Naturales* (FCEN), University of Buenos Aires (UBA), and researcher at the Institute of Physiology, Molecular Biology and Neurosciences of the Argentine Research Council (IFIBYNE-CONICET).

Kornblihtt and his group work on the regulation of alternative pre-mRNA splicing, investigating how a single gene can generate multiple proteins. They found that promoters affect alternative splicing through changes in



transcriptional elongation and recruitment of splicing factors to the RNA polymerase, and also explained how DNA damage and epigenetic chromatin changes modulate alternative splicing through its coupling with transcription.

From 2002 to 2011, Kornblihtt was international research scholar at the Howard Hughes Medical Institute in the USA. He has also been awarded a Guggenheim

fellowship (1991), the Konex Platinum Award (2003), a chair at *Fundación Antorchas*, Argentina (2000-2008), the Bicentennial Medal (2010), and the Houssay Achievement Award in Chemistry, Biochemistry and Molecular Biology (also in 2010).

In addition, Kornblihtt is a member of Argentina's National Committee on Ethics in Science and Technology, he has supervised 14 PhD theses, and has served as president of the Argentine Society for Biochemistry and Molecular Biology (2010-11). In 2011, he received the Honorary Mention Domingo Faustino Sarmiento of the Argentine Senate, and the 'Investigator of the Nation' 2010 prize from the President of Argentina. In the same year he was elected foreign associate of the US National Academy of Sciences.



PHYSICS

Thanu Padmanabhan, Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune, India

For developing a thermodynamical perspective in which gravity is interpreted as an emergent phenomenon and for contributing significantly to our understanding of dark energy

Thanu Padmanabhan's early work was in quantum cosmology, structure formation in the universe and statistical mechanics of gravitating systems. He showed that initial singularity in cosmology can be eliminated by quantum gravitational effects, and that Planck length can be interpreted as the zero point length of spacetime, in a model-independent manner.

He also examined the problem of statistical mechanics of gravitating systems. His contributions to the study of gravitational clustering in an expanding universe were well received both in cosmology and condensed matter physics. This eventually led to his working on several aspects of cosmological structure formation, both analytically and through numerical simulations. Padmanabhan played a key role in initiating contemporary research in standard cosmology in India and, in recent years, has contributed significantly to the statistical analysis of data relating to dark energy and to its theoretical modelling.

Padmanabhan's interpretation of gravity as an emergent phenomenon has far-reaching implications for quantum gravity and the nature of dark energy. He has demonstrated that the field equations of gravity in a wide class of theories can be described in a purely thermodynamic language.

After earning his Bachelor and Master's degrees in physics from Kerala University in Trivandrum, Padmanabhan joined the Tata Institute of Fundamental Research in Mumbai where he obtained his PhD and held various faculty positions between 1980 and 1992. He then moved to the Inter-University Centre for Astronomy and Astrophysics (IUCAA) in Pune, where he became dean in 1997. He has been a visiting faculty member at several institutions abroad including Caltech and Princeton University in the United States and the Institute of Astronomy, University of Cambridge, UK.

Padmanabhan has published more than 200 papers in international journals and authored nine books that have been acclaimed as classics in the field. He has received numerous awards and distinctions in India and abroad: he was a Sackler Distinguished Astronomer of the Institute of Astronomy, and is currently the president of the Cosmology Commission of the International Astronomical Union. He has also received the medal of honour for distinguished service, Padma Shri, from the President of India.



TWAS Prizes for Young Scientists in Developing Countries and **African Union-TWAS Young Scientists National Awards** are both given in collaboration with ministries of science and technology, national academies of science, and scientific research councils in a number of developing countries, with the AU-TWAS awards being reserved for African countries. Prizes are presented by a high-ranking official at a special ceremony. Winners are young scientists no older than 40 years of age who are selected by the participating national organizations, often with the input of TWAS Fellows from the country. TWAS has agreements with 23 non-African countries for the first scheme, and with 13 African countries for the second. Maximum impact is achieved by holding the African award ceremonies in the participating African countries on Africa Day, 9 September.

TWAS Prizes for Young Scientists



PESTICIDES IN THE PHILIPPINES

Marlon N. Manalo received the 2011 Philippine National Academy of Science (NAST) -TWAS Prize for Young Scientists in chemistry.

Marlon N. Manalo's research on citrus fruits could have a direct impact on one of the greatest challenges facing the world today: adequate food supplies for the ever-increasing population. Food security is particularly important in developing countries, where not only is productivity low, but approximately one third of the crops produced are destroyed by pests and disease. Crop protection methodologies to date have tended to rely heavily on synthetic pesticides, and this has led to unforeseen side effects. Growing public alarm has meant revived interest in exploring the potential of using the chemical compounds that occur naturally in plants as pesticides: these phytochemicals are often environmentally benign and so safer for humans and animals.

Manalo and his research group at the Institute of Chemistry in the University of the Philippines, Los Baños, are isolating the limonoid constituents of citrus and elucidating their structures. Limonoids are currently under investigation by researchers for a wide variety of antiviral, antifungal and antimalarial properties. To



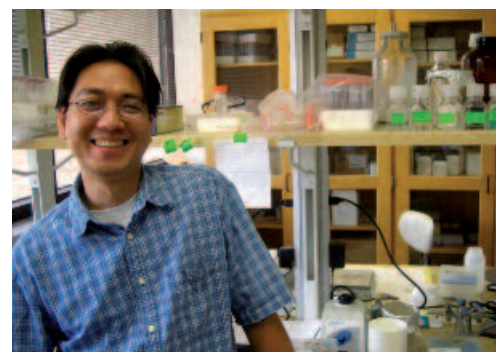
TWAS PRIZES TO YOUNG SCIENTISTS AWARDED IN 2011

Name	Country	Awarding Body	Field
Ashik Mosaddik	Bangladesh	Bangladesh Academy of Sciences (BAS)	Biological Sciences
Masud Hasan	Bangladesh	Bangladesh Academy of Sciences (BAS)	Physical Sciences
Muhammad Anisuzzaman Talukder	Bangladesh	Bangladesh Academy of Sciences (BAS)	Physics
Shamsun Nahar Khan	Bangladesh	Bangladesh Academy of Sciences (BAS)	Biochemistry
León Felipe Otálvaro Tamayo	Colombia	<i>Academia Colombiana de Ciencias Exactas, Físicas y Naturales</i>	Chemistry
Leonardo Castellanos	Colombia	<i>Academia Colombiana de Ciencias Exactas, Físicas y Naturales</i>	Chemistry
Joaquin Barnoya Perez	Guatemala	<i>Academia de Ciencias Medicas, Físicas y Naturales de Guatemala</i>	Medical Sciences
Pierre Koivogui	Guinea	Ministry of Higher Education and Scientific Research	Earth and Life Sciences
Ghodrat Tahmasebipour	Iran, Isl. Rep.	Iranian Research Organization for Science and Technology (IROST)	Physics (Nanoscience and Nanotechnology)
Syede Mahta Jenabi	Iran, Isl. Rep.	Iranian Research Organization for Science and Technology (IROST)	Electronic & Computer Sciences
Enkh-Amgalan Jigjiddorj	Mongolia	Mongolian Academy of Sciences	Biology
Mend-Amar Majig	Mongolia	Mongolian Academy of Sciences	Applied Mathematics
Hari Bahadur K.C.	Nepal	Nepal Academy of Science & Technology	Biology
Madhav Prasad Ghimire	Nepal	Nepal Academy of Science & Technology	Physics
Rosa Ranjit	Nepal	Nepal Academy of Science & Technology	Chemistry
Mehboob-ur-Rahman	Pakistan	Pakistan Academy of Sciences	Agriculture
Zia-ur-Rehman	Pakistan	Pakistan Academy of Sciences	Chemistry
Catherina C. Caballero-George	Panama	<i>Asociación Panameña para el avance de la Ciencia (APANAC)</i>	Medical Sciences
José Ochoa Cámara	Peru	<i>Academia Nacional de Ciencia y Tecnología (ANCYT)</i>	Biology
Marlon N. Manalo	Philippines	National Academy of Science (NAST)	Chemistry
Atitaya Siripinyanond	Thailand	National Research Council	Chemistry
Kaan Guven	Turkey	The Scientific and Technical Research Council of Turkey	Physics
Erkinjon Karimov	Uzbekistan	Uzbek Academy of Sciences	Mathematics
Viktoriya S. Giryanskaya	Uzbekistan	Uzbek Academy of Sciences	Astrophysics
Zabardast T. Buriev	Uzbekistan	Uzbek Academy of Sciences	Biology

examine their suitability as environmentally benign pesticides, Manalo's group is employing 'virtual docking' to screen potentially active limonoids. Using a combination of solvent extraction, chromatographic and bioassay techniques, they can isolate and purify the active compounds. The chemical structures of the active compounds are then determined using various spectroscopic methods.

Manalo has a solid background for this research: his PhD at Georgetown University in Washington DC, USA, focused on the theoretical computations of nuclear magnetic resonance (NMR) spectroscopy to determine the structure of molecules by recording the so-called chemical shift. During this time, he published papers which recognized the importance of the solvent effect on the geometry of the molecule and its contribution to the change in chemical shift.

After obtaining his PhD, Manalo gained valuable postdoctoral experience in the United States before returning to the University of the Philippines to take up his current position in the chemistry faculty.





SCORPIONS IN SOUTH AMERICA

José Antonio Ochoa Cámara was named the winner of the 2011 Peruvian National Academy of Science and Technology (ANCYT) - TWAS Prize for Young Scientists in biology.

Once José Ochoa had obtained his undergraduate degree in biology at the *Universidad Nacional de San Antonio Abad del Cusco* in Peru, he was hooked on scorpions and began to travel throughout South (and North) America in order to refine his research. His PhD at the *Universidad Nacional de Cordoba* in Argentina reviewed the systematics and biogeography of the scorpions of southern Peru. He then moved to the American Museum of Natural History in New York, doing postdoctoral research in the specialist Division of Invertebrate Zoology. A fellowship award enabled him to continue his studies in Brazil, at the University of São Paulo.

Adding to these travels, Ochoa has been on many expeditions throughout South America, including Argentina, Bolivia, Chile, Ecuador, Peru and Venezuela in search of the indigenous scorpion fauna. Scorpions have been



comprehensively described for several countries, including Argentina, Colombia and Ecuador. For Peru, however, descriptions have been sketchy.

Ochoa's extensive data and findings have increased our knowledge of species distribution in South America and he is now particularly interested in the relationship scorpions have to the biogeography of the Andes, the Amazon and the Pacific.

Another of his current projects is the first attempt to study the phylogeny of the family of scorpions known as Chactidae, using morphological and DNA sequence data. This neotropical group of scorpions represents one of two major radiations of scorpion diversity in the rainforests of central and northern South America. A phylogenetic analysis of their relationships contributes greatly to our understanding of neotropical arthropod diversity and is an interesting model for testing South American biogeographical hypotheses.

Ochoa is also interested in biodiversity conservation, and is currently working in nature parks in southern Peru. In addition, his detailed studies of scorpions have contributed to assessing and monitoring biodiversity in the Lower Urubamba Region of southeastern Peru.

MATHEMATICAL MODELLING IN MONGOLIA

Mend-Amar Majig, recipient of the 2011 Mongolian Academy of Sciences-TWAS Prize for Young Scientists in applied mathematics.

Mend-Amar Majig graduated from the National University of Mongolia in 2000, majoring in applied mathematics, and since then has been working intensively in the areas of optimization and mathematical modelling.

As a doctoral student at the Graduate School of Informatics at Kyoto University, Japan, Majig's research focused on global optimization approaches for general variational inequality problems. Global optimization is a branch of applied mathematics and numerical analysis that deals with the optimization of a function or a set of functions according to some criteria. Typically, a set of bound and more general constraints is also present, and the decision variables are optimized taking the constraints into consideration. The variational inequality problem has now become one of the core subjects in optimization, and indeed covers various classes of optimization problems, including the nonlinear system of equations and equilibrium problems of many kinds.

Since its emergence in the 1960s, the variational inequality problem has been widely explored by mathematicians, engineers and economists. Although there have been plenty of methods proposed for solving it, most of them restrict themselves by imposing some assumptions on the problem, such as monotonicity. For the general variational inequality problem, there are very few methods, and even fewer that can be used in practice.

