ANNUAL REPORT 2013

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TWAS – The World Academy of Sciences for the advancement of science in developing countries – is a global science academy based in Trieste, Italy. It works to advance innovation and sustainable prosperity in the developing world through support of research, education, policy and diplomacy.

TWAS was founded in 1983 by a distinguished group of scientists from the developing world, under the leadership of Abdus Salam, the Pakistani physicist and Nobel laureate. They shared a belief that developing nations, by building strength in science and engineering, could build the knowledge and skill to address such challenges as hunger, disease and poverty. From the start, the Academy has had essential support from Italian scientists and political leaders.

Today, TWAS has some 1,100 elected Fellows from more than 90 countries; 15 of them are Nobel laureates. About 85% come from developing nations, and the rest are scientists and engineers from the developed world whose work has had a significant impact in the South. The Academy's secretariat is located on the campus of the Abdus Salam International Centre for Theoretic Physics (ICTP).

Through more than three decades, TWAS's mission has remained consistent:

- Recognize, support and promote excellence in scientific research in the developing world;
- Respond to the needs of young scientists in countries that are lagging in science and technology;
- 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.

TWAS works in cooperation with a global network of partner organizations, most notably UNESCO and ICTP. TWAS works in close association with three other Trieste-based organizations: the Organization for Women in Science for the Developing World (OWSD); IAP, the global network of science academies; and the InterAcademy Medical Panel (IAMP).

THE WORLD ACADEMY OF SCIENCES

FOR THE ADVANCEMENT OF SCIENCE IN DEVELOPING COUNTRIES

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FOREWORD

Building on a Strong Foundation

Bai Chunli
TWAS President

2013 has been auspicious for TWAS. We celebrated the Academy's 30th anniversary with a year of activities, culminating in the 24th TWAS General Meeting in Buenos Aires. We initiated some valuable new programmes and projects. And we looked to the future, with growth in our fellowships and prize programmes and accomplishments in our science diplomacy initiative.

This also has been my first year as president of TWAS, and the year has come with a humbling awareness: My predecessors and the Academy's membership achieved so much in the first 30 years, and now it falls on me and the TWAS Council – and all of us – to build on their work. From its first days, TWAS has been an evolving organization. It has changed and grown to embrace new opportunities and to take on new responsibilities. In this way, it built a sterling reputation as the voice for science and engineering in the developing world.

In 2013, we made a fundamental change in our identity: After a 2012 vote by our members, we are now The World Academy of Sciences for the advancement of science in developing countries. The new name reflects a rapidly changing world. Humanity and the Earth are facing profound challenges – population growth, climate change, the loss of biodiversity. By necessity, science is becoming a truly global enterprise.

TWAS must be positioned to support these efforts, especially in places where the need is greatest. Toward that goal, TWAS and the Chinese Academy of Sciences (CAS, of which I'm also president) initiated two programmes with strong practical value for science in the developing world.

The CAS-TWAS President's Fellowship Programme was begun in early 2013, offering 140 fully funded scholarships to promising early-career scientists from the developing world to earn their PhDs at CAS universities. By year's end, the number of scholarships offered annually increased to 200.

Five CAS-TWAS Centres of Excellence received a significant new investment from China. The five centres are focused on areas of practical need and great potential for the developing world: water; climate and environmental science; green technology; biotechnology; and space science for disaster preparedness. The new funding has allowed the centres of excellence to improve their research facilities and to offer advanced educational and training workshops to hundreds of developing-world scientists every year.

As always in TWAS history, our partnerships are helping to ensure that we can fulfil our mission. The government of Argentina generously supported the General Meeting in Buenos Aires; in the process, we deepened ties with the Ministry

of Science, Technology and Productive Innovation and the National Council of Scientific and Technical Research (CONICET). At the meeting, Argentina, India and South Africa pledged some 250 new fellowships in their countries.

We were honoured by the presence of science ministers and other top-level science policy officials from nearly a dozen nations. Over four days, we heard compelling presentations on topics ranging from poverty and desertification to science communication and advances in brain imaging. The General Meeting also was the setting for a special award to two of TWAS's most committed and influential supporters: Immacolata Pannone from the Italian Ministry of Foreign Affairs and Fu Shuqin from CAS.

We also were proud to award the first TWAS-Lenovo Science Prize to Chilean physicist Claudio Bunster Weitzman. Lenovo, a leading global IT company based in China and a spin-off from CAS, provides support for our most prestigious prize.

Later in the year, I met with many TWAS friends in South America. In Ecuador, I met with a trio of TWAS representatives and with officers of the new Ecuadorean Academy of Sciences.

And yet, for all of these accomplishments, it is very important that we look forward and seriously consider the work that must still be done.

In my view, TWAS can become more effective and contribute more. Our members are often in strong positions to share their expertise with their governments, or in their regions. In particular, it is my belief that TWAS can work with partners both to advance science and address poverty, economic development and conservation of the environment.

Another top priority is to diversify our membership. Women number only about 10% of our members. And while our Fellows represent 91 nations, many nations have no Fellows at all. Qualified scientists are out there; it is up to TWAS to find them and encourage them. Similarly, we should look for ways to further tap the energy and skill of our Young Affiliates.

In China, the age of 30 is very important. The lessons of youth have been learned, and our mature character is confident and steadfast. In the *Analects,* Confucius put it simply: "At 30, I stood firm." This well describes TWAS today. We are established and well-known; we hold a position of respect in the world of science, both South and North. The global family of science relies on our leadership. Working together, with our combined skill and energy, we can make great contributions.

2013: The Year in Review

Romain Murenzi
TWAS Executive Director

It could be said, fairly, that every TWAS project and every TWAS conference is an exercise in science diplomacy. We are working with many partners from across the globe to build science and engineering in the developing world, and without doubt we are striving to build a better world through science.

But in 2013, the Academy's engagement in this field took on a new focus: We helped to organize a series of events that brought scientists and diplomats together to consider new areas of regional cooperation, or important issues such as energy and science policy. A long-time TWAS partner, the Swedish International Development Cooperation Agency (Sida), has provided crucial funding for this effort.

The early success of our work in science diplomacy reflects a central truth about organizational dynamics: Successful organizations are constantly renewing themselves; this renewal allows them to innovate and stay strong. It was a lesson understood very well by TWAS founder Abdus Salam, who was often in mind this year as we celebrated the Academy's 30th anniversary.

Our major activity in 2013 was fundraising, as usual. We started to request a voluntary contribution from the members and the reaction was very positive.

There have been other points of innovation and growth this year in TWAS operations: a new president, Bai Chunli; major new fellowships; an ambitious new Centres of Excellence partnership with the Chinese Academy of Sciences (CAS); new leadership in our Public Information Office; a new film, *Seeds of Science*, that brought the work of TWAS to life through the stories of four African scientists.

Still, we do not forget the day-to-day work that is the foundation of our mission. Through our PhD and postdoctoral fellowships, through research grants and support for meetings, we are building a corps of strong scientists and laboratories to serve the people of the developing world. And through our prizes and awards, we are honouring the best research in the developing world, while encouraging others to emulate the winners' creativity and dedication.

A wide range of initiatives and accomplishments illustrate our continuing influential support for science in the developing world:

The 24th General Meeting in Buenos Aires, Argentina

- The meeting, held for the first time in Buenos Aires, marked TWAS's 30th anniversary. Argentina's Ministry of Science, Technology and Productive Innovation and the National Council of Scientific and Technical Research (CONICET) provided generous support.

- The meeting, from 1 to 4 October 2013, convened more than 300 TWAS Fellows, researchers, top science policy officials and educators.
- 52 new TWAS Fellows were elected, raising membership to 1,111. Six of the new members are women.
- In his opening address, TWAS President Bai Chunli urged participants to celebrate the accomplishments of the Academy's first 30 years. But a range of challenges remains, he said, particularly helping Least Developed Countries to build S&T capabilities.
- Argentine science minister Lino Barañao said global population growth creates "challenges in terms of food, energy and health that can only be dealt with through transforming achievements in science and technology".