By reformulating the original problem as a particular global optimization problem and exploiting its special features, Majig's methods can solve variational inequality problems with very general settings.

For the last three years Majig has been head of the Department of Applied Mathematics at the National University of Mongolia. He has published ten papers in internationally recognized journals and regularly presents his

work at international conferences and workshops.

Majig's research is now focused more on applying mathematics to real life problems and he conducts scientific seminars on these topics.



AFRICAN UNION-TWAS YOUNG SCIENTISTS NATIONAL AWARDS

CROPS IN CAMEROON

Ayeoffe Fontem Lun received the AU-TWAS Kwame Nkrumah Scientific Award for Young Scientists 2011 in Cameroon, in the field of Earth and Life Sciences. The award is jointly given by the African Union, TWAS, the Ministry of Scientific Research and Innovation of Cameroon, and the Cameroon Academy of Sciences.

Throughout her research career, Fontem has been involved in the development of crop management practices to increase yields and thereby food security and household incomes.

She began her research in Nigeria, obtaining a BSc in microbiology from the University of Uyo before moving to the University of Ibadan to undertake an MSc in crop protection, followed by a PhD in weed science and toxicology. She has now returned to Cameroon as a lecturer in the Department of Plant and Animal Sciences at the University of Buea.

Fontem pioneered research into the application of nicosulfuron to eradicate



the blady grass, *Imperata cylindrica*, a weed that tends to grow in and around maize in the savanna regions of Nigeria. Nicosulfuron is a systemic selective herbicide, effective at killing even those grasses closely related to maize: the maize plant survives because it is able to metabolize nicosulfuron into harmless compounds. The herbicide is easy to apply, requires no adjuvant to enhance its effectiveness and does not wash into the soil. It is also harmless to birds, fish and insects.

Fontem's results showed that nicosulfuron could not only be applied in very low doses, but also that its effectiveness can increase grain yield significantly. The herbicide had no adverse effects on the carbohydrate and protein components of maize and the performance of rotation crops such as soybean and cowpea.

To ensure that her research results have a direct impact on local farming communities, Fontem used 'participatory research and extension approaches'

2011 AU-TWAS AWARDS

Name	Country	Awarding Body	Field
Ahokanou Fernand Gbaguidi	Benin	Ministry of Science and Technology of Benin & <i>Centre Béninois de la Recherche Scientifique et Technique</i> (CBRST) of Benin	Basic Sciences, Technology and Innovation
Imaël Henri Nestor Bassolé	Burkina Faso	Ministry of Science and Technology of Burkina Faso & <i>Centre Nationale de la Recherche Scientifique et Technologique</i> (CNRST) of Burkina Faso	Earth and Life Sciences
Ayeoffe Fontem Lum	Cameroon	Ministry of Scientific Research and Innovation of Cameroon & Cameroon Academy of Sciences	Earth and Life Sciences
Ismael Taha Ibrahim	Egypt	Ministry of Science and Technology of Egypt & Academy of Scientific Research and Technology (ASRT) of Egypt	Earth and Life Sciences
Emad Fathy H. El-Shamy	Egypt	Ministry of Science and Technology of Egypt & Academy of Scientific Research and Technology (ASRT) of Egypt	Basic Sciences, Technology and Innovation
Motlatsi Molati	Lesotho	Department of Science and Technology, Ministry of Communications, Science and Technology of Lesotho	Basic Sciences, Technology and Innovation
Davies Emmanuel Mweta	Malawi	Ministry of Education, Science and Technology of Malawi & National Commission for Science and Technology of Malawi	Basic Sciences, Technology and Innovation
Emmanuel Iyayi Unuabonah	Nigeria	Ministry of Science & Technology of Nigeria & Nigerian Academy of Sciences	Basic Sciences, Technology and Innovation
Mayowa Ojo Owolabi	Nigeria	Ministry of Science & Technology of Nigeria & Nigerian Academy of Sciences	Earth and Life Sciences
Bernard Slippers	South Africa	Department of Science and Technology of the Republic of South Africa & Academy of Science of South Africa (ASSAf)	Basic Sciences, Technology and Innovation
Asaad M. Ali Khalid Ahmed	Sudan	Ministry of Science and Technology of Sudan & Sudan Institute for Natural Sciences (SIFNS)	Earth and Life Sciences
Ietidal E-T. Mohamed Abdel Rahman	Sudan	Ministry of Science and Technology of Sudan & Sudan Institute for Natural Sciences (SIFNS)	Earth and Life Sciences
Nada Babiker Hamza Babiker	Sudan	Ministry of Science and Technology of Sudan & Sudan Institute for Natural Sciences (SIFNS)	Earth and Life Sciences
Eihab B. Mohammed Bashier	Sudan	Ministry of Science and Technology of Sudan & Sudan Institute for Natural Sciences (SIFNS)	Basic Sciences, Technology and Innovation
Abdelmoneim A. M. Sulieman	Sudan	Ministry of Science and Technology of Sudan & Sudan Institute for Natural Sciences (SIFNS)	Basic Sciences, Technology and Innovation

(PREA), a system developed and adopted effectively throughout Africa to improve agricultural practices. Subsequently, most farmers in Kogi and Benue States in Nigeria are using Fontem's weed management recommendations, and these practices have spread to neighbouring states.

Fontem has published 27 scientific articles in reputed refereed journals outlining these results, and has edited and co-edited seven books and two conference proceedings.



The **TWAS-UNESCO Associateship Scheme** is conducted in collaboration with more than 100 scientific institutions in the South that have been designated 'centres of excellence'. The scheme enables researchers from developing countries, each of whom is appointed for three years, to make two visits to a selected centre to pursue collaborative research. TWAS provides travel support and contributes to incidental local expenses. Host centres cover living expenses. In 2011, TWAS awarded 32 new associateships to scientists from 16 countries, including Botswana, Iraq, Nepal, Sudan and Uzbekistan. In addition, 35 TWAS-UNESCO associates travelled to institutions in 12 countries in the developing world: Argentina, China, Egypt, India, Iran, Jordan, Mexico, Pakistan, South Africa, Taiwan (China), Thailand and Uruguay.

Associateship Scheme



CRYSTALLIZING COMPOUNDS IN ARGENTINA

In March 2011, Tapashi Ghosh Roy left the Department of Chemistry at the University of Chittagong in Bangladesh to work for three months with Fabio Doctorovich in his specialized laboratory at the Institute of Chemical Physics of Materials, Environment and Energy (INQUIMAE) in Buenos Aires, Argentina.

Roy explained why the visits (this was her second) were so important to her research: "In Bangladesh it is still not feasible to carry out standard research due to the lack of experimental equipment. We can create chemical reactions to synthesize new compounds, but we can't characterize them easily due to the lack of sophisticated apparatus."

Scientists working in the field of inorganic chemistry study the behaviour and analogues of non-biological compounds, and how they can be modified, separated or used, often in product applications. Indeed, inorganic chemists might be best described as tinkerers, people who enjoy putting things together and solving problems. They need to be precise and persistent, and their work (even given state-of-the-art equipment) is challenging.

Roy had achieved much in her lab in Bangladesh, but in order to proceed with her research she needed to take some very specific measurements she just did not have the equipment for. Roy applied to the TWAS-UNESCO associateship scheme, identifying INQUIMAE as an appropriate host institute.



INQUIMAE was founded in 1984 on the basis of five existing chemistry research groups and with the goal of promoting interdisciplinary research in the fields of physical chemistry associated with materials science, environmental science and energy resources. Since 1995, INQUIMAE has also been a member of CONICET, Argentina's National Scientific and Technical Research Council, a government agency which directs and coordinates most of the scientific and technical research done in universities and research institutes throughout Argentina.

With these credentials, a very well equipped lab, and an expert collaborator in Fabio Doctorovich, INQUIMAE was a perfect match.

The first time she visited under the scheme, Roy brought with her a large number of samples prepared by her students at Chittagong University. She took a variety of analytical measurements of these samples, using infrared, microanalysis, mass spectroscopy, nuclear magnetic resonance (NMR) and single crystal x-ray diffraction (XRD). Several crystal structures were measured and solved at INQUIMAE and a nitrosyl compound, after many trials by changing different conditions, was synthesized for the first time in Doctorovich's laboratory. The compound was purified and characterized, and crystals of the compound were grown. The structure was confirmed by single crystal x-ray diffraction and the reactions of this compound with dioxygen and bromine were studied.

To ensure a mutually beneficial exchange of information, Roy gave two presentations during her visit: on the research she had recently carried out at her home university; and on the research she had carried out in Doctorovich's lab.

There have been many productive outcomes from the collaboration: it is expected that, together with Doctorovich, Roy will publish four or five papers on this research (in *Inorganic Chemistry* or a similar journal,

and other short papers in *Acta Crystallographica*). Subsequent to Roy's first visit, three MSc theses and one PhD thesis completed by students from her home laboratory have included research done on samples Roy analysed at INQUIMAE.

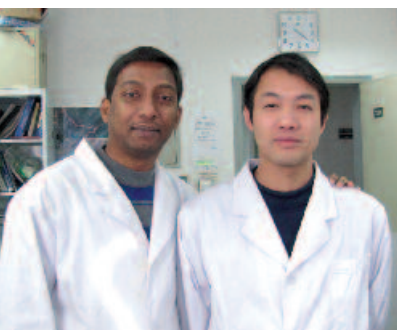
In addition to working hard on her research, Roy enjoyed the social and cultural aspects of her visit: "I visited a few Argentine families, too, with the help of my house owner and co-workers. I was invited to some birthday, welcome and farewell parties arranged by my host scientist and his colleagues. I enjoyed all of them and the opportunity to learn about Argentine culture."



The collaboration between the two institutes will certainly continue, with the director of INQUIMAE encouraging Roy to send her students to study in the lab, and Doctorovich agreeing to provide instrumental facilities for samples that Roy might send from her home lab. In addition, Roy plans to apply for a TWAS research grant to purchase equipment for her home lab (including the specialized ultraviolet and infrared spectrometers that she has now learnt to use). Roy will also apply for a second TWAS-UNESCO associateship, so that she can return to INQUIMAE to continue this important collaboration.

TWAS's **South-South Fellowship Programme** provides opportunities for scientists from one developing country to carry out research at an approved institution in another developing country. The programme operates in partnership with a growing number of institutions in the developing world. Collectively, TWAS and its partner organizations now offer more than 300 fellowships a year, making this programme the largest South-South fellowship scheme in the world. TWAS administers the programme and covers the travel costs, while programme partners cover all in-country expenses such as tuition fees and living expenses.

South-South Fellowships

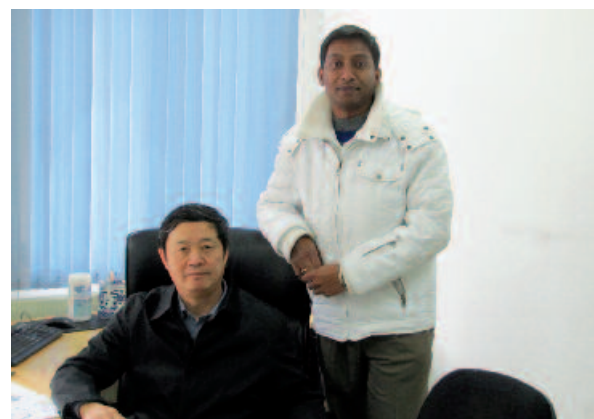


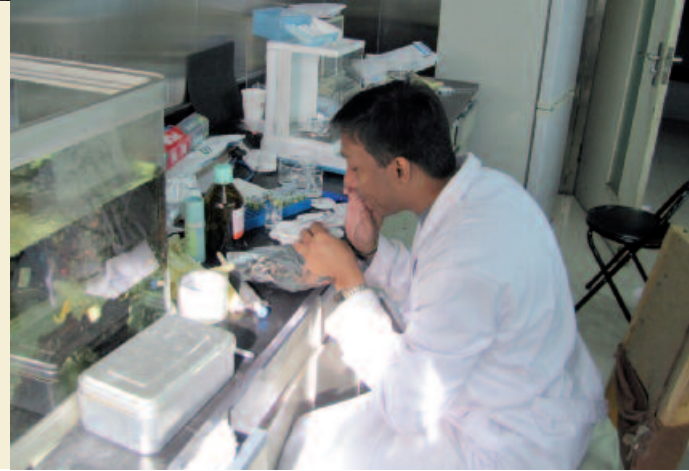
FROM INDIA TO CHINA

Senthil Kumaran Satyanarayanan was awarded a TWAS postgraduate fellowship, in conjunction with the Chinese Academy of Sciences (CAS), in order to complete his PhD on aquatic toxicology. The fellowship allowed him to travel from his home institute, the Department of Zoology at Bharathiar University in Tamil Nadu, India, and undertake research in the specialist Laboratory of Environmental Aquatic Chemistry, based at CAS in Beijing, for a period of eleven months, from February 2010 to January 2011.