Prizes and Awards

- Claudio Bunster Weitzman of Chile won the first TWAS-Lenovo Science Prize for his contributions to the understanding of gravity and other topics on the frontiers of theoretical physics. China-based Lenovo, the world's top PC maker, provided the USD100,000 prize.
- The 12 TWAS Prize winners for 2012 received their prizes at the General Meeting, and 14 winners for 2013 were announced.
- Immacolata Pannone from the Italian Ministry of Foreign Affairs and Fu Shuqin from CAS, who for many years have provided immeasurable support to TWAS, were honoured with the TWAS-UNESCO Special Lifetime Achievement Awards.
- In February, winners of the Elsevier Foundation Awards for Early Career Women Scientists in the Developing World were announced. The prizes are awarded by The Elsevier Foundation, the Organization for Women in Science for the Developing World (OWSD) and TWAS.

Science Diplomacy

- TWAS worked with the Italian Ministry of Foreign Affairs and the Hungarian Academy of Sciences to organize a roundtable that brought high-level science and policy leaders from the Southern Mediterranean and Central Europe to Budapest to discuss areas of common interest. Sida and UNESCO provided important support.
- Ivo Šlaus, a physicist and president of the World Academy of Art & Science (WAAS), urged scholars to engage with the political realities of the world at a lecture organized by TWAS in partnership with AAAS, the American Association for the Advancement of Science.
- A week-long workshop brought energy-sector scientists and policymakers from throughout the world to TWAS headquarters to explore the relationship between science, policy and diplomacy.
- I represented TWAS on the science diplomacy panel during the 6th World Science Forum in Rio de Janeiro, and was interviewed on the topic for the website of the Hungarian Academy.

Fellowship and Exchange Programmes

- The new CAS-TWAS President's Fellowship Programme was begun in early 2013, offering 140 fully funded scholarships to promising early-career developing world scientists to earn PhDs at major Chinese universities. The number of fellowships has been encreased to 200.
- At the General Meeting, Argentina, India and South Africa pledged some 250 fellowships to TWAS's South-South programme. In addition, Argentina opened 175 of its centres of research excellence to visits by researchers from the developing world under the TWAS-UNESCO Associateship Scheme.
- For 2013, TWAS offered a total of 207 South-South fellowships for PhD study, postdoctoral research and visiting scholars. Of these, 186 were accepted.
- With funding from Sida, TWAS awarded 44 research grants to individuals and 20 to research groups in S&T-lagging countries. TWAS and COMSTECH partnered to give 26 research grants to young scientists in Organization of Islamic Cooperation member states.

Regional Offices

- TWAS's five regional offices undertook a range of highly valuable activities: appointing 24 Young Affiliates to five-year terms; awarding the TWAS Regional Prizes; and organizing conferences and other events, many focused on young scientists.

Italian engagement

- The documentary *Seeds of Science*, produced by Italian filmmaker Nicole Leghissa, explored how TWAS's work supports scientists in Kenya in their efforts to improve agriculture and provide clean water. The film premiered at the annual TriesteNext science festival. It also was screened for a VIP audience at the Trieste headquarters for Italian television station RAI-Friuli Venezia Giulia, and was broadcast by the station twice in December.
- At TriesteNext, TWAS and other Italian science organizations collaborated on a photo exhibit that showed researchers at work around the world.
- Italian news media – print, broadcast and online – carried 40 stories mentioning TWAS in 2012.

Clearly, these highlights suggest that 2013 was a very successful year for TWAS. Many people deserve credit for this – our Council and our members worldwide; our many generous partners; our Regional Offices; and our small but dedicated staff in Trieste. Working together, we are advancing science and prosperity in the developing world.

The 24th General Meeting, from 1 to 4 October 2013, convened more than 300 researchers, top science policy officials and educators, including many TWAS fellows from developing countries. The meeting was held for the first time in Buenos Aires, Argentina.

TWAS 30th Anniversary in Buenos Aires

Argentina is a long-time leader and model for science in developing world. In 2013, TWAS brought its 24th General Meeting to Buenos Aires, the capital of the Latin American nation.

TWAS's annual event serves as a stage for dozens of lectures on progress in a wide array of scientific fields, giving scientists from developing countries the opportunity to engage in cross-disciplinary discussions as well as the chance to meet other researchers from other parts of the world. Featured speakers discussed pertinent topics such as the latest developments in neuroscience and the effects of income disparity. It was also an opportunity to celebrate TWAS's 30th year providing needed opportunities to developing world researchers.

The event had been held in Latin America four times before: in Venezuela (1990), in Mexico (2008), and twice in Brazil (1997 and 2006). This year's meeting ran from 1 to 4 October, and those who came to Buenos Aires

found a nation focused on science, engineering and technology.

Home to three Nobel laureates, Argentina in recent decades has taken great strides to build its science, engineering and technology sectors, and can claim influential accomplishments in fields ranging from biomedicine to astroparticles. The country supports thousands of scientists and their research through the National Scientific and Technical Research Council (CONICET), an independent body under the Argentinian Ministry of Science, Technology and Innovation that was created in 2007 by President Cristina Fernández de Kirchner. CONICET and the ministry also supported and co-organized the TWAS General Meeting.

One the first day, government ministers and their representatives from some of the developing world's science leaders gathered at the meeting to discuss the development challenges their nations have faced, policies that have helped to advance science in those nations and plans for future progress.

Lino Barañao, Argentina's minister of Science, Technology and Innovative Production, underscored the nation's renewed commitment to science. There was a time when science was disdained, he said, and scientists were seen as dangerous. But people now are fortunate, he added, "because we now live in a period where science is shaping the life of many countries." TWAS's 24th General Meeting, Barañao added, spreads a broader message: that science has no borders and that, through science, all people can share knowledge, working to better lives.

"It's very exciting that TWAS is celebrating its 30th anniversary in Buenos Aires," said TWAS President Bai Chunli. "Latin American scientists have been centrally important to TWAS since the Academy's founding. And today, Argentina is a hub of global science, with innovation in fields ranging from agriculture to space technology. Such innovation will be essential to address global challenges that are growing in scale and complexity."

During a ministerial session on the meeting's first day, Derek Hanekom, South Africa's minister of Science and Technology, reflected on the importance of science to civilization itself, and the importance of national and regional academies to science in the developing world.

"TWAS must play a critical role in mobilizing science and scientists from the South, strengthening their quest for support from their respective governments," Hanekom said. "For as much as we agree on the importance of international partnerships to strengthen our-

selves, national partnerships between government, science, the private sector and the civic sector are perhaps even more important."

HIGHLIGHTS OF THE 24TH GENERAL MEETING

- *TWAS-Lenovo Science Prize.* The greatest honour the Academy bestows to scientists in the developing world went to Chilean theoretical physicist Claudio Bunster Weitzman for his contributions to understanding gravity and the quirky physics of tiny, fundamental particles of matter. He has tackled such complex and mysterious topics as black holes, incredibly massive collapsed stars where the gravity is so intense that even light cannot escape, and magnetic monopoles, extremely minuscule particles that some physicists suspect generate magnetic field lines. Lenovo is a USD34 billion personal technology company and the largest PC company in the world, serving customers in more than 160 countries.

Bunster's work has been on the frontier of several areas of theoretical physics, sometimes even bringing them together in creative ways. The prize also honours Bunster's record of promoting scientific research in Chile even during the oppressive rule of Chilean dictator Augusto Pinochet.

- *TWAS Medals.* TWAS honoured two women who have provided decades of commitment to the Academy's cause: Fu Shuqin and Immacolata Pannone.

Pannone is a scientific expert in the Bilateral and Multilateral Scientific and Technological Unit of the Italian Ministry of Foreign Affairs; she has been working with the ministry since 1991 on S&T cooperation with countries outside the European Union. She was cited for "her continuous commitment in enhancing the special relationship between Italy and TWAS in support of science in the developing world." Fu is past director of the TWAS Regional Office for East & Southeast Asia within the Chinese Academy of Sciences (CAS); she has been a driving force within the Academy, which is China's top academic institution and comprehensive R&D centre in natural sciences and high-tech innovation. Her work with CAS began in 1989, when she started as a programme officer.

- *Growing number of fellowships.* Government representatives from several developing countries announced a pledge for dozens of new TWAS PhD and postdoctoral fellowships: Argentina pledges 30, India 125, and South Africa at least 100.
- *The meeting featured two symposia,* one on the development of Argentina's science and technology, and a second on quantum information and quantum computing.

LECTURE HIGHLIGHTS

• Francisco José Barrantes, TWAS vice president for Latin America and the Caribbean and a neuroscientist at the University of Buenos Aires, gave a TWAS Medal lecture in which he discussed the nanoscale functions of the brain.