Pharmaceuticals and personal care products (PPCPs) are environmental pollutants which easily enter aquatic ecosystems in the form of domestic wastewater. Kumaran's research has focused on the toxic effects of one of the substances – triclocarban – commonly found in many PPCPs because of its antifungal and antibacterial properties.

Triclocarban, marketed under the trademark TCC, has been extensively used since 1957 in soaps, mouthwashes, detergents, toothpaste, shampoos, deodorants, cosmetics and skin care lotions. Yet despite its extensive production over the last half century, the effects of TCC in wastewater and its subsequent contribution to aquatic toxicology have received only limited attention.





Kumaran's research provides some new data on the multiple potential toxic effects of TCC on the Chinese rare minnow (*Gobiocypris rarus*). His work importantly confirms that *G. rarus* has been subjected to severe stress, which has induced conformational changes in the fish that he was able to measure with techniques he learnt during his stay at the lab in Beijing. His results show that these changes are directly related to TCC exposure. Kumaran's work will improve our understanding of the toxicological mechanisms of TCC, and provide guidance for a much deeper investigation.

Kumaran's supervisor in Beijing, Zijian Wang, said that he was "greatly satisfied" with Kumaran's research efforts during his stay. "He came up with an original research problem and worked extremely hard, and was able to use the laboratory facilities to the full. He has worked on two particular toxicants which are of great scientific interest. I am sure that in the near future he will publish some good research papers in international journals and I will strongly recommend him for a postdoctoral fellowship at my lab."

The feeling is clearly mutual: Kumaran found Wang's suggestions and insights invaluable in helping to define his present field of research. "Without his unceasing guidance, unstinting cooperation and encouragement, my research may not have become a reality." Indeed, Kumaran was very positive about the whole experience: "I was provided with accommodation very near to the insitute, which meant I could go to the laboratory whenever I needed. I was provided with all the necessary facilities and space for my research. The group I worked with had the most

sophisticated instruments. Also, being part of a research group has helped me to work in a broader context."

During his stay in Beijing, Kumaran had the opportunity to attend an international symposium in Kunming and a workshop in Changzhou, as well as an international workshop organized by CAS and the TWAS Regional Office in Beijing entitled, 'Frontiers in Water and Sanitation: A Workshop for Water Engineers and Scientists from Developing Countries'. He also co-authored several research publications and participated in the research activities of other doctoral students.

For his part, and to maintain effective collaborations between the two institutions involved, Wang is planning to organize a training course in aquatic toxicology at Kumaran's home institute in Tamil Nadu.

The **TWAS Research Professors in Least Developed Countries (LDCs)** scheme was launched in 2005. More than 100 TWAS members have expressed interest in participating in the programme, which enables them to visit a research institution in an LDC three times during a five-year period for one to three months on each occasion. The areas of expertise of these members have been circulated to more than 1,000 institutions in LDCs so that they can select their preferred expert. Four TWAS Research Professors took part in the programme in 2011, including Ahmed A. Azad, whose experience is highlighted below.

TWAS Research Professors



DEVELOPING SCIENCE CAPACITY IN BANGLADESH

The year 2021 will mark the golden jubilee of Bangladesh's independence. In its 'Vision 2021' manifesto, the Bangladesh Awami League Party, who won the 2008 elections, committed themselves to building a "middle income country where poverty will be drastically reduced, where our citizens will be able to meet every basic need, and where development will be on fast track, with ever-increasing rates of inclusive growth."

TWAS Research Professor Ahmed A. Azad is in no doubt that any plan to achieve such ambitious development and prosperity in Bangladesh must include a massive, coordinated and expert investment in science and technology. Azad is keen to play his part and, during the last two years, his major concern has been to transform the existing Centre for Advanced Research in Sciences (CARS) at Dhaka University (DU) into a world-class research and technology centre for postgraduate research in agricultural, biomedical and environmental sciences.

Azad knows DU well. Born in Bangladesh, he obtained both his BSc and MSc in biochemistry there. DU was once considered one of the top four research universities on the Indian subcontinent and indeed, with the university's preparation behind him, Azad was able to secure fellowships to undertake both his doctorate and postdoctoral studies in molecular biology and biochemistry at the University of Toronto in Canada.

Azad went on to acquire over 38 years of varied research and management



experience both in medical biotechnology and in the commercialization of research. After five years at the Australian National University, he spent 19 years at Australia's national science agency, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) in Melbourne, as Chief Research Scientist and programme manager in molecular virology. He then spent five years as director of research at the University of Cape Town, South Africa, where he remains an honorary professor. His research focus has been the development of drugs and vaccines against viruses that cause immunodeficiency.

By returning to his *alma mater* as TWAS Research Professor, Azad has been able to put his scientific expertise to the service of another key interest and passion: building science capacity in Bangladesh. Azad's personal contribution is to offer his expert advice and guidance in transforming the existing Centre for Advanced Research in Sciences (CARS) at DU into a productive research and technology resource centre that can serve as a model for other academic and research institutions in Bangladesh.

While DU still maintains a highly competitive undergraduate teaching programme, its research standing has eroded over time due to lack of support. This has resulted in the absence of full time researchers, inadequate equipment (and the people trained in operating that equipment), and the absence of many contemporary technologies required for modern biosciences research.

During Azad's third and final visit to Bangladesh as TWAS Research Professor (1 February to 3 March 2011), he held a series of strategic meetings with the administrative and faculty representatives of DU and CARS, scientists from various other research centres,

as well as representatives from government, industries and nongovernmental organizations. These wide ranging discussions led to some specific action plans, including structural modifications to the building and the transformation of a large number of rooms into open plan research laboratories to accommodate up to 150 additional full time researchers. One entire wing of the ground floor of CARS will be converted into offices for specialists in technology transfer (including intellectual property and liaison with industries) as well as offices for regulatory issues such as bioethics and biosafety.

Most importantly, Azad guided the centre in implementing its new emphasis on teaching and training PhD students and postdoctoral fellows. PhD students with their own scholarships, together with their supervisors in the various science and engineering faculties already at DU, will be re-located and housed together in the specialized centre, which will include a large lecture theatre with the latest audio-visual facilities. CARS will also introduce the first advanced molecular biosciences postgraduate course in Bangladesh. An annual summer course in these same cutting-edge technologies will be offered, with the help and active participation of non-resident Bangladeshi researchers and technical experts.

Azad knows that the initiatives he has proposed during his TWAS Research Professorship "are extensive and ambitious" but he is convinced that they are "absolutely essential" if Bangladesh is going to compete internationally in science and technology. Now that his tenure as TWAS Research Professor has ended, he will remain in an advisory and coordinating role on all these projects, as well as assisting CARS and DU in fundraising from within and outside Bangladesh.

The **TWAS Visiting Scientist Programme** provides institutions and research groups in developing countries, especially those with limited outside contacts, with opportunities to establish long-term links with internationally-renowned experts. The primary goal is to help build scientific research and teaching capacity in the host country. In 2011, TWAS funded two scientists, enabling them to visit institutions in the Democratic Republic of Congo and Uzbekistan. Stanislav Pen-Mouratov, from Israel, was one of those who participated. He went to Uzbekistan.

North-South Collaboration



SOIL ANALYSIS IN UZBEKISTAN

Under the TWAS Visiting Scientist programme, Stanislav Pen-Mouratov (currently senior researcher at the Soil Ecology Laboratory at Bar-Ilan University in Ramat Gan, Israel) visited the Institute of Geology and Geophysics (IGG) at the Academy of Sciences of Uzbekistan in Tashkent for two weeks in June 2011.

His mission was to establish two new projects, examining soil ecosystems in the Angren and Chadak industrial areas, working with his long-term collaborator at the institute, Nosir Shukurov, senior scientist in the Laboratory of Geochemistry and Geotechnology at ICG.

The city of Angren lies 115 kilometres east of Tashkent and is the centre of the Uzbekistan coal industry. It was created from mining settlements that grew up along a rich coal seam, providing the fuel for a string of industrial plants. Angren was a major industrial base during Soviet times but its importance has sharply declined since 1991, when, with the break-up of the Soviet Union, links between the different republics were disrupted and industrial production slumped. However, in April this year, Uzbek President Islam



Karimov committed to creating a special industrial zone in Angren, intended to create jobs and establish facilities to process mineral resources.

Soil microbiology and biogeochemistry investigations will play a very important role in assessing the ecological situation in this historically polluted post-Soviet area. Results from such studies will also be very useful in developing new tools for bioindication and bioremediation of polluted sites, and in building the foundations for future ecologically safe industrial development in this area of Uzbekistan.

Pen-Mouratov and Shukurov wanted to take a closer look at the soil around these industrial areas, to examine the effect of these metals on biological activity, and in particular the so-called soil free-living nematodes. Nematodes are microscopic non-segmented worms whose trophic structure, sex structure, and taxa composition are very sensitive to changes in the soil quality. An incredible variety of nematodes function at several trophic levels of the soil food web. Destructive kinds feed on plants and algae, but those feeding on bacteria and fungi are known as soil free-living nematodes. These beneficial nematodes help control disease and cycle nutrients but are among the trophic groups most sensitive to disturbances in ecosystems, including the presence of heavy metals.

In Pen-Mouratov and Shukurov's studies, the pollution effect on the density and biomass of soil free-living nematodes was found to be highest at the pollution source, with fungivores and plant parasites dominating in both the upper and deeper soil layers next to the pollution source. These groups decreased along a 15-kilometre transect, whereas bacteria- and fungi-feeders increased. In essence, the beneficial nematodes are being selectively killed off in direct proportion to the amount of heavy metal pollutants in the soil.

To get these important measurements, the researchers and accompanying young scientists undertook field trips to the Angren and Chadak industrial areas to collect soil samples. Back in the laboratory, nematodes were extract-

ed from the sub samples and observed under a new digital biological microscope that Pen-Mouratov had helped to install and operate.

Pen-Mouratov also gave lectures for the local scientists and PhD students on soil free-living nematodes as bioindicators of soil health, as well as outlining a methodology for developing skills in the quantitative and qualitative analysis of soil free-living nematodes.

Pen-Mouratov stresses that this visit was in fact a two-way exchange. The TWAS Visiting Scientist programme gave him "the opportunity to participate in scientific research under conditions of high industrial activity in a developing country. I also had the opportunity to share my own knowledge and experience with



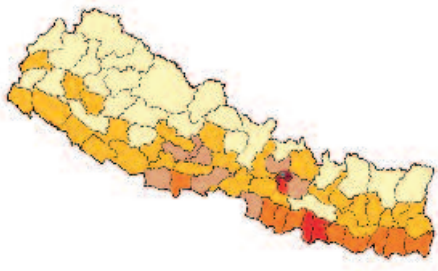
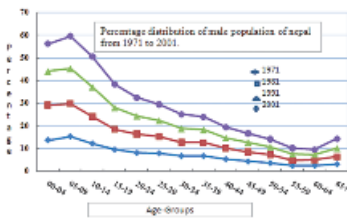
young Uzbekistan scientists. I am very much looking forward to future pleasant and productive relations."

Shukurov agreed that "it was a very useful and productive visit. Stanislav Pen-Mouratov provided lectures which were immediately useful to my students' research investigations. We will certainly continue to collaborate."

Data and conclusions from their joint research on "Soil biotic activity in coal-ash landfills of Central Asia" have been submitted to the international journal *Applied Soil Ecology*.

The **TWAS Research Grants Programme in basic sciences for individual researchers** – supported by the Swedish International Development Cooperation Agency (Sida) – provides up to USD15,000 to young scientists in science- and technology-lagging countries to support projects in the basic sciences. The grant covers the costs of specialized equipment, essential consumable material and scientific literature. In 2011, 22 TWAS Research Grants were awarded to individual young scientists in 15 countries, including Bangladesh, Belize, Guatemala, Indonesia, Jamaica, Mongolia, Peru, Vietnam and seven countries in sub-Saharan Africa. The following example of TWAS-supported research focuses on the work of Jyoti Upadhyaya Devkota, in Nepal, who has used mathematical stochastic modelling to predict population dynamics.