• Chinese scientist Zheng Xiaojing of Lanzhou University, Lanzhou, China delivered a TWAS Medal lecture on a mathematical model to predict how dune fields form, evolve and shift. Her model can reveal the influence of wind speed and other factors on dune-formation patterns. It could support strategies for helping protect villages against sand storms and spreading deserts.

• Chemist Michael Lawrence Klein of Temple University, in Philadelphia, Pennsylvania, USA, gave a TWAS Medal lecture on using computer simulations to understand molecular cell membrane channels for ions that are relevant to pharmacology.

• Ricardo Paes de Barros, secretary of the Brazilian Secretariat of Strategic Affairs and the first-ever winner of the TWAS-Celso Furtado Prize in Social Sciences, spoke on his research on poverty and inequality issues in Brazil and public policies aimed at alleviating both problems.

• Diego Andres Golombek, a chronobiologist with *Universidad Nacional de Quilmes* in Argentina and probably the most renowned science popularizer in the country, gave a lecture encouraging scientists to view popularization in science and technology as necessary. Golombek was one of five scientists from different regions of the developing world awarded with the TWAS Regional Prizes for their science popularization work. Other prize winners were from Bangladesh, the Philippines, South Africa and Egypt.



OTHER HIGHLIGHTS

• The Academy elected 52 new TWAS fellows. Of the new inductees, 11 are from Brazil, nine are from China, 12 are from India, four are from Taiwan, China, and two are from Vietnam. The remaining 14 live and work in Australia, Azerbaijan, Benin, Ethiopia, France, Japan, Kenya, Pakistan, South Korea, Tanzania, Thailand, the United Kingdom, the United States and Venezuela. Six of the 52 new members are women. These members will be formally welcomed into the Academy in 2014.

At the close of the meeting, the membership stood at 1,111. A total of 119 members are women and 87% live and work in developing countries.

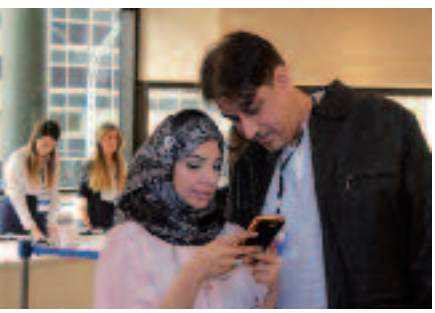
• The 12 TWAS Prize winners for 2012 included honourees from Argentina; Brazil; China; Taiwan, China; India; Malaysia; South Africa; and Uzbekistan. They received their awards and each gave a lecture on their research. Their work included practical applications of science that have a direct impact on developing economies, such as AIDS research in South Africa and the study of how microbes can improve the growth of crops that are under stress.

• Thirteen TWAS Prize winners for 2013 were announced, including honourees from Brazil; China; Taiwan, China; India; Jordan; and Turkey. Given annually, these prizes include an award of USD15,000 and rank among the highest scientific accolades given to scientists in developing countries.

The second winner of the Celso Furtado Prize was announced: Agricultural economist Linxiu Zhang. She conducts research that illuminates the employment needs of young people in rural areas of China and what government policies must be developed to address their needs.

• The C.N.R. Rao Prize was awarded to Firdausi Qadri, director of the Centre for Vaccine Sciences at the International Centre for Diarrhoeal Disease Research in Bangladesh. Qadri was selected for significant contributions to her field in almost 30 years of work on enteric diseases, and for her studies aimed at developing new strategies for mass immunization against some common infectious diseases in developing countries, particularly in Bangladesh.

• The Atta-ur-Rahman Prize in Chemistry was presented to Mohammad Abdul Hasnat, a rising young Bangladeshi chemist whose work is helping develop new technology for cleaning drinking water. Research by Hasnat, of the Department of Chemistry at Shahjalal University of Science & Technology in Bangladesh, has helped develop a reactor with electrodes that removes harmful nitrates from drinking water.



• Certificates were presented to TWAS Young Affiliates. Twenty-four young scientists were selected as Young Affiliates, and 12 of them travelled to Buenos Aires to attend their first TWAS conference. They received their certificates during the induction ceremony and later presented their research work. Additionally, 27 Young Affiliates who had been selected in previous years also attended the meeting.

Each year, the TWAS Regional Offices nominate up to five outstanding young scientists from their region. During their five-year tenure, TWAS Young Affiliates are invited to attend all TWAS General Meetings and General Conferences as observers. This can mean travelling to five different countries, often on five different continents, and benefiting from the exceptional networking opportunities that such meetings provide. The Young Affiliates sessions are attended by TWAS members who give support, suggestions and further contacts.

PROGRAMMES

The TWAS-Lenovo Science Prize is one of the most prestigious honours given to scientists from the developing world. During the first four-year cycle (2013-2016), the prize competition will focus on the basic sciences, with the subject area changing each year. The 2013 prize was awarded for accomplishments in physics and astronomy. The winner receives USD100,000. The prize is sponsored by Lenovo, a USD34 billion personal technology company, and the largest PC company in the world, serving customers in more than 160 countries.

TWAS-Lenovo Science Prize

TWAS-LENOVO SCIENCE PRIZE

CLAUDIO BUNSTER WEITZMAN AND THE RIDDLES OF PHYSICS

Theoretical physicists frequently serve as the stewards of impossible-seeming ideas, especially when they must reconcile the strange laws of the inconceivably enormous with the even-stranger laws of the inconceivably small. Similarly, scientists from the developing world can be caught between their desire to practice on the edge of their field and the political realities of paltry public science budgets or even authoritarianism. Scientists who seek to reconcile this conflict have a difficult task, but those who succeed leave an impact like few others.

In 2013, the TWAS-Lenovo Science Prize, one of the most prestigious prizes given to scientists in the developing world, was awarded to such a reconciler: Chilean theoretical physicist Claudio Bunster Weitzman. The prize, the most prestigious given by TWAS, was awarded for his contributions to understanding gravity and the quirky physics of tiny, fundamental particles of matter. It was presented to Bunster on 1 October at a special ceremony during the 2013 TWAS General Meeting in Buenos Aires, Argentina. He gleefully thrust the prize into the air as applause from the crowd washed over him.

Bunster has been a TWAS member since 1991. At the meeting, he recalled the early days of TWAS and its "dear little centre" in Trieste. He said the Academy's current role as a promoter of science in the developing world provides valuable proof that such an institution can work. "I think that Abdus (Salam) would be happy and proud."

"I am deeply grateful to all of those who consider me worthy of the award and went into the battle for it," Bunster said. "We will honour their trust by keeping up the fight with renewed strength."

This is the first year ever for the TWAS-Lenovo Science Prize, the successor to the Ernesto Illy Trieste Science Prize that ran for eight years. During its first four-year cycle (2013-2016), the TWAS-Lenovo prize subject is focusing on the basic sciences, with the subject area changing each year: physics and astronomy in 2013, biological sciences in 2014, mathematics in 2015 and chemical sciences in 2016.

"Being a global technology firm originated from a developing country, we understand how science and technology can be of great value and importance to a growing economy," said George He, chief technology officer at Lenovo. "We felt deeply the responsibility to help promote and support fundamental research in developing countries. Work like Dr. Bunster's, which started a school of theoretical physics in Chile, is most meaningful and has far-reaching impacts in this sense."

Bunster's work has been on the frontier of several areas of theoretical physics, sometimes even bringing them together in creative ways. He has tackled such complex and mysterious topics as black holes, incredibly massive collapsed stars where the gravity is so intense that even light cannot escape, and magnetic monopoles, extremely minuscule particles that some physicists suspect generate magnetic field lines. Magnetic monopoles consistently appear in equations even though they have never been seen in action, and Bunster has worked with other leaders in the field to consider creative ideas, such as the possibility that the particles might be so elusive because they are hiding in the difficult-to-observe black holes.

"The work done by Claudio Bunster Weitzman over the course of a very productive career has improved our understanding of the fundamental workings of nature," said TWAS President Bai Chunli. "He is a world-class scientist, and he is a powerful symbol of the excellent science that is being done by researchers in the South."

Bunster's interest in theoretical physics began with the problem in classical dynamics called the radiation reaction – a recoil force from when a charged particle emits electromagnetic radiation. His work on the problem led to a new interpretation of the equation behind the motion. Later, his work focused on general relativity – the theory describing the curvature of spacetime by gravity – shedding light on such areas as the nature of black holes. For example, his work has shown that when a black hole swallows a magnetic monopole, it starts rotating, as the enormous one in the centre of the Milky Way does.

The prize not only honours Bunster's scientific achievements, but befits his role as a scientist who bravely stood for promoting scientific research in the developing world even during a time of oppression. After about 15 years abroad in the United States, he returned to Chile as the nation was enduring the dictatorship of General Augusto Pinochet.

In 1984, he showed that a world-class science institute could be established in the developing world, founding the *Centro de Estudios Científicos* (CECs) in Chile, an independent research centre. Even though the Pinochet regime barred him from teaching at Chilean universities, CECs's success eventually led Bunster to permanently settle in Chile. He has been the director of CECs since its founding, and the centre is currently home to first-rate research in theoretical physics, biological sciences, glaciology and climate change.

TWAS Prizes for scientific excellence rank among the highest scientific honours given to scientists in developing countries. They are awarded annually in the fields of agricultural sciences, biology, chemistry, earth sciences, engineering sciences, mathematics, medical sciences and physics, with each carrying a USD15,000 prize. The 2013 prizes, announced during the Academy's 24th General Meeting in Buenos Aires, Argentina, will be presented in 2014 at the 25th General Meeting.

TWAS Prizes

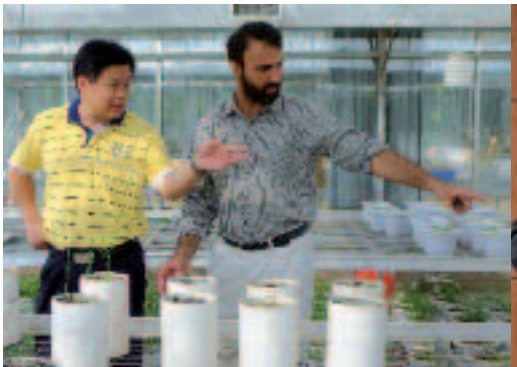
AGRICULTURAL SCIENCES

Zhu Yongguan, Institute of Urban Environment, Chinese Academy of Sciences, Xiamen, China

For his systematic contribution to the understanding of arsenic dynamics in soil-plant systems, and mitigation of arsenic pollution, particularly in rice

An estimated 10% of Chinese farmland soil is polluted, and much of that pollution is from mines that release arsenic, a cancer-causing element that is poisonous to plants and humans alike.

Zhu Yongguan of the Chinese Academy of Sciences (CAS) researches the relationship between plants and soils, working across scientific disciplines to address problems with soil and the environment, especially China's arsenic problem. His findings include how arsenic moves from soil to plants, particularly the parts we eat every day, and how that, in turn, affects human health. He has also discovered how bits of iron on rice roots affect



arsenic's movement into rice plants. He and his colleagues have also identified genes that influence arsenic accumulation and metabolism in plants. In rice paddy soils, he discovered how microbes influence the relationship between nitrogen, iron and arsenic, and determined how the arsenic in such soil becomes volatile.

In addition to his work on arsenic, Zhu studies antibiotic resistance. He and his colleagues have researched soil microbes, nutrients, metals, antibiotics and resistance-related genes that may influence human health. He's also studied antibiotic resistance among pigs in swine farms, determining how widespread and diverse genes that cause resistance are.

Zhu received his PhD in environmental biology from Imperial College, London, in 1998, then became a postdoctoral fellow at The University of Adelaide in Australia. He returned to China in 2002, where he is now a professor of soil environmental sciences and environmental biology and director of CAS's Institute of Urban Environment.

Zhu is also influential in global policy on arsenic pollution. He has been invited twice by the World Health Organization and the Food and Agricultural Organization of the United Nations to chair discussion groups on methods to reduce arsenic contamination in rice. He is a scientific committee member for the International Council for Science (ICSU) programme on Human Health and Wellbeing in the Changing Urban Environment, and served with the International Atomic Energy Agency's Standing Advisory Group for Nuclear Application.

BIOLOGY

Sue Duan Lin-Chao, Institute of Molecular Biology, *Academia Sinica*, Taipei, Taiwan, China

For her contribution to the molecular mechanisms of RNA degradation machinery during post-transcriptional regulation in bacteria

In our tiny but lengthy stretches of DNA code, determining where the genes are and what they do is essential but often tricky. A single gene can exist in bits and pieces across the molecular landscape. Scientists are always trying to solve this puzzle and find the genes that cobble together living creatures, and that endeavour is where Sue Duan Lin-Chao makes her trade.

Lin-Chao was born and educated in Taiwan, receiving her bachelor's degree in biology from National Changhua University of Education and her master's in Molecular and Cell Biology at the University of Texas at Dallas, USA. She stayed there to complete her PhD work on controlling how many

times plasmids – self-copying molecules found in bacteria that are separate from the bacterium's genome – replicate.

Later, she worked with genetic engineering pioneer Stanley Cohen at Stanford University, USA, to develop a way to identify genes in mammalian cells called gene trapping. In this technique a special, easy-to-identify gene called a 'reporter' is packaged into a retrovirus that randomly inserts it into cell genomes. The reporter gene 'reports back' if an important gene has been split. This method is now used widely in biology.

In 1990, she returned to Taiwan and established her lab at the Institute of Molecular Biology, *Academia Sinica*, where she is currently working to extend her studies of what causes the degradation of RNA – strands of coding molecules similar to DNA – and how that relates to mammal biology and diseases.

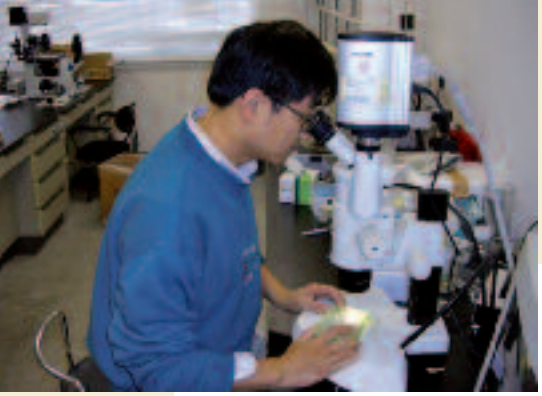
Lin-Chao's accomplishments in science extend beyond research. She founded the Biosafety Committee of *Academia Sinica* in 2001 – establishing a platform to ensure lab safety. From 2005 to 2008 she chaired the Committee for the National Advanced Bioinformatics Core for the National Science Council of Taiwan. She also founded the Taiwan International Graduate Programme on Molecular and Cell Biology at *Academia Sinica*.

She has authored 70 peer-reviewed papers and two book chapters, and has reviewed research for numerous prestigious journals, including *Nature*, *Proceedings of the National Academy of Sciences*, and *Current Microbiology*.

Xu Guoliang, Institute of Biochemistry and Cell Biology, Shanghai Institutes of Biological Sciences, Chinese Academy of Sciences

For his contribution to the understanding of the role and mechanism of DNA oxidation in epigenetic regulation of mammalian development

The human genome is one of the most complicated and beguiling machines in nature. What the genome does, especially during the critical growing period of both humans and other mammals, means not only understanding what the genetic code does, but how it responds to its environment.



Geneticist Xu Guoliang of the Shanghai Institutes of Biological Sciences studies epigenetics – how factors outside the genetic code affect which genes are active in the cells of young mammals. Genes are not always busy at work, and can be switched off or on depending on their circumstances; that's how they form the wide variety of cells found in the bodies of living creatures.

The biggest epigenetic puzzle Xu and his colleagues have solved is the process behind how molecules called methyl groups are removed from the genome. Methyl groups are important to understand because they're renowned for turning genes on or off, and might be useful in devising therapies for a number of diseases, including cancer. This discovery was published in *Science* and *Nature* in 2011 to great acclaim among epigeneticists and developmental biologists.

He received his doctorate in genetics from the Max Planck Institute for Molecular Genetics in Germany and did a postdoctoral stint with the top-tier geneticist Timothy Bestor in the Department of Genetics and Development of Columbia University, New York, USA. He returned to China in 2001, and received numerous prestigious awards from the Max Planck Society for independent young investigators.

Xu is currently a principal investigator in the Institute of Biochemistry and Cell Biology, Shanghai Institutes of Biological Sciences, CAS. He has co-authored more than 50 research papers and has received recognition in the field of epigenetics, including invitations for presentations on international conferences.