Research Grants for Individuals



POPULATION MODELLING IN NEPAL

The demographic future of any country is uncertain: there is not just one possible future but many, and some futures are more probable than others.

The ability to accurately predict the size, composition and distribution of populations is of vital importance for policymakers, planners and researchers. Decisions on whether to build new hospitals or close down schools are based on such predictions. Yet population analysts are dependent on the accuracy of the data that have been collected. In many societies, the regular, ongoing collection of data occurs automatically through the official registration of important ‘events’ such as births, marriages and deaths. In addition, national censuses provide more detailed information. However, in many developing countries, collecting accurate data – and thus forecasting population changes – is not so straightforward.

Forecasting demographic statistics in Nepal is particularly challenging. Nepal is home to some 25 million people, many of whom live in remote areas that can only be reached on foot. They have little or no access to transport, electricity or telephones. Although the main sources of data are population censuses, national sample surveys, the registration of vital events, and *ad hoc* demographic studies, each of these sources is open to a large margin of error. A census, for example, requires considerable organization, a great deal of preparation and several years to analyse the results. In Nepal, censuses have been carried out every ten years since 1961. However, since respondents

have to be physically contacted, and their answers physically collected, it is highly likely that an unsatisfactory percentage of Nepalese are not included in the results.

Other methods, such as the official registration of births, deaths, marriages and migration, are also unreliable. Many Nepalese simply do not register. Added to this, there is no standardized method for recording such data: there are discrepancies, for example, between rural and urban areas, and between the different agencies responsible for collecting data, including doctors, the police and tax authorities.

Further hindrances to gathering useful and usable data include bureaucratic hurdles and a lack of political will and incentives.

effectively by performing a stochastic analysis. There are two aspects to these forecast models: deterministic and probabilistic. Deterministic forecasts tend to give a point estimate but don't give an indication of uncertainty. Probabilistic forecasts, on the other hand, give first a range of possible values and then attach a likelihood to this range. In essence, a probabilistic forecast will calculate precisely how likely something is to happen.

Devkota's project aims to make a probabilistic prediction of vital events and then assess the expected accuracy of the predicted values. The range of possible values of the vital event along with the probability attached to it can then be estimated. Devkota describes this technique as a "mixed effect model".

Devkota received a total of USD6,000 in order to buy computers capable of collecting, computing and furnishing the statistical analysis efficiently. She also requested a laptop and liquid-crystal display projector. She told us that "in Nepal the load shedding is up to 18 hours per day, and a laptop increases work efficiency. There is often no power during the daytime and work that can be done on laptops such as data analysis or the preparation of papers can be done in the absence of power up to several hours." Devkota will use the projector to train other researchers in her demographic modelling techniques. She also requested a number of specialized books on the latest developments in the field.

The results of this research have been published in two papers in the *Journal of Applied Statistical Science*, and Devkota presented a paper on mathematical modelling at the University of Evora in Portugal. While working on the TWAS grant, she was promoted to the post of associate professor. In addition, two senior scientists and 12 research students were able to benefit directly from the results Devkota achieved. Clearly, a specialized research group in stochastic modelling is beginning to cluster around Devkota in Kathmandu.

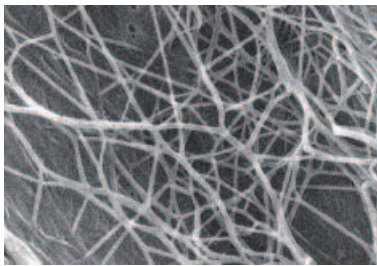


To improve the situation in Nepal, TWAS Research Grant recipient, Jyoti Upadhyaya Devkota, proposed a more reliable method of predicting population change: through mathematical modelling. Devkota works as an associate professor of statistics at Kathmandu University in Nepal, where her research interests lie in the interdisciplinary application of statistics and data analysis tools across various fields.

Devkota claims that mathematical modelling can explain various features of human demography very

The **TWAS Research Grants Programme in Basic Sciences for Research Units**, launched by TWAS in 2002, is designed to assist small research groups in science-and-technology-lagging countries. Although these groups have conducted important research with significant results, the difficult conditions under which they work have prevented them from realizing their full potential. With support from the Swedish International Development Cooperation Agency (Sida), this programme provides research units in some 81 countries with an opportunity to achieve that potential. Each selected research unit receives a grant of up to USD30,000 that can be renewed two additional times on the basis of a positive report and re-application. In 2011, 16 research groups in 11 countries were supported. Here we look at the Research Centre for Physics at the Indonesian Institute of Sciences (LIPI), in Bandung, Indonesia.

Research Grants for Groups

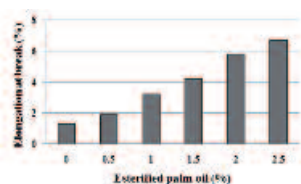
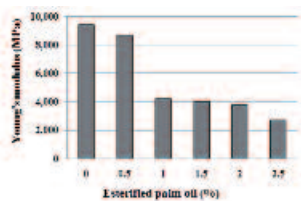


COCONUT COMPOSITES IN INDONESIA

Strong, yet flexible, light but load-bearing materials are much sought after in industry and by consumers. These ‘composites’ are either engineered or naturally occurring materials made from two or more constituents which remain separate and distinct within the finished structure, with the characteristic that the combined materials are stronger than the individual. Natural composites include wood and bone; man-made composites include concrete and plastics.

Glass fibres are the most widely used reinforcement in the composites industry: they have good tensile and compressive strength and stiffness and are relatively low in cost. Boats, baths, roofing and pipes are all made from glass fibre reinforced plastic (otherwise known as fibreglass). Carbon fibres, on the other hand, are stiffer, lighter but more expensive and brittle than glass, and are used in aircraft, wind turbines, sporting goods and high-end automotive and marine applications. However, the production of composites using glass or carbon causes a significant environmental problem because they do not degrade easily.

For these reasons, physicists and chemists at the Research Centre for Physics at the Indonesian Institute of Sciences (LIPI), in Bandung, Indonesia, have been attempting to find a fibre to substitute glass or carbon – one that is both biodegradable and locally sourced. The team is led by Myrtha Karina, who applied for a TWAS Research Grant in order to buy the necessary equipment to undertake these studies.





Karina has over 50 publications in the field of composite materials and returned to her home town of Bandung after completing her postgraduate studies in wood science and technology at Kyoto University in Japan.

Directly substituting natural fibres is not straightforward, however. Natural fibres attract water which lowers their compatibility with the polymer component of composites, which, in contrast, repels water. This incompatibility causes poor bonding, resulting in reduced mechanical strength. In order to function in composites, the hydrophilic properties of natural fibres must be modified beforehand, typically by using a chemical treatment. The challenge then is to create totally 'green' and high mechanical strength composites with the minimum use of chemicals.

Bacterial cellulose (BC) fulfills these criteria. BC is a natural polymer, existing as an ultra-fine ribbon network structure of extra-cellular cellulose in the form of gel film. Typically, however, BC is produced by bacteria cultivated in a synthetic growth medium which is rich in glucose.

The research unit's innovation was to replace this synthetic culture medium with coconut water, which is naturally rich in glucose and available locally in large quantities. Thus, natural fibres could be modified using BC. Most importantly, this would represent a totally green procedure for producing high strength materials.

The unit applied to TWAS for the specialized equipment (including a Fourier Transform infrared spectrometer, a gel permeation chromatograph and a scanning electron microscope), supplies and literature they needed in order to carry out these experiments and to monitor and measure any changes.

In practice, the team had difficulties integrating natural fibres using coconut water as the culture medium. As an alternative, they tried integrating other readily available, biodegradable local natural resources, such as castor oil and oil palm-based dioctyl phthalate and diacetyl-glycerol. The resulting composites were then characterized by their physical and mechanical properties.

The experiments proved successful and the results have now been submitted to the *Journal of Applied*



Polymer Science and Procedia Chemistry. In addition, two papers were presented at an international conference on 'Innovation Polymer Science and Technology', in Bali in late 2011.

Three senior scientists, two technicians and three research students participated in the research and the results are discussed in three doctorate theses, one master's and an undergraduate thesis – thus demonstrating the valuable training element of providing grants for research equipment to experienced team leaders.

Like all organizations, **TWAS must effectively communicate its activities to its members and other interested parties.** The Academy's audience includes the international organizations that are committed to building scientific capacity in developing countries, as well as national ministries, research councils and science academies. The goal is not only to highlight the Academy's excellent work but, more importantly, to advance the Academy's long-standing goal to build scientific capacity in all developing countries. Within the Academy's secretariat, the Academy's communication efforts are the responsibility of the Public Information Office (PIO).

Public Information Office



The two major focal points for the Public Information Office (PIO) in 2011 were the TWAS 22nd General Meeting which was held in Trieste, Italy, thus providing an ideal opportunity for the Academy to showcase its activities to the local and national Italian media; and a focused media strategy for both the retirement of Mohamed Hassan, TWAS executive director for twenty-six years, and the subsequent appointment of Romain Murenzi.

TWAS's 22nd General Meeting took place on the campus that the TWAS headquarters shares with the Abdus Salam International Centre for Theoretical Physics (ICTP). The TWAS PIO prepared daily news stories for the Academy's website and later a lengthy feature article on the conference for the *TWAS Newsletter*. Stories about the winner of the Ernesto Illy Trieste Science Prize and the 2010 TWAS Prize winners received extensive press coverage, especially in the international science media. For example, the Italian press published eight stories on the conference and 12 others on the Ernesto Illy Trieste Science Prize.

There was wide coverage of TWAS throughout the year in the international press, including: 'A World View Commentary' in *Nature*; a feature story on *Nature's* website; interviews in *SciDev.Net* and *Physics Today*; news stories and announcements in *Science*, UNESCO's *World of Science*, *Science News* and *AAAS News*. Throughout the year, TWAS continued to increase its visibility in the Italian media, with over 80 print, radio and TV stories.



Murenzi was featured in the 29 June 2011 edition of *Nature* in a lead commentary 'Give the new generation a chance', a special issue devoted to the state of science in Africa. In July, he was also interviewed for *SciDev.Net*, when he focused on his future plans for the Academy.

During the year, the TWAS PIO also participated in three major international meetings:

- at the World Conference of Science Journalists held in June in Doha (Qatar), TWAS and the US National Academies of Science jointly organized and moderated the session: 'Under the Pressure Cooker: How Information Professionals Communicate Big Stories'. The session was attended by media relations directors from the European Organization for Nuclear Research (CERN) and the executive director of the Academy of Sciences for South Africa, among others;
- in August, the PIO represented TWAS at the 44th session of the 'Erice International Seminars on Planetary Emergencies' in Erice, Italy;
- in September, TWAS PIO also organized and moderated a session at the 6th Science Centre World Conference in Cape Town, South Africa on 'Science Centres: Facilitating Education with Scientists'. Panelists included the African Union (AU) commissioner Jean-Pierre Ezin and Mohamed El-Faham, director of the Centre for Special Studies and Programmes at the *Biblioteca Alexandrina* in Egypt.

In 2011, TWAS successfully applied for a European Union 7th Framework Programme (FP7) grant for capacity development and hazard risk reduction and adaptation (CATALYST). Among the seven partners, TWAS is responsible for implementing the communication and information dissemination aspects of the project, which runs until September 2013.

TWAS continued to attract positive attention in the local Italian press and to spread its wings further throughout Italy. TWAS PIO set up an information and display stand for *La Notte dei Ricercatori* (Researchers' Night) in September in Trieste, and prepared an introductory brochure in Italian along with a video introducing Murenzi. 6,000 people attended the event.

Four additional volumes in the TWAS series 'Excellence in Science: Profiles of Research Institutions in Developing Countries' were published, featuring the National Agricultural Research Laboratories, Uganda; the Okavango Research Institute, Botswana; the Institute of Marine Sciences, Zanzibar, Tanzania; and the International Center for Chemical and Biological Sciences, Pakistan. Moreover, an agreement was signed with the Italian publishing house *Scienza Express* to translate the series into Italian.

ISSN numbers were assigned to four TWAS publications: *TWAS Newsletter*; *Annual Report*; *Excellence in Science*; and the *TWAS Year Book*.