CHEMISTRY

Ayyappanpillai Ajayaghosh, National Institute for Interdisciplinary Science and Technology, Council of Scientific & Industrial Research, Trivandrum, India

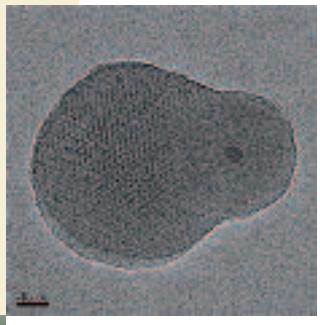
For his contribution to the understanding of the self-assembly of linear pi-systems to supramolecular architectures towards a new class of soft functional materials

Imagine you wanted to build a brick wall, but didn't need to place the bricks one at a time. Instead, you could just drop the bricks into a pile, flip a switch, and watch the wall build itself.

Ayyappanpillai Ajayaghosh studies molecular self-assembly – the process by which molecules come together on their own into larger structures and a field that stretches across several disciplines, connecting chemistry, biology,

and materials science. In his time working on molecular self-assembly, Ajayaghosh has inspired an entire branch of scientific study within molecular self-assembly by creating a new category of self-assembled materials that are functionally soft. His work on this material has been summarized in a highly cited 2007 article in *Accounts of Chemical Research*.

Ajayaghosh's contributions have led to the use of these self-assembling molecules as building blocks to design larger molecular structures with a diverse range of shapes and sizes that can be controlled on tiny scales. He's also found how their abilities to conduct electricity can be managed by controlling external factors such as temperature. These insights on molecular assemblies have helped scientists to design organic electronic devices and wide-ranging applications in light harvesting, sensing, imaging and security.



For the past 15 years, Ajayaghosh has also studied organic molecules that give off light and conduct a limited amount of electricity. He's also worked on scientific tools to help sense and image such molecules.

Ajayaghosh obtained his master's and PhD degrees in chemistry from Calicut University, Kerala, India. He joined the National Institute for Interdisciplinary Science and Technology within the Council of Scientific & Industrial Research in Trivandrum as a scientist in 1988 and has since then pursued research in several interdisciplinary areas.

He has received numerous prizes, such as the Thomson Reuters Research Excellence Award; he is a fellow of the three major Indian science academies and an editor for several journals, including *Physical Chemistry Chemical Physics*. He has given public lectures on the benefit of science to humankind; the impact of science in society, energy and environment; and the proper use of pesticides and plastics.

Chung-Yuan Mou, National Taiwan University, Taipei, Taiwan, China

For his contributions in the synthesis of mesoporous silica materials, and his leadership in discovering its catalytic and biomedical applications

Some surprising uses exist for an object with pores too tiny to see. For one thing, you can use it to trap water in an environment in which it can't freeze, even when cooled to –73 degrees Celsius. Then you can observe that water's strange density and behaviour, and gather

evidence that water under certain circumstances can transform into a new form of liquid.

This is just one way scientists have used a nanomaterial called mesoporous silica, developed by Chung-Yuan Mou and his colleagues in 2004. It is also useful for giving patients pharmaceutical drugs and other medically useful substances. For example, Mou's team found a way to bring foreign genes into the genomes found in cells using mesoporous silica instead of the normal delivery method: viruses. Mesoporous silica has since rapidly grown into a significant research subject within medicine.

Born in Keelung, Taiwan, Mou received his bachelor's from National Taiwan University in 1970, and obtained his PhD from Washington University in St. Louis. He returned to Taiwan in 1978 to be an associate professor at National Taiwan University, and has been full professor since 1982.

Mou started his research career in theoretical chemistry, and entered experimental work in 1991. His laboratory became the first Taiwanese lab producing quantities of C_{60}, hollow spherical molecules made entirely of carbon and popularly known as buckyballs. He has also worked on carbon nanotubes, a conducting nanomaterial with much potential in energy and electronics.

In the following years, he worked on mesoporous silica, and his first work in that field was accepted by *Science*. He has had a leading role in this field ever since, producing research that has applications in both energy and biomedicine. Mou has won many awards and co-authored more than 300 research papers.

He also works to develop science policy to strengthen homegrown research and to bridge scientific research with industry. Between 2012 and 2014, he served as a deputy minister of the National Science Council of Taiwan.

EARTH SCIENCES

Li Xia, School of Geography and Planning, Sun Yat-sen University, Guangzhou, China

For his contribution to the development of cellular automata and agent-based models for land use simulation and planning for sustainable land development in China

As cities spread into neighbouring landscapes, so do the patterns by which human beings use that land. This is especially true in China, where urbanization is spreading fast and people are coming into conflict with their environment.

Geographical Information Systems (GIS), are computer-powered networks that help gather and crunch geographical data into useful interpretations for scientists, but these systems are still lacking when it comes to some functions, such as simulating how cities will use the land they spread into. That's where Li Xia comes in.

Li has helped create models for both development planning and preserving precious environmental resources. He has carried out several studies finding that constraining the amount of space available in those computer simulations improves how those simulations reflect reality. His simulations have been helpful, for example, in the fast-developing Pearl River Delta, neighbouring the metropolis of Hong Kong. His simulations helped pinpoint land uses in the delta that made energy consumption less efficient, take an inventory of regional wetlands and assess how urban sprawl was encroaching on area farmland.

Li is a homegrown scientist, having received his PhD in geographical information systems from the Centre of Urban Planning and Environmental Management at the University of Hong Kong. He has worked as a researcher with both the University of Hong Kong and the Guangzhou Institute of Geography in Guangdong, China. He has been a professor at the School of Geography and Planning in Sun Yat-sen University, Guangzhou, China, since 2003, and is currently the chair professor. He also was a guest professor from at the University of Cincinnati, USA, from 2006 to 2007.

His 2000 paper on these models in *IJGIS* has been recommended by the journal as one of the classics of 1987-2011 which "no matter what your specialization, you should be familiar with".

ENGINEERING

Indranil Manna, Indian Institute of Technology (IIT), Kanpur, India

For his contributions in establishing microstructure-property correlation in nanocrystalline/amorphous materials and laser/plasma-assisted surface engineered components

The fine details of how we create the materials that make up our buildings, tools and machines are important to science and engineering. The environment can mechanically or chemically degrade metallic and ceramic substances, and it is up to engineers to make them stronger, more useful and extend their lifespan.

Indranil Manna is a metallurgical engineer who pursues new ways to design bulk metallic and ceramic objects and alter their surfaces. He has made discoveries about the tiny crystalline and structureless materials that allow engineers to do more on the nanometre scale to, for example, strengthen aluminium alloys and steel.

The materials and the methods he employs for his work vary widely. But his research largely focuses on phase transformation, such as the transformation of a solid into a liquid or gas. Phase transformations can significantly change metals and ceramics in ways that make them more useful. Manna has also used laser and plasma technology to engineer components that protect surfaces from corrosion, such as rusting in iron.

Manna obtained his PhD from the IIT Kharagpur in 1990. After teaching at IIT Kharagpur for over 25 years, Manna was invited to lead the Central Glass & Ceramic Research Institute in Kolkata in 2010. He later took over as the 10th director of IIT Kanpur in November 2012.

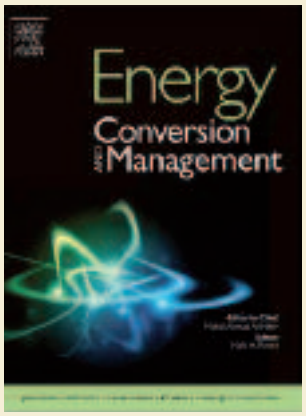
Manna has the Maout Medal of Calcutta University and the Young Scientist Medal of the Indian National Science Academy. He was elected president of the Materials Science Section of the 97th Indian Science Congress in 2010. Recently, the government of India gave him the Jagadish Chandra Bose Fellowship of the Department of Science and Technology, which he will hold until 2017.

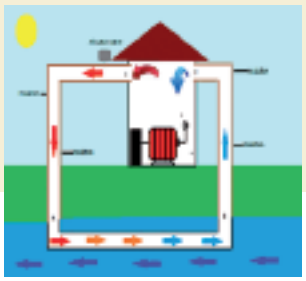
Mohammad Ahmad Al-Nimr, Jordan University of Science and Technology, Irbid, Jordan

For his contribution to the invention, modification and investigation of the behaviour of many energy devices and systems that utilize, generate, convert, store and manage energy efficiently

The future of our energy infrastructures relies on engineers who can devise efficient, economic and clean ways to gather, store and use that energy.