In order to maximize its public outreach, TWAS has taken increasing advantage of the new social media, with postings on YouTube, Flickr and Facebook as well as the 'TWASnews' page set up on Twitter.

Among its regular activities, the *TWAS Newsletter*, which has a print run of 2,500 copies, was again published four times. Generously supported by the Kuwait Foundation for the Advancement of Sciences (KFAS), the *Newsletter* is the Academy's flagship publication. Its magazine-like format provides a timely and effective way of keeping members, as well as colleagues and partners in other international organizations and the science media, up to date with the work TWAS does, and that of its associated organizations, OWSD, IAP and IAMP.

The *TWAS Year Book*, containing brief biographies of all TWAS Fellows and Associate Fellows, was published in October 2011. The *Year Book* serves as an important and valuable source of information for TWAS members as well as those who are interested in knowing more about those who have been elected to the Academy.

In addition to its ongoing responsibilities, the PIO: maintains the Academy's website (publishing more than 50 news articles during 2011); provides editorial and technical assistance for the websites of the Academy's associated organizations; and prepares booklets, leaflets, brochures and posters describing TWAS's activities.

Over the course of the past decade, **TWAS has forged a number of partnerships with a diverse group of organizations**, each of which extends the reach of TWAS and helps the Academy achieve its goals through collaboration with like-minded partners.

Partnerships



PHYSICS COLLABORATION

Since 2009, TWAS and the Abdus Salam International Centre for Theoretical Physics (ICTP) have been working together more closely through a series of co-sponsored initiatives.

Under an agreement between the two organizations, in 2011, TWAS supported workshops organized by several ICTP sections, including the Aeronomy and Radiopropagation Laboratory, which held events in Nigeria on ‘Satellite Navigation Science and Technology for Africa’ and in Guatemala on ‘Low-Cost Wireless Computer Networking’. In collaboration with both ICTP and the UK-based Institute of Physics, TWAS also co-sponsored workshops on entrepreneurship for scientists in Jordan and the Philippines.

In addition, the ‘Joint ICTP-TWAS Workshop on Science Communication in Developing Countries: Bridging the Gap Between Science, Policy and the General Public’ was held in Trieste from 17 to 21 October, attended by 43 participants from seven developed and 17 developing countries.

Among other collaborative activities, TWAS supported four young scientists from science and technology-lagging countries (specifically Ethiopia, Sudan, Togo and Uzbekistan) to carry out part of their PhD programmes at institutions in Trieste and the surrounding area, under the ICTP Sandwich Training Educational Programme (STEP) programme.



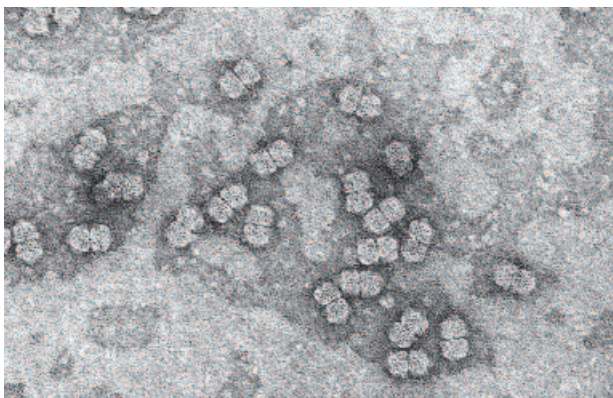


BIOTECH COLLABORATION

Following a Memorandum of Understanding signed in 2008, TWAS and the International Centre for Genetic Engineering and Biotechnology (ICGEB) joined forces with the United Nations Educational, Scientific and Cultural Organization's International Basic Sciences Programme (UNESCO/IBSP) to fund a three-year 'Joint Project on Capacity Building in Basic Molecular Biology'. The aim is to support networks of institutions from developing and developed countries with a focus on research on the biotic stresses (pests and pathogens) of crop plants and domestic animals.



The five networks selected for funding are being led by institutions in Cuba, Kenya and Peru, with two in South Africa. Partner laboratories are located in such countries as Brazil, Pakistan, Sudan, Switzerland, Tanzania and Uganda, and topics include the development of bioinformatic tools to help with the early identification of emerging plant viruses, as well as studies on two types of such emerging viruses, the whitefly-transmitted begomoviruses and the leafhopper-transmitted mastreviruses.



EUROAFRICA-ICT

The second phase of the EuroAfrica-ICT project, funded through the European Union's (EU) Seventh Framework Programme (FP7), which ran from January 2010 to December 2011, saw TWAS link up with a number of institutions in Europe and sub-Saharan Africa. The project was aimed at increasing the number of scientists from sub-Saharan Africa carrying out research in information and communication technology (ICT) that develop collaborative projects with European-based partners.

The main event organized in 2011 was the Fourth Euro-Africa Cooperation Forum on ICT Research, held in Cape Town, South Africa, on 14-15 November. The event attracted some 250 participants, including high-level personnel from South Africa's science community, the African Union and the European Union, along





with many ICT researchers and representatives of development agencies and the private sector.

The EuroAfrica-ICT consortium members also organized an awareness workshop on 6-7 April in Khartoum, Sudan, and a ‘concertation’ meeting in Pretoria, South Africa, on 6 June. In addition, EuroAfrica-ICT consortium members developed and published a database of African centres of excellence in ICT research to aid European researchers seeking partners in Africa.

For additional information, see: www.euroafrica-ict.org.

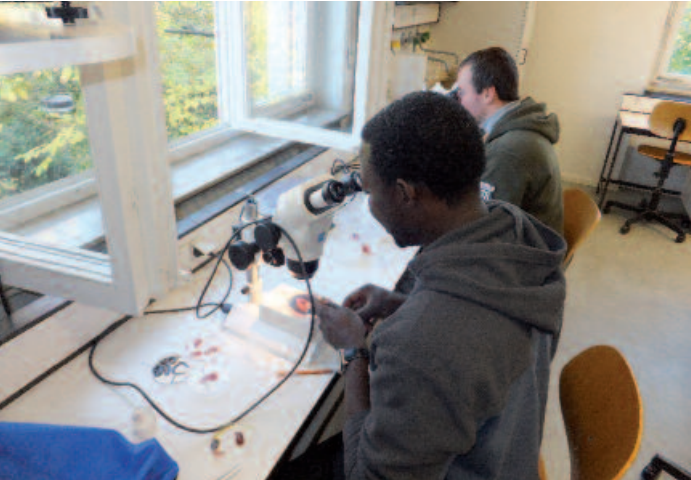
MICROSOFT SUPPORT FOR AFRICA

In 2009, TWAS entered into a three-year agreement with Microsoft Research, UK, and the African Academy of Sciences (AAS) to coordinate two programmes designed to promote computer science research in Africa: an awards programme for young African computer scientists, and a support programme for computer science workshops and meetings in Africa.

The winners of the third round of TWAS-AAS-Microsoft awards for young computer scientists in Africa – from three different African countries – were:

- **Mohamad Abou El-Nasr**, Computer Engineering Department, Arab Academy for Science, Technology & Maritime Transport (AASTMT), Alexandria, Egypt;





- **Adesina Simon Sodiya**, Department of Computer Science, University of Agriculture, Abeokuta, Ogun State, Nigeria; and.
- **Hein Venter**, Information and Computer Security Architectures (ICSA) Research Group, Department of Computer Science, University of Pretoria, South Africa.

Each winner received EUR7,000, with EUR5,000 of the prize money being earmarked for further research.

In addition, Microsoft Research supported computer science meetings in Benin (one), Senegal (one), Sudan (three) and Uganda (two).

TWAS-COMSTECH GRANTS

In June 2009, TWAS and the Organization of Islamic Cooperation (OIC) Standing Committee on Scientific and Technological Cooperation (COMSTECH) signed a memorandum of understanding whereby the two organizations agreed to co-finance a Joint Research Grants programme whereby grants of up to USD15,000 are made available to scientists under the age of 40 working in OIC member states. Awards are available in the fields of: earth sciences; engineering sciences; information technology and computer sciences; materials science including nanotechnology; pharmaceutical sciences; and renewable energy.

In response to the third call for proposals, in 2011 TWAS and COMSTECH provided grants to 23 young scientists in seven countries: Bangladesh, Egypt, Indonesia, Jordan, Malaysia, Pakistan and Turkey.



SOUTH-NORTH OPPORTUNITIES

In collaboration with the German Research Foundation (DFG), TWAS launched its first South-North fellowship programme. The programme is open to postdoctoral scientists from sub-Saharan Africa (except South Africa) who graduated with their PhD degree within the last



five years. In 2011, the programme was expanded to provide support to 20 young African scientists (compared to 10 in its first year of operation in 2010). Among the successful candidates were six from Nigeria, four from Cameroon, two from Kenya and one each from Benin, Burkina Faso, Ethiopia, Malawi, Sudan, Tanzania, Uganda and Zimbabwe. Each was supported to undertake a two-to-three month research visit at their selected host institute in Germany with the idea that this will lead to more long-term collaborations between the African scientists and their German counterparts. As with the TWAS South-South fellowships programme, TWAS provides travel and visa support, while all expenses in Germany are covered by DFG.



GOVERNING SOLAR RADIATION

Against a background of little to no progress among the international community on an agreement to cut greenhouse gas emissions, the world's scientific community is beginning to discuss and analyse alternative ways of reducing global temperatures in the event that climate change has severe impacts, including reducing the amount of sunlight that reaches the Earth's surface – so-called solar radiation management.

To date, experiments have been limited to computer simulations, with small-scale field trials also being considered – but it remains an open question whether there should be international oversight over such experiments if they are proposed. Project participants went on to consider how such oversight might be governed, as well as which organizations, if any, had the international legitimacy to do so.

To tackle these questions and open up the debate, TWAS joined with the UK's Royal Society and the



United States-based Environmental Defense Fund in co-convening the Solar Radiation Management Governance Initiative (SRMGI) to explore different governance options. To ensure representation from the developing world, a number of TWAS Fellows took part in SRMGI steering and working groups. Following a conference held at the Kavli Royal

Society International Centre outside London on 22-24 March 2011, the three convening organizations published a report of the project's deliberations in December – with the release date chosen to coincide with international climate negotiations that were ongoing in Durban, South Africa, at the time.

For additional information, see: www.srmgi.org.

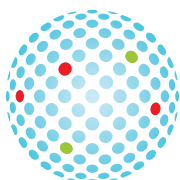




CATALYST FOR CHANGE

In October 2011, TWAS joined a consortium of seven European partners in CATALYST, a project funded by the European Union Seventh Framework Programme (FP7/2007-2013). The aim of the project is to promote capacity building efforts in relation to natural disasters and hazard risk reduction through the identification and dissemination of best practices. The project will unfold through a series of online 'think tank' activities as well as four regional workshops scheduled for late 2012: in east and west Africa, central America and the Caribbean, south and southeast Asia, and the European Mediterranean.

TWAS, and especially its Public Information Office, is responsible for coordinating the outreach activities of the project, including publication of the final 'best practices' case study documents and a policy paper, due in mid 2013.



CATALYST

CAPACITY DEVELOPMENT FOR HAZARD RISK
REDUCTION AND ADAPTATION

SUPPORT FOR SCIENTIFIC MEETINGS

In 2011, TWAS provided support for 16 scientific meetings in 14 developing countries. Among the meetings supported were:

- Workshop on the 'Role of Energy and Water in Food Security', November 2011, Beirut, Lebanon;
- Workshop on 'Mineral Processing Techniques and



Mining Waste Management', 21-23 November 2011, Marrakesh, Morocco;

- International Conference on Ion Channel Signaling Mechanisms: From Basic Science to Clinical Application, 31 October - 4 November 2011, Marrakesh, Morocco;
- II International Society for Horticultural Science's 'Genetically Modified Organisms in Horticulture Symposium', 11-15 September 2011, White River, South Africa;
- International Symposium on Women in Science and Engineering (WISE) 2011, 29-30 September 2011, Kuala Lumpur, Malaysia;
- Conference on 'Chemistry of Material Sciences and Green Technology', 29-30 September 2011, Ulaanbaatar, Mongolia;
- XXVI Annual Meeting of the Argentine Society for Research in Neuroscience, 19-23 October 2011, Cordoba, Argentina;
- Hemipteran-Plant Interactions Symposium, 11-14 July 2011, Piracicaba, Brazil;
- Training Course on 'Genetics of Laboratory Rodents', 14-25 November 2011, Montevideo, Uruguay.