One such device is a mechanism that helps heat-storage units maintain their warmth levels by using temperature and pressure sensors. Those sensors govern the movements of an internal partition that can block heat from





leaving the container. This 'smart' thermal insulation system is one of several projects from mechanical engineer Mohammad Ahmad Al-Nimr.

Al-Nimr has investigated heat management in numerous processes, including the heat-collecting work of solar thermal panels. He has developed improvements on solar water purification systems, air conditioning systems, cooling towers and containers that collect, store and use solar energy. He has also proposed the inventive idea of using fins that are made of liquid metal and full of holes to increase the circulation of heat in thermal systems.

Al-Nimr received his PhD in mechanical engineering from the University of Michigan, Ann Arbor, USA, in 1991. He then joined the faculty at the Jordan University of Science and Technology, where he now teaches courses in energy and thermal power while conducting research.

He has published over 250 articles on heat transfer and energy topics – including storage, generation, conversion, management and renewability. Al-Nimr has received numerous prestigious awards, such as the Khalifa Award for distinguished professors in scientific research in 2012.

He has served as an advisor in evaluating European Union projects on research and education, such as TEMPUS, which supports advancing university-level education in the regions surrounding the EU.

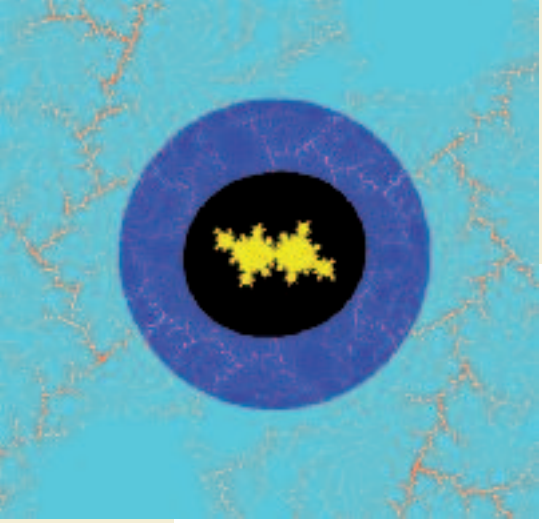
MATHEMATICS

Artur Avila Cordeiro de Melo, National Institute for Pure and Applied Mathematics (IMPA), Rio de Janeiro, Brazil, Brazil

For his contributions to the theories of renormalization in low-dimension dynamical systems, one-dimensional Schrödinger operators, and of Teichmüller flow, interval exchange transformations and translation flows

Artur Avila's incredible talent for mathematics becomes clear the moment you learn he received his mathematics PhD at the age of 21.

That degree is from the National Institute for Pure and Applied Mathematics in Rio de Janeiro, Brazil, received under the guidance of accomplished Brazilian mathematician Welington de Melo. Now Avila works as a researcher at IMPA and also as director of research at the National Centre



for Scientific Research (CNRS) in France.

At the age of 34, Avila already has had a remarkable career. His formulations on long-standing problems have led to pioneering research, bringing new perspectives and techniques to several other mathematical fields. His work spans areas of dynamical systems, in which an unchanging rule describes the motion of objects, and analysis. The areas include the dynamics of points in one dimension, as well as elements of mathematics that describe the probabilistic movements of subatomic particles over time.

Avila lived in Paris from 2001 to 2006, first as a postdoctoral researcher at the *Collège de France* and then as a *chargé de recherche* at CNRS. From 2006 to 2009, he went back to IMPA with a research fellowship from the Clay Mathematics Institute, and now devides his time between Rio and Paris.

In 2006 he received the bronze medal of the CNRS and the Salem prize. He received the European Mathematical Society prize in 2008 and the French Academy of Sciences' Grand Prix Jacques Herbrand in 2009. In 2010, he gave a plenary address at the International Congress of Mathematicians.

MEDICAL SCIENCE

Mei-Hwei Chang, National Taiwan University, Taipei City, Taiwan, China

For her contribution in providing the effect of hepatitis B vaccine in preventing human hepatocellular carcinoma and promoting the concept of cancer preventive vaccine

Liver cancer is the sixth most common cancer in the world and had the second highest death rate in 2012. Only about 5% of those who suffer from it survive for more than five years, according to the World Cancer Research Fund. It also plagues the developing world, including Asian

countries, in particular Mongolia, Vietnam, Laos and China. But effective treatments are scarce.

Hepatologist Mei-Hwei Chang of National Taiwan University (NTU) is trying to control liver cancer rates by focusing on the prevention of one of liver cancer's main causes, the hepatitis B virus (HBV). Chang's research has demonstrated, for example, that chronic HBV infection accounts for nearly every single instance of childhood liver cancer in Taiwan – especially important since infants can easily catch HBV from their chronically infected mothers.

Her team also demonstrated the effectiveness of a universal HBV vaccination programme in Taiwan, causing a drop of liver cancer in children and adolescents by about 70% – effectively saving the lives of large numbers of people and proving the importance of vaccines to prevent cancer. Her work even provided the first-ever follow-up evidence collected over 25 years on the effects of vaccination on preventing HBV infection.

Chang earned her medical degree at the College of Medicine, National Taiwan University (NTU), and received fellowship training at the University of California, Los Angeles School of Medicine, USA. She then established the pioneer fellowship training programme of paediatric gastroenterology, hepatology and nutrition in Asia.

She has since devoted her career to promoting the value of cancer-preventing vaccines through lectures at international conferences and more than 400 scientific articles. She is now the chairperson of the Hepatitis Research Center at NTU hospital and a distinguished chair professor of NTU.

Turgay Dalkara, Institute of Neurological Sciences and Psychiatry at Hacettepe University, Ankara, Turkey

For his contribution to our understanding of molecular and cellular mechanisms of ischaemic brain damage and migraine

The blood is like a supply line that provides your brain with the oxygen and sugar it needs to work. If supplies run short or are completely cut off, you could suffer the second most common cause of death in the world: a stroke.

Neurologist Turgay Dalkara's research has made major contributions to doctors' understanding of cellular death, the molecule nitric oxide and its derivatives influence the rise of brain damage from a lack of blood. Recently, his laboratory also showed that injury to cells located on tiny blood vessel walls may impede circulation and worsen stroke damage by limiting how much oxygen and pharmaceuticals the brain tissue receives. These discoveries suggested that drugs that restore those cells on the blood vessel walls could complement other existing treatments. The research was published in 2009 in *Nature Medicine*, and included in the *Nature Medicine* Classics collection.

Dalkara has also done critical work on doctors' understanding of migraines, the powerful recurrent headaches that plague one in every six people worldwide. He helped connect migraines to waves of heightened activity surging through the brain, and uncovered how this wave triggered inflammation and pain. This research, which could lead to new ways to treat migraines, was published in *Science* and highlighted in the news section of *Nature*.

Dalkara is a professor, medical faculty member and director of the Institute of Neurological Sciences and Psychiatry at Hacettepe University in Ankara, Turkey. He received his medical degree in neurology and his PhD in pharmacology at Hacettepe and did his postdoctoral fellowship at the Montreal Neurological Institute, McGill University, Canada. He joined Massachusetts General Hospital at Harvard Medical School in Boston, USA, in 1992 and has since then conducted research there during the summers as a visiting faculty member.

Dalkara established Turkey's first neuroscience PhD programme in 1991 to train scientists who also work as doctors. He started the first MD-PhD combined programme in Turkey in 2003 and founded a Turkish committee to organize neuroscience research activities nationwide.

PHYSICS

Rajesh Gopakumar, Harish-Chandra Research Institute, Allahabad, India

For his discovery of the duality between a class of two dimensional conformal field theories and higher spin theory in three dimensional anti-de Sitter space

Much of theoretical physics resides on the difficult task of connecting one theory with another, so that all of physics may someday be combined into one overarching set of laws. Rajesh Gopakumar is one such theoretical

physicist, whose work is helping to bring sense to the baffling laws of quantum physics.

Gopakumar has worked in quantum field theory and string theory, particularly where the two fields intersect. Quantum field theory is about understanding how nature works at sizes smaller than atoms, while string theory describes one way those laws of the very small could connect to the laws of the very large, such as gravity, and explaining such mysteries as the power of black holes and the accelerating expansion of the universe.

The primary aim of Gopakumar's research has been to better understand the relationship called the gauge-string duality, which connects string theory to topics such as quark soups. Quark soups have a temperature or density so great that quarks flow freely instead of collecting into larger particles such as neutrons and protons.

He's continually discovered new examples of the gauge-string duality. For example, his work on a simplified version of string theory led to what's now known as the 'Gopakumar-Vafa duality', which in turn gave rise to a new category of algebraic invariants – mathematical quantities that remain the same even as mathematicians make continuous changes.

Gopakumar did his doctoral work at Princeton University, USA. He received his PhD in 1997 under the supervision of 2004 Physics Nobel Laureate David Gross (TWAS Fellow 2007). After a few years as a research associate at Harvard University, USA, Gopakumar joined Harish-Chandra Research Institute in his home country in 2001. He also held a visiting membership at the Institute for Advanced Study, Princeton, from 2001 to 2004.

Gopakumar received the B.M. Birla Science Prize in 2004, the ICTP Prize in 2006, and the Shanti Swarup Bhatnagar Prize in the physical sciences for 2009 – the highest scientific award in India. He is also a founding member of the Global Young Academy, which grew out of an initiative by TWAS.

Marcos Pimenta, Department of Physics. Federal University of Minas Gerais (UFMG) and Brazilian Institute for Science and Technology of Carbon Nanomaterials, Belo Horizonte, Brazil

For his contribution to our understanding of the optical and electronic properties of carbon nanomaterials using resonance Raman spectroscopy

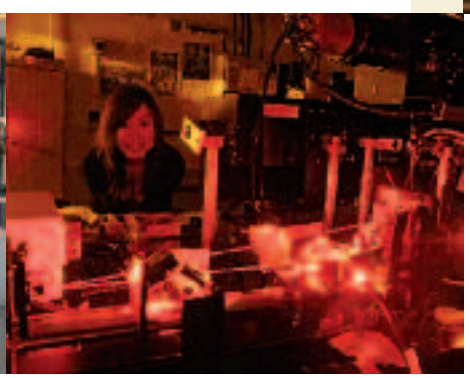
Physicist Marcos Pimenta works with two of the biggest modern developments in nanoscience: graphene, thin 2-dimensional sheets, and nanotubes, carbon atoms arranged into a minuscule cylinder. Both of these pure

carbon substances are extremely hard, excellent conductors of heat, and scientists and engineers often use them to produce electronic devices and new materials.

How graphene and nanotubes respond to heat, electricity or stress can dramatically change when mixed with other materials. Pimenta made important contributions to the study of graphene and carbon nanotubes using resonance Raman spectroscopy – a method using laser light to observe how a material's atoms vibrate and how it behaves electronically.

He received his PhD in physics in 1987 from the University of Orléans, France, and in 1989 he became professor at the Department of Physics of Federal University of Minas Gerais (UFMG) in Belo Horizonte, Brazil.

In 1992, he created the Raman Spectroscopy Laboratory at UFMG and in 1997 began the research area of carbon nanomaterials there. He has served in high-level positions for several Brazilian nanoscience organizations, and is currently director of the Brazilian Institute for Science and Technology (INCT) of Carbon Nanomaterials.



He has published more than 180 peer-reviewed scientific papers, including 13 in *Physical Review Letters* and 50 in *Physical Review B*.

He has won national and international awards, including the 2009 Somiya Award for International Collaboration from the International Union of Materials Research Societies, for collaborative works with scientists in the United States, Mexico and Japan. In 2010, he received the command of the Brazilian Order of Scientific Merit.

TWAS Prizes for Young Scientists in Developing Countries are awards to scientists not older than 40. The prizes are given in collaboration with national academies of science, scientific research councils and ministries of science and technology in developing countries. TWAS provides the prize money (up to USD2,000) while the national organizations select the recipients. Winners are chosen on a rotating basis from each of the major fields of natural science: biology, chemistry, mathematics and physics. High-ranking government officials – for example, ministers of science and technology – present the prizes at a special ceremony. About 45 national organizations currently participate in the programme. In 2013, 41 young scientists in 22 developing countries received the award.

TWAS Prizes for Young Scientists

PHYSICS IN THAILAND

Worawat Meevasana, 34, was named the winner of the National Research Council of Thailand–TWAS Prize for Young Scientists in physics.

Physicist Worawat Meevasana has had a fast-blossoming career in physics, applying his skill to the development of new electronics. But he's also using his education in the developed world to contribute to the advancement of applied physics and agriculture in his home country of Thailand.

Meevasana did his PhD work at Stanford University in the United States. While there, he trained in using synchrotron radiation – the electromagnetic radiation that comes from accelerated bits of matter – in studying condensed matter, the most expansive field of modern physics. He completed his degree in 2008 and returned home to bring his new knowledge to the Thai research community, becoming a researcher at Thailand's Synchrotron Light Research Institute in 2009 and joining the faculty of the School of Physics, Suranaree University of Technology, in 2010.

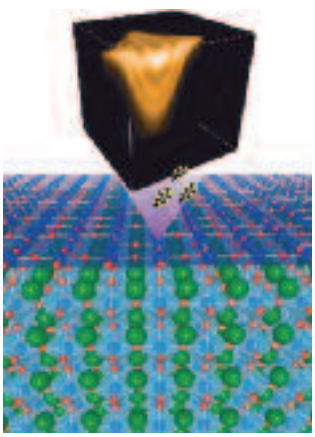
TWAS PRIZES TO YOUNG SCIENTISTS AWARDED IN 2013

Name	Country	Awarding Organization	Field
Abul Bashar Mir Md. Khademul Islam	Bangladesh	Bangladesh Academy of Sciences (BAS)	Biology
Abu Shadat Mohammod Noman	Bangladesh	Bangladesh Academy of Sciences (BAS)	Biological Sciences
Md. Rafiqul Islam Rafiq	Bangladesh	Bangladesh Academy of Sciences (BAS)	Engineering and Earth Sciences
Shafi Mohammad Tareq	Bangladesh	Bangladesh Academy of Sciences (BAS)	Environmental Sciences
Carlos Daniel Cadena-Ordoñez	Colombia	Academia Colombiana de Ciencias Exactas, Físicas y Naturales	Biology
Jeffrey Alejandro Sibaja Cordero	Costa Rica	Consejo Nacional para Investigaciones Cientificas y Tecnologicas (CONICIT)	Biology
Hosein Bazyar	Iran, Isl. Rep.	Iranian Research Organization for Science & Technology (IROST)	Physics
Gombodorj Bayarmagnai	Mongolia	Mongolian Academy of Sciences	Mathematics
Magsar Urgamal	Mongolia	Mongolian Academy of Sciences	Biology
Gyanendra Gurung	Nepal	Nepal Academy of Science and Technology (NAST)	Geophysics
Rajendra Joshi	Nepal	Nepal Academy of Science and Technology (NAST)	Chemistry
Dhiraj Maskey	Nepal	Nepal Academy of Science and Technology (NAST)	Health Sciences
Nabin Rayamajhi	Nepal	Nepal Academy of Science and Technology (NAST)	Biology
Jose del Rosario Loaiza	Panama	Asociación Panameña para el avance de la Ciencia (APANAC)	Biology
Raphael Alamar Guerrero	Philippines	National Academy of Science and Technology (NAST)	Physics
Nanayakkarawasam Karijjawattage Anjana Silva	Sri Lanka	National Science Foundation	Biology
Worawat Meevasana	Thailand	National Research Council of Thailand (NRCT)	Physics
Turgay Unver	Turkey	The Scientific and Technical Research Council of Turkey (TUBITAK)	Physics

Since returning, Meevasana's research has focused on the use of carbon-based materials and other such tools for creating exciting new technologies beyond the current generation of graphene-based electronics. His group includes six graduate students who are under his wing through worldwide collaborations between Thailand, the USA, Japan, UK, and the Netherlands.

Meevasana is also researching a new area, applying his knowledge of synchrotron radiation for agricultural technology advancement. Local developments in agricultural tools would be a deeply meaningful advancement for Thailand, where 41% of the land is used for agriculture, 40% of the population are agricultural workers and 66% live in rural areas. His work is largely to help develop new fertilizers.