The strength of organizations like TWAS depends on providing information to scientists throughout the developing world. The scientific excellence of the Academy's new members, the fellowships awarded and the research programmes funded depend on the Academy reaching the maximum number of candidates and then selecting the best. To help with this exercise, TWAS has established a suite of Regional Offices throughout the South. Among the activities shared by the five Regional Offices are the identification and nomination of scientists for TWAS membership, TWAS Prizes and TWAS Regional Prizes, the selection of TWAS Young Affiliates, the organization of Regional Conferences for Young Scientists, and awareness-raising of TWAS activities among scientists in the respective region.

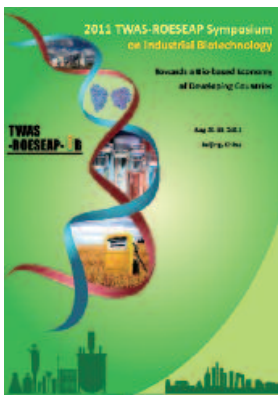
Regional Offices

TWAS REGIONAL OFFICE FOR EAST AND SOUTHEAST ASIA AND THE PACIFIC Headquarters: Chinese Academy of Sciences (CAS), Beijing, China

In 2011, the TWAS Regional Office for East and Southeast Asia and the Pacific (TWAS-ROESEAP) organized two major regional meetings.

From 26 to 30 August, the TWAS-ROESEAP Symposium on Industrial Biotechnology took place at the Institute of Microbiology (CAS). The workshop, which was attended by more than 120 scientists and students from 17 African and Asian developing countries highlighted the importance of industrial biotechnology for the sustainable development of developing countries, focusing on such areas as industrial enzymes and biocatalysis, cell factory and industrial fermentation, and biotechnology processes and applications.

Then, from 26 to 29 September, TWAS-ROESEAP again teamed up with the World Meteorological Organization (WMO) to organize the 10th CAS-TWAS-WMO International Training Workshop, this time on 'Regional Climate Change and its Impact Assessment'. The meeting attempted to understand past climate change signals, from both global and regional points of view, and to reveal the impacts of climate change on sectors such as water





resources and agriculture. The meeting was attended by more than 60 participants, including 26 international representatives from 14 countries other than China.

TWAS-ROESEAP actively supports the CAS-TWAS fellowship programme and the TWAS-UNESCO associateship scheme. For example, 45 students and scientists from 14 developing countries were awarded CAS-TWAS postgraduate (17), postdoctoral (13) and visiting scholar (15) fellowships in 2010 and travelled to China in 2011 to take up their fellowships in CAS institutes. In addition, TWAS-UNESCO associateship awardees from Cameroon, India and Nigeria travelled to their selected CAS centres of excellence to develop cooperative research programmes.

TWAS-ROESEAP and current TWAS members in the region also ensured that many outstanding scientists were nominated as potential TWAS members or potential TWAS Prize winners.

- *coordinator: Chunli Bai (TWAS Fellow 1997)*
- *email: sqfu@cashq.ac.cn*
- *website: www.beijing.twas.org*

TWAS REGIONAL OFFICE FOR SUB-SAHARAN AFRICA
Headquarters: African Academy of Sciences (AAS),
Nairobi, Kenya

In February 2011, the TWAS Regional Office for Sub-Saharan Africa (TWAS-ROSSA) organized the 5th TWAS-ROSSA Regional Conference for Young Scientists (RCYS), on the theme ‘Exchanging Knowledge on Climate Change Impacts and Vulnerability in Africa: The Role of Networking’. In addition, on 10-12 November, TWAS-ROSSA partnered with AAS and the International Centre for Insect Physiology and Ecology (*icipe*) to host the 6th RCYS, focusing on ‘Climate Change and Food Security: The Road for Africa’, in Nairobi, Kenya.

During the meeting, awards were presented to the winners of the various prize schemes organized by TWAS-ROSSA and AAS, including the TWAS Regional Prize for the development of educational science material (see below), the TWAS-AAS-Microsoft Awards for Young African Computer Scientists (see page 58-59), and the TWAS Regional Young Scientist Prize. In 2011, this latter award focused on basic sciences, the

winner being John S. Terblanche, Conservation Ecology and Entomology Department, Stellenbosch University, South Africa.

TWAS-ROSSA continued its efforts towards strengthening the capacity of TWAS National Chapters in Africa. This year, chapters in Mozambique and Zimbabwe received financial support for local activities.

To celebrate the International Year of Chemistry 2011, TWAS-ROSSA also nominated 15 candidates from the region to attend the 'Afro-Asia Workshop on Advanced Topics in Chemistry' hosted by TWAS-ROCASA (see page 65), 14 of whom attended. Among these was TWAS Young Affiliate Emmanuel Iyayi Unuabonah, who was one of three scientists to be awarded the TWAS Regional Prize for Young Scientists for their contributions at the conference.

- coordinator: *Berhanu Abegaz (TWAS Fellow 1998)*
- email: aas@aasciences.org
- website: www.nairobi.twas.org

TWAS ARAB REGIONAL OFFICE

Headquarters: *Bibliotheca Alexandrina, Alexandria, Egypt*

The TWAS Arab Regional Office (TWAS-ARO) is linked closely with the *Bibliotheca Alexandrina's* Centre for Special Studies and Programmes (CSSP).



The main event organized by TWAS-ARO in 2011 was TWAS/BioVision.NXT. The meeting was held within the framework of the biennial BioVision 'The World Life Sciences Forum', held in Lyon, France, from 27 to 29 March. Through its Regional Offices, TWAS sponsored 50 young researchers from developing countries to attend the meetings, which were also attended by Nobel Laureates and other eminent life scientists, with whom the young scientists were invited to interact through a series of 'Coffee With' sessions.

On 28 July 2011, TWAS-ARO hosted a 'Research and Industry Day: From Lab to Reality'. The seminar covered topics such as the problems faced by young researchers when introducing their research to industry, the importance of the role of small and medium enterprises in the industrialization of scientific research, as well as innovation, patent regulations and investment in scientific research. More than 50 participants attended the event.

Finally, the TWAS-ARO 7th Annual Meeting was held from 28 to 29 December 2011 on the theme 'Water in the Arab Region'. The meeting provided an opportunity for open discussions and recommendations regarding

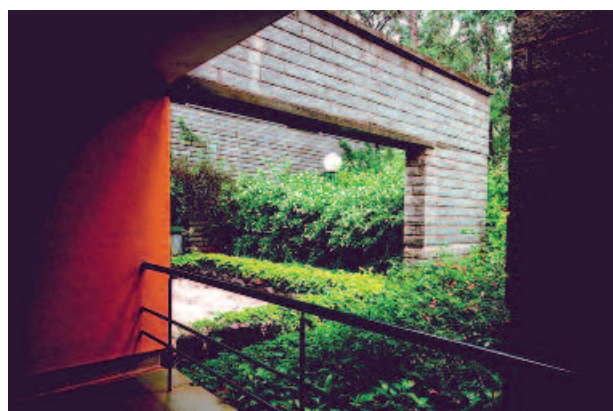


water resources and climate change, agricultural water management, wastewater treatment and re-use, and water economics. During the meeting, the winners of the Young Arab Scientists (YAS) Prize received their awards: Emad Yousif, Department of Chemistry, Al-Nahrain University, Baghdad, Iraq, and Tarek Belal, Department of Pharmaceutical Analytical Chemistry, Alexandria University, Egypt. The theme of the 2001 YAS award was 'Chemistry for Sustainable Development in the Arab World'. Also at the meeting, the TWAS-ARO Regional Prize for 2011 on the 'Development of Scientific Educational Material' was presented to Nadia Al Wardy (see page 67).

- coordinator: *Ismail Serageldin (TWAS Fellow 2001)*
- email: twas.aro@bibalex.org
- website: www.bibalex.org/TWASARO

**TWAS REGIONAL OFFICE FOR CENTRAL AND SOUTH ASIA
Headquarters: Jawaharlal Nehru Centre for Advanced
Scientific Research (JNCASR), Bangalore, India**

The main event organized by the TWAS Regional Office for Central and South Asia (TWAS-ROCASA) in 2011 was the 'Afro-Asia Workshop on Advanced Topics in Chemistry' held on 13-17 June at the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR), Bangalore. The workshop, held under the auspices of the



International Year of Chemistry 2011, was inaugurated with a lecture from TWAS Founding Fellow C.N.R. Rao, together with opening remarks from TWAS executive director Romain Murenzi and T. Ramasami, Secretary of the Department of Science and Technology for the Government of India. Some 45 young scientists from 14 different countries, including 14 African scientists, participated.

TWAS-ROCASA also organizes the popular 'Summer Research Fellowship Programme' (TWAS-SRFP) and, in cooperation with the Indian Centre for International



Cooperation in Science (CICS) and JNCASR, the Regional Office helps to identify eminent scientists in India as 'supervisors' for the young scientists selected under the JNC-CICS Fellowship Programme in the region. In 2011, eight young scientists (one from Cameroon, three from Nigeria, one from Sri Lanka, one from Bangladesh and two from Kazakhstan) were selected.

The Regional Office also updated the regional directory of TWAS Fellows that features the biographical and contact details of Academy members in the region.

- *coordinator: Varadachari Krishnan (TWAS Fellow 1996)*
- *email: twasrocasa@jncasr.ac.in*
- *website: www.bangalore.twas.org*

TWAS REGIONAL OFFICE FOR LATIN AMERICA AND THE CARIBBEAN

Headquarters: Brazilian Academy of Sciences (ABC), Rio de Janeiro, Brazil

The 8th TWAS-ROLAC Regional Conference for Young Scientists (RCYS) was held in May 2011 in Rio de Janeiro in conjunction with a meeting of the Brazilian Academy of Sciences. The main components of the meeting were scientific presentations by 20 young scientists from the region.

The 2011 TWAS-ROLAC Prizes for young scientists were awarded to: Irasema Alcántara Ayala, Mexico, in earth sciences; Fernando Coda Marques, Brazil, in mathematics; and Aimé Peláis Barranco, Cuba, in physics. The prizes, each worth USD2,000, were presented during the 9th TWAS-ROLAC RCYS, which took place from 7 to 9 December in Trinidad and Tobago, the first time such a meeting has been held outside Brazil. Also at the meeting, during which 20 young scientists presented reports on their work, Patricio Felmer (Chile) was presented with the TWAS-ROLAC Regional Prize for the development of educational science material (see page 67), and the TWAS-ROLAC Executive Council met to discuss the Regional Office's activities and future plans.

Finally, the TWAS-ROLAC webpage was updated to make it more functional and more effective in distributing all the information relevant for the TWAS Fellows and the scientific community in the region.

- *coordinator: Carlos A. Aragão de Carvalho (TWAS Fellow 2002)*
- *email: contact@twas-rolac.org*
- *website: www.twas-rolac.org*

REGIONAL PRIZES

In 2006, TWAS instituted three regional prizes of USD3,000 each, awarded annually on a rotating basis.



In 2011, the Regional Prizes for ‘Development of Educational Scientific Material’ were awarded to:

- TWAS-ARO: Nadia Al Wardy, Department of Biochemistry, Sultan Qaboos University, Sultanate of Oman.
- TWAS-ROCASA: Jayashree Ramadas, Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research, India.
- TWAS-ROLAC: Patricio Felmer, *Departamento de Ingeniería Matemática, Universidad de Chile, Santiago, Chile.*
- TWAS-ROSSA: Peet van Schalkwyk, North-West University, South Africa.

- TWAS-ROESEAP: Liu Changming, Beijing No.4 High School, Beijing, China.

YOUNG AFFILIATES

Starting in 2007, each TWAS Regional Office has selected up to five Young Affiliates (who must be excellent young scientists aged 40 or below). In 2011, the following 24 young scientists were selected following a nomination and selection process that involves the TWAS Fellows in each region:

YOUNG AFFILIATES

TWAS-ARO	TWAS-ROCASA	TWAS-ROLAC	TWAS-ROSSA	TWAS-ROESEAP
Ramy Karam Aziz, Egypt	Partha Sarathy Mukherjee, India	Fernando Coda Marques, Brazil	Romain L. Glele-Kakaï, Benin	Keng-Hui Lin, Taiwan, China
Mohammad Ahmad Salim Al-Ghouti, Jordan	Bahram Hemmateenejad, Iran	Antonio Costa-Filho, Brazil	Fogue S. Kouam, Cameroon	Tonni Agustiono Kurniawan, Indonesia
Abdel-Massih Roula, Lebanon	Sohail Nadeem, Pakistan	Marcio Rodrigues, Brazil	Joseph M. Mwangangi, Kenya	Chong Kok-Keong, Malaysia
Samir Abbes, Tunisia	Ilkay Erdogan-Orhan, Turkey	Eduardo Teixeira, Brazil	Etinosa O. Igbinosa, Nigeria	Satit Saejung, Thailand
Hassane Bouzahir, United Arab Emirates	Karimbergen Kudaybergenov, Uzbekistan	Luis F. Larrond, Chile	Christine Lochner, South Africa	

TWAS hosts the secretariats of three international organizations dedicated to serving the needs of science and scientists in the developing world and promoting scientific capacity as an essential component of sustainable economic development. Highlights of the 2011 activities of these organizations follow.

The TWAS Family



ORGANIZATION FOR WOMEN IN SCIENCE FOR THE DEVELOPING WORLD (OWSD)

With over 4,000 members, OWSD is one of the largest organizations of women scientists in the world.

OWSD's flagship Postgraduate Fellowship Programme for Young Women Scientists from sub-Saharan Africa and the Least Developed Countries, sponsored by the Swedish International Cooperation Development Agency (Sida) and launched in 1998, continues to grow. In 2011, 192 eligible applications were received out of which 34 young women from 17 countries were selected. In September, OWSD announced that Nwe Nwe Htwe of Myanmar had become the 100th young woman scientist to graduate from the fellowship programme.

The 2011 prize ceremony for the OWSD Awards for Young Women Scientists, sponsored by the Elsevier Foundation, took place in September during the International Symposium on Women in Science and Engineering (WISE 2011), hosted by the Ministry of Science, Technology and Innovation, and the *Institut Kimia Malaysia* (IKM) in Kuala Lumpur, Malaysia. The awards were presented to the 11 winners by Datuk Seri Shahrizat Abdul Jalil, Minister for Women, Family and Community Development in Malaysia.

In January 2011, the second GenderInSITE workshop was held in Paris with support from Sida. GenderInSITE is a joint initiative of OWSD, the United



Nations Commission on Science and Technology for Development, and TWAS. Some 20 participants from international agencies, science organizations, academies, and civil society attended. The purpose of GenderInSITE is to promote the role of women in science, technology and innovation (STI) and to analyse how STI can help improve women's lives and livelihoods. Following the workshop, a series of papers and surveys were commissioned to identify key gender issues affecting national and regional STI policies and programmes.

In June 2011 the OWSD Executive Board met in Kuwait at the generous invitation of the Kuwait Institute for Scientific Research (KISR). The board discussed at length strategic issues such as policy, national chapters and fundraising.

To further promote the role of women in science and decision-making, OWSD collaborates with such organizations as IAP, the global network of science academies, largely through the IAP Women for Science Programme. OWSD is also a member of the InterAmerican Network of Academies of Science (IANAS) Women for Science Working Group, and has partnered with the Network of African Science Academies (NASAC) to develop an initiative for women in science with science academies in sub-Saharan Africa.

For more information about OWSD, see www.owsdw.org.

IAP - THE GLOBAL NETWORK OF SCIENCE ACADEMIES

Established in 1993, IAP, the global network of science academies, focuses on promoting cooperation and capacity building among the world's merit-based science academies. In 2011, the IAP network included 104 member academies as well as two new observers: the Euro-Mediterranean Network (EMAN) hosted by the *Accademia Nazionale dei Lincei* (Italy), and the Global Young Academy (GYA) hosted by the Berlin-Brandenburg

Academy of Sciences and Humanities (Germany).

During 2011, IAP held two meetings of its Executive Committee (EC), co-chaired by Howard Alper (Canada) and Mohamed Hassan (Sudan) and including representatives from the Australian Academy of Science, the *Academia Chilena de Ciencias*, the Chinese Academy of Sciences, the Academy of Scientific Research and Technology (Egypt), the *Académie des Sciences* (France), the Indian National Science Academy, the *Accademia Nazionale dei Lincei* (Italy), the *Akademi Sains Malaysia*, the *Academia Mexicana de Ciencias*, the Royal Society (UK), the US National Academy of Sciences (NAS), and TWAS, the academy of sciences for the developing world (as *ex officio* member).

The March 2011 EC meeting, held in Washington, DC, USA, was generously hosted by US NAS and was followed by a joint session of IAP with the InterAcademy Council (IAC) and the InterAcademy Medical Panel (IAMP). Among the highlights of the meetings were the keynote address by Joseph L. Rotman on 'Grand Challenges Canada', and the kind offer by the Brazilian Academy of Sciences to host the IAP 2013 General Assembly and Conference on the topic 'Grand Challenges and Integrated Innovations'. The meeting also marked the official recognition of IAMP as an IAP Affiliated Thematic Network; of IAC as an IAP Affiliated Functional Network; and the Association of Academies of Sciences in Asia (AASA), the European Academies' Science Advisory Council (EASAC), the Inter-American Network of Academies of Sciences (IANAS) and the Network of African Science Academies (NASAC) as IAP Affiliated Regional Networks.





The year's second EC meeting, held in Mexico City in October and kindly hosted by the *Academia Mexicana de Ciencias*, allowed for awarding grants to the IAP Affiliated Regional Networks, as well as to eight new projects submitted by member academies on topics such as science communication, science education and women in science. Among the highlights of the meeting was the presentation by Romain Murenzi, TWAS executive director, on the TWAS-AAAS International Programme on Science and Diplomacy which identified potential roles for IAP in this initiative.

The year was also distinguished by the establishment of the IAP Development Advisory Committee (DAC) – a committee co-chaired by Carlos Henrique de Brito Cruz (Brazil) and Francisco J. Ayala (USA) and including world-renowned experts and private sector representatives – which was set up to provide key advice to IAP and IAC in fund-raising efforts and relationship-building activities. The first meeting of DAC was held in Washington, DC, on 27 March while the second meeting was held in New York on 5 December.

In addition, IAP funded and facilitated a number of workshops and activities organized by IAP members and the regional networks. These activities included:

- A workshop on 'Communication and Advisory Roles of Academies of Sciences' hosted by the Academy of Sciences in Cuba, on 19 May 2011, within the framework of the commemoration of the 150th anniversary of the Cuban academy;
- An Association of Academies of Sciences in Asia (AASA) workshop on 'The Roles of Academies of Sciences in Water and Energy Problems in Central Asia and Ways for their Solution' hosted by the Academy of Sciences of Kyrgyz Republic and held in Bishkek on 30 June - 2 July 2011;
- The fourth IAP Young Scientists Conference, which took place in September 2011 in Dalian, China, in con-

junction with the World Economic Forum's 'Annual Meeting of New Champions'. Following a call for nominations in February 2011, 80 nominations from IAP member academies were reviewed. The committee selected 42 young scientists from 23 countries, including six young scientists who returned to the conference to serve as 'Young Scientist Mentors'. During the meeting, the young scientists addressed issues such as resource scarcity, effective decision making, and the development of new materials for emerging technologies.

Also in 2011, IAP continued to foster the science-policy interface on issues of global concerns, through the establishment of a working group to develop a statement on population and, together with IAC, the establishment of a committee on research integrity.

As per previous years, the activities of IAP and the IAP secretariat are funded by a generous contribution from the Government of Italy as well as by in-kind contributions by science academies worldwide.

For additional information about IAP, see www.interacademies.net.

INTERACADEMY MEDICAL PANEL (IAMP)

Established in 2000, the InterAcademy Medical Panel (IAMP) became an IAP Affiliated Thematic Network in 2011 and is a member of the M8 Alliance of Academic Health Centers and Medical Universities. Its membership comprises 70 medical academies and medical sections of academies of science and engineering – all committed to improving health worldwide through inter-academy cooperation.

In 2011, IAMP held two meetings of its Executive Committee (EC), co-chaired by Jo Ivey Boufford (USA) and Lai-Meng Looi (Malaysia) and including representatives from the Brazilian Academy of Sciences, the African Academy of Sciences, the *Academia Nacional de Medicina de Colombia*, the *Académie Nationale de*



Médecine (France), the *Deutsche Akademie der Naturforscher – Leopoldina* (Germany), the *Accademia dei Lincei* (Italy), the Nigerian Academy of Sciences, the Royal Swedish Academy of Sciences, the Turkish Academy of Sciences and TWAS, the academy of sciences for the developing world (as *ex officio* member).

IAMP's March 2011 EC meeting, generously hosted by the Institute of Medicine, Washington, DC, USA, provided the opportunity for EC members to be updated on two IAMP-sponsored projects funded by IAP, namely a project on mother and child health (Nigeria Academy of Sciences) and another on science writing in the medical field (Academy of Science of South Africa), as well as to discuss activities related to a Lancet report on 'Health professionals for a new century: Transforming education to strengthen health systems in an interdependent world'.

The October 2011 IAMP EC meeting was kindly hosted by the *Deutsche Akademie der Naturforscher – Leopoldina* and by the World Health Summit (WHS) in Berlin, Germany. At the meeting, held in conjunction with the WHS, discussions focused on the role of IAMP within the framework of recent United Nations activities on non-communicable diseases (NCDs). The meeting was also held back-to-back with the first edition of the IAMP Young Physician Leaders (YPLs) Programme, where 22 YPLs from 18 countries – including 14 from low and middle-income countries – participated in leadership training activities on 19 October and then attended the following summit. This IAMP activity was made possible thanks to the generous support of IAP, the Berlin-Brandenburg Academy of Sciences and Humanities (Germany), the *Charité - Universitätsmedizin Berlin* (Germany), the M8 Alliance and the WHS.

In 2011, IAMP convened a workshop on 'Scientific Writing Training in French and Portuguese-speaking Countries in the Developing World', held in Paris,



France, on 7-8 June 2011 and co-hosted by the French *Académie de Sciences* and the *Académie Nationale de Médecine*.

IAMP also continued its promotion of the science-policy interface by raising awareness of the IAMP Statement on the 'Health Co-benefits of Climate Change Mitigation' (published in November 2010), through the convening of a symposium at the Pacific Science Congress in Kuala Lumpur, Malaysia, in June 2011 and, in September, by endorsing the Joint G8+ Science Academies 'Statement on Water and Health'.

IAMP activities are supported by IAP, the global network of science academies, as well as by in-kind and counterpart contributions by member academies and other organizations worldwide.

For additional information on IAMP, see www.iamp-online.org.

iamp
the interacademy medical panel



A P P E N D I C E S

2011 in Figures

In 2010, under the **TWAS-UNESCO Associateship Scheme**, TWAS appointed 32 developing-world scientists from 16 countries, including Botswana, Iraq, Nepal, Sudan and Uzbekistan, as associates. In addition, 35 associates travelled to carry out collaborative research at scientific institutions in 12 countries in the developing world: Argentina, China, Egypt, India, Iran, Jordan, Mexico, Pakistan, South Africa, Taiwan, China, Thailand and Uruguay.

Geographical area	Awarded	Hosted
Africa and Arab region	12	9
Asia and Pacific region	19	15
Latin America and the Caribbean	1	8
<i>TOTAL</i>	32	32

In 2011, 24 developing-world scientists from nine countries, including Cuba, Ethiopia, Iraq and Togo, were awarded fellowships, under the **TWAS Research and Advanced Training Fellowship** programme, to visit research institutes in 10 host countries: Argentina, Brazil, Burkina Faso, China, India, Jamaica, Rep. Korea, Malaysia, Pakistan and South Africa.

Geographical area	Awarded	Hosted
Africa and Arab region	19	5
Asia and Pacific region	2	13
Latin America and the Caribbean	3	6
<i>TOTAL</i>	24	24

In 2011, TWAS provided up to USD5,000 to support 16 **Scientific Meetings** in 14 developing countries. Supported meetings covered a range of disciplines, from the role of energy and water in food security, to insect-plant interactions, neuroscience, and women in science and engineering.

Geographical area	<i>TOTAL</i>
Africa and Arab region	5
Asia and Pacific region	4
Latin America and the Caribbean	7
<i>TOTAL</i>	16

TWAS's **South-South Fellowships** are awarded in collaboration with partner organizations in a number of developing countries, including the National Council for Scientific and Technological Development (CNPq), Brazil; the Chinese Academy of Sciences (CAS), China; the Council for Scientific and Industrial Research (CSIR) and the Department of Biotechnology (DBT) of the Government of India; the S.N. Bose National Centre for Basic Sciences and the Indian Association for the Cultivation of Science (IACS), India; the International Centre of Insect Physiology and Ecology (*icipe*), Kenya; the *Universiti Sains Malaysia* (USM), Malaysia; the National Science and Technology Council (CONACyT), Mexico; the National Centre of Excellence in Molecular Biology (CEMB) and the International Centre for Chemical and Biological Sciences (ICCBS), Pakistan; and the National Centre for Genetic Engineering and Biotechnology (BIOTEC), Thailand.

In 2011, TWAS awarded a total of 164 fellowships, of which 146 have been accepted.

Programme partner	Postgraduate fellowship		Postdoctoral fellowship		Visiting scholar	
	Awarded	Accepted	Awarded	Accepted	Awarded	Accepted
CNPq, Brazil	38	34	10	7	–	–
CAS, China	20	20	15	15	15	15
CSIR, India	7	5	3	3	–	–
DBT, India	6	4	1	1	–	–
IACS, India	0	0	0	0	–	–
S.N. Bose, India	1	1	1	1	–	–
<i>icipe</i> , Kenya	1	1	0	0	0	0
USM, Malaysia	10	7	10	9	8	8
CONACyT, Mexico	3	[pending]	6	6	–	–
CEMB, Pakistan	0	0	0	0	–	–
ICCBS, Pakistan	7	7	1	1	–	–
BIOTEC, Thailand	–	–	1	1	–	–
TOTAL	93	79	48	44	23	23

In 2011, 22 TWAS Research Grants of up to USD15,000 each were awarded to individual researchers in some 15 science-and-technology-lagging countries, including such least developed countries as Bangladesh, Benin and Madagascar.

Geographical area	Biology	Chemistry	Mathematics	Physics	TOTAL
Africa and Arab region	6	2	1	0	9
Asia and Pacific region	3	3	1	1	8
Latin America and the Caribbean	3	2	0	0	5
TOTAL	12	7	2	1	22

In 2011, 16 TWAS Research Units were funded in 11 science-and-technology-lagging countries with grants of up to USD30,000 each, including two least developed countries and such sub-Saharan African countries as Cameroon, Côte d'Ivoire, Ghana, Mali and Nigeria.

Geographical area	Biology	Chemistry	Mathematics	Physics	TOTAL
Africa and Arab region	2	2	1	2	7
Asia and Pacific region	5	1	0	1	7
Latin America and the Caribbean	1	0	0	1	2
TOTAL	8	3	1	4	16

In 2011, in response to the third call for proposals under the TWAS-COMSTECH Joint Research Grants programme, TWAS and the Organization of Islamic Cooperation (OIC) Standing Committee on Scientific and Technological Cooperation (COMSTECH) awarded 23 research grants of up to USD15,000 to young scientists working in seven OIC member states.

Region	Earth Sciences	Engineering Sciences	Information and Computer Technologies	Materials Science – including nanotechnology	Pharmaceutical Sciences	Renewable Energy	Total
Africa and Arab region	0	0	0	1	1	1	3
Asia	2	4	5	5	2	2	20
TOTAL	2	4	5	6	3	3	23

Under the TWAS Research Professors in Least Developed Countries (LDCs) programme, four TWAS members visited their respective host institution in 2011.

TWAS Fellow	Field of expertise	Host institution in LDC	Year of appointment
Ahmed Abdullah Azad, Australia	Structural, cell and molecular biology	Centre for Advanced Research in Sciences (CARS), Dhaka University, Bangladesh	2005
Mahouton Norbert Hounkonnou, Benin	Physics	Department of Physics, University of Zambia, Lusaka, Zambia	2006
S.M. Qaim, Germany	Chemical sciences	Department of Applied Chemistry and Chemical Technology, Rajshahi University, Rajshahi, Bangladesh	2005
K.B. Sinha, India	Mathematical sciences	International Chair in Mathematical Physics and Applications, ICMQA-UNESCO, Cotonou, Benin	2009

The TWAS Visiting Scientist Programme enables eminent scientists from either developed or developing countries to visit institutions and research groups in developing countries. In 2011, two scientists travelled to their selected host institutions.

Visiting scientist	Field of expertise	Host institution
Akier Assanta Mafu, Canada	Food safety and processing	Institute of Applied Techniques in Food Processing, Kimbese City, Congo, Dem. Rep.
Stanislav Pen-Mouratov, Israel	Soil ecology	Institute of Geology and Geophysics, Academy of Sciences of Uzbekistan, Tashkent, Uzbekistan

In 2009, TWAS began a partnership with the *Deutsche Forschungsgemeinschaft* (DFG, or German Research Foundation) to support TWAS-DFG Cooperation Visits for postdoctoral scientists from sub-Saharan Africa (excluding South Africa) for 2-3 month visits to institutions in Germany. In 2011, 20 young African scientists were awarded.

Country of origin	Awarded
Nigeria	6
Cameroon	4
Kenya	2
Benin, Burkina Faso, Ethiopia, Malawi, Sudan, Tanzania, Uganda, Zimbabwe	1 per country
TOTAL	20

The TWAS Secretariat

Executive Director's Office

Executive Director

Romain Murenzi (from April 2011)

Mohamed H.A. Hassan (until March 2011)

Special Advisor

Giusto Sciarabba (from September 2011)

Helen Martin

Sandra Ravalico

Finance and Administration

Sabina Caris

Antonino Coppola

Alessandra Piani (from May 2012)

Patricia Presiren

Paola Vespa

Ezio Vuck

Programmes and Activities

Programme Officer

Peter McGrath

Sabina Caris

Sara Dalafi

Maria Teresa Mahdavi

Mara Marchesan (until December 2011)

Antonella Mastrolia

Fabrizia Niscio

Payal Patel (from January 2012)

Cristina Simões

Public Information Office

Public Information Officer

Daniel Schaffer (until January 2012)

Acting Public Information Officer

Peter McGrath (from February 2012)

Tasia Asakawa (until December 2011)

Tonya Blowers (from February 2012)

Jennifer Coppola (from February 2012)

Gisela Isten

Cristina Serra

OWSD - Organization for Women in Science for the Developing World

Sara Dalafi

Leena Mungapen

IAP - the global network of science academies

IAMP - InterAcademy Medical Panel

Coordinator

Lucilla Spini (from February 2012)

Muthoni Kareithi

Joanna Lacey

For specific contact details, see www.twas.org/contact-us/contacts

Financial Report 2011

FINANCE

The total amount of funds received for activities in 2011 was USD3,714,540. The main contributions were from: the Ministry of Foreign Affairs, Italy (USD2,296,294); the Swedish International Development Cooperation Agency (Sida) (USD892,576); *illycaffè* S.p.A., Trieste (USD99,877), COMSTECH, Pakistan (USD99,855), Microsoft Research Ltd, UK (USD69,842), and the Kuwait Foundation for the Advancement of Sciences (KFAS) (USD49,972). It should be noted that USD240,000 from the interest gained on the TWAS Endowment Fund was transferred to TWAS regular programme funds.

In addition, it is estimated that partner organizations in the TWAS South-South Fellowships programme (see pages 44-45 and 75) contributed some USD2.5 million in local (host country) expenses and TWAS Regional Offices contributed some USD400,000 in supporting TWAS regional activities (see pages 62-67).

At 31 December 2011, the TWAS Endowment Fund stood at USD12,338,985 with the target set at USD25 million. Donations during 2011 totalled USD60,324 including USD25,000 from the *Consejo Nacional de Ciencia y Tecnologia* (CONACYT), Mexico; USD27,248 from the *Academia Sinica*, Taiwan, China, plus other contributions amounting to USD8,076. Interest in 2011 totalled USD60,998.

Finally, funds totalling USD337,245 previously received from the Brazilian Ministry of Science and Technology for TWNSO, an organization formerly hosted by TWAS, were transferred to TWAS specifically to support the TWAS-Celso Furtado Prize in Social Sciences (USD60,000) and the TWAS Endowment Fund (USD277,245). All TWAS accounts are audited by UNESCO.

TWAS FINANCIAL REPORT 2011 (IN USD)

INCOME¹

Balance	187,906
1) Ministry of Foreign Affairs, Italy	2,296,294
2) Swedish International Development Cooperation Agency (Sida)	892,576
3) <i>illycaffè</i> , Trieste	99,877
4) COMSTECH, Pakistan	99,855
5) Microsoft Research Ltd, UK	69,842
6) Kuwait Foundation for the Advancement of Sciences (KFAS)	49,972
7) Ministry of Research, Science and Technology, Iran I.R.	48,169
8) US NAS, USA	40,406
9) African Union, Ethiopia	35,980
10) <i>Academie Hassan II des Science et Techniques</i> , Morocco	31,228
11) EuroAfrica-ICT (EC), Belgium	34,810
12) <i>Fondation Scientifique de Lyon</i> , France	7,123
13) Other contributions	8,409
18) Prior year adjustment	631,133
19) Interest income	10,509
21) Transfer from TWAS Endowment Fund (Interest)	240,000
22) Transfer from TWNSO account	60,000
	4,844,089

EXPENDITURE 2011 ²	Spent
1) Prizes	
1.1) Trieste Science Prize	102,102
1.2) TWAS Prizes and Medals	127,928
1.3) Prizes for Young Scientists	26,501
<i>Sub-Total for (1)</i>	256,531
2) Research Grants	600,413
3) Fellowships, Associateships and Professorships³	
3.1) Fellowship Programmes	405,248
3.2) Associateship, Professorship & Visiting Programmes	229,592
<i>Sub-Total for (3)</i>	634,840
4) Meetings	
4.1) Council and General Meetings	211,100
4.2) Officers and Steering Committee Meetings and Meetings in Trieste	43,689
4.3) Scientific Meetings in the South	73,702
<i>Sub-Total for (4)</i>	328,491
5) Publications	153,785
6) Joint Projects	
6.1) TWAS Regional Offices ⁴	255,234
6.2) TWAS-AAS-Microsoft Project	96,377
6.3) TWAS/COMSTEC Research Grant	201,798
6.4) EuroAfrica-ICT Project	22,010
6.5) OWSDW	106,815
6.6) TWAS-ICGEB-UNESCO Project	50,000
6.7) TWAS – ICTP Projects ⁵	102,938
6.8) AU – TWAS Young Scientists National Award	59,998
6.9) US NAS Project	38,118
6.10) International Science Diplomacy Programme	2,500
6.11) EU Catalyst	8,347
<i>Sub-Total for (6)</i>	944,135
7) Operational Expenses	
7.1) Staff Costs	1,648,031
7.2) ICTP Services	66,000
7.3) Communications	35,176
7.4) Travels	42,422
7.5) Library, office and other supplies	54,030
7.6) Other general operating expenses	37,679
<i>Sub-Total for (7)</i>	1,883,338
Total	4,801,533
Excess (shortfall) of income over expenditure	42,556
Reserve Fund⁶	
Amount available at the beginning of period	3,000,000
Reserve for end of service entitlements	(130,217)
Reserve Fund balance end of period	2,869,783
Reserve and Regular Fund balances, end of period	2,912,339

¹ For presentation purposes, all contributions are expressed in US dollars and have been converted using the UN official rate of exchange valid at the time the contributions were received.

² Amount disbursed plus unliquidated obligations.

³ Estimated local costs to be covered by host country: US\$ 2,500,000.

⁴ Estimated local costs covered by Regional Offices: US\$ 400,000

⁵ Amount granted in 2011 USD 50,000 plus unspent balance of the previous agreement

⁶ The Reserve Fund was created several years ago and is designed to cover the end of service entitlements of TWAS Staff.

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Tonya Blowers: Writer/Editor
Gisela Isten: Editor/Picture Editor

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- illycaffè, S.p.A., Trieste, Italy
- COMSTECH, Pakistan
- Microsoft Research Ltd., UK
- the Kuwait Foundation for the Advancement of Sciences (KFAS)
- Ministry of Research, Science and Technology, Iran I.R.
- US National Academy of Sciences, USA
- African Union, Ethiopia
- Academie Hassan II des Science et Techniques, Morocco
- the European Union, Seventh Framework Programme (FP7)



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THE ACADEMY OF SCIENCES
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