Meevasana already has a publishing history in several prestigious journals. His 37 international publications include papers in *Nature Materials*, *Physical Review Letters*, *Science* and *Applied Physics Letters*. He's now regularly invited to present his research in seminars and conferences and give lectures in Thailand's high school physics programmes.



BIODIVERSITY IN COSTA RICA

Jeffrey Alejandro Sibaja Cordero, 35, was named the winner of the Costa Rica National Council for Scientific and Technological Research–TWAS Prize for Young Scientists in biology.

Taxonomist and ecologist Jeffrey Alejandro Sibaja Cordero of the University of Costa Rica in San José has spent his career finding new species and genera of small spineless creatures that inhabit the floor of the sea.

Cocos Island is a small, uninhabited island 550 kilometres off the Costa Rican coast, mountainous, densely forested and surrounded by the deep blue Pacific Ocean. It's one of the Central American nation's most important conservation areas and a UNESCO World Heritage Site. The focus of Sibaja's research is its surrounding underwater ecosystem, which hosts a diverse community of coral, fish, worms, molluscs and crustaceans. Sharks, whales, dolphins and whale sharks have also been known to roam in Cocos' aquatic neighbourhood.

Sibaja has contributed heavily to Costa Rica's knowledge of marine animal life. His finds include a new species of *Caecum*, a tiny sea snail that lives in the sandy bottom; a new Tanaidacea, a small shrimp-like crustacean that is usually only a few millimetres long; and the first discovery in the eastern Pacific of the lancelet *Asymmetron lucayanum*, a pale 2-centimetre-long fish-like creature that dwells under the sand of the sea floor.

His work on small invertebrates on the Cocos Island seafloor was the driving force behind his international PhD in biology of ecosystems and organisms from the University of Vigo, Spain, in 2012. He previously earned a

bachelor and licentiate's degree with emphasis on aquatic biology from the University of Costa Rica in 2005. His research has had an impact on the ecology, taxonomy and gathering of invertebrate specimens, and he has found new uses for GPS technology through his work managing marine resources at Cocos Island.

2013 AFRICAN UNION-TWAS AWARDS

Name	Country	Field	Awarding Organization 1	Awarding Organization 2
Donatien Kabore	Burkina Faso	Basic Sciences, Technology and Innovation	Ministry of Scientific Research and Innovation of Burkina Faso	Centre National de la Recherche Scientifique et Tecnologique (CNRST), Burkina Faso
Olivier Gnankine	Burkina Faso	Life and Earth Sciences	Ministry of Scientific Research and Innovation of Burkina Faso	Centre National de la Recherche Scientifique et Tecnologique (CNRST), Burkina Faso
Andrew Ako Ako	Cameroon	Life and Earth Sciences	Ministry of Scientific Research and Innovation of Cameroon	Cameroon Academy of Sciences
Mohamed Fawzy Ramadan Hassanien	Egypt	Basic Sciences, Technology and Innovation	Ministry of Science and Technology of Egypt	Academy of Scientific Research and Technology (ASRT) of Egypt
Mohamed Lotfy Taha Elsaie	Egypt	Life and Earth Sciences (ASRT), Egypt	Ministry of Science and Technology of Egypt	Academy of Scientific Research and Technology (ASRT) of Egypt
Ibrahima Sory Diare	Guinea	Life and Earth Sciences	Ministry of Higher Education and Scientific Research of Guinea (MESRS)	
Benard Okelo Nyaare	Kenya	Basic Sciences, Technology and Innovation	Directorate of Research Management and Development (DRMD), Ministry of Education, Science and Technology, Kenya	
Florence Oyiera Habwe	Kenya	Life and Earth Sciences	Directorate of Research Management and Development (DRMD), Ministry of Education, Science and Technology, Kenya	
Leboli Zachia Thamae	Lesotho	Basic Sciences, Technology and Innovation	Department of Science and Technology, Ministry of Communications, Science and Technology of Lesotho	
Moeketsi Peter Ntakatsane	Lesotho	Life and Earth Sciences	Department of Science and Technology, Ministry of Communications, Science and Technology of Lesotho	
Cosmo Socrates Abdul Ngongondo	Malawi	Life and Earth Sciences	Ministry of Education, Science and Technology of Malawi	National Commission for Science and Technology of Malawi
Adejuwon Adewale Adeneye	Nigeria	Basic Sciences, Technology and Innovation	Ministry of Science and Technology of Nigeria	Nigerian Academy of Sciences
Item Justin Atangwho	Nigeria	Life and Earth Sciences	Ministry of Science and Technology of Nigeria	Nigerian Academy of Sciences
Cornelius Scheffer	South Africa	Basic Sciences, Technology and Innovation	Department of Science and Technology of the Republic of South Africa	Academy of Science of South Africa (ASSAf)
Benjamin Landon Myer	South Africa	Life and Earth Sciences	Department of Science and Technology of the Republic of South Africa	Academy of Science of South Africa (ASSAf)
M.E. Idrees Ammar	Sudan	Basic Sciences, Technology and Innovation	Sudan National Centre for Research (CNCR), Ministry of Science and Technology of Sudan	Sudan Institute for Natural Sciences (SIFNS), Ministry of Higher Education and Scientific Research
M.A. Mohammed Asadig	Sudan	Basic Sciences, Technology and Innovation	Sudan National Centre for Research (CNCR), Ministry of Science and Technology of Sudan	Sudan Institute for Natural Sciences (SIFNS), Ministry of Higher Education and Scientific Research
A.E. Mohammed Badr	Sudan	Basic Sciences, Technology and Innovation	Sudan National Centre for Research (CNCR), Ministry of Science and Technology of Sudan	Sudan Institute for Natural Sciences (SIFNS), Ministry of Higher Education and Scientific Research
E.A. Abdalrahim Emad	Sudan	Basic Sciences, Technology and Innovation	Sudan National Centre for Research (CNCR), Ministry of Science and Technology of Sudan	Sudan Institute for Natural Sciences (SIFNS), Ministry of Higher Education and Scientific Research
A.M. Ahmed Isam	Sudan	Basic Sciences, Technology and Innovation	Sudan National Centre for Research (CNCR), Ministry of Science and Technology of Sudan	Sudan Institute for Natural Sciences (SIFNS), Ministry of Higher Education and Scientific Research
A.R. Mohammed Marmar	Sudan	Basic Sciences, Technology and Innovation	Sudan National Centre for Research (CNCR), Ministry of Science and Technology of Sudan	Sudan Institute for Natural Sciences (SIFNS), Ministry of Higher Education and Scientific Research
B.H. Eltayeb Amro	Sudan	Life and Earth Sciences	Sudan National Centre for Research (CNCR), Ministry of Science and Technology of Sudan	Sudan Institute for Natural Sciences (SIFNS), Ministry of Higher Education and Scientific Research
Maxwell Barson	Zimbabwe	Life and Earth Sciences	Ministry of Science and Technology Development of Zimbabwe	Zimbabwe Academy of Sciences

Sibaja has published papers in the *Journal of Tropical Biology*, the *Pacific Science Journal*, the *Marine Pollution Bulletin*, *Zootaxa*, the *Journal of Oceanograhy Marine Science* and others.

FOOD SECURITY IN KENYA

Florence Oyiera Habwe, 35, received the AU-TWAS Young Scientists National Award 2013 in Kenya in the field of life and earth sciences. The award is given by the African Union, TWAS and the Kenyan Ministry of Higher Education, Science and Technology, Directorate of Research Management and Development.

As a country that doesn't produce enough food to feed its own populace, Kenya needs creative scientists. Nutritionist Florence Oyiera Habwe of Maseno University in Kisumu, Kenya, is one such scientist. She helps her home country take large steps to promoting healthier, more productive lives.

Most of Habwe's research has been on understanding the local crops behind Kenyan foods and ways to supply people with needed nutrients through those crops. These nutrient-imbued foods, which can be better delivered to the population through commercialization, contain vital nutrients such as iron, which can help prevent chronic diseases like anaemia.

Habwe has also contributed greatly by recording and improving the recipes of meals prepared by the ageing population of Kenya. Many of these recipes are known only within certain communities and would otherwise be lost with the changing of generations. Her work gathering recipes also made it possible to mass-produce 20 nutritionally improved African indigenous vegetable recipes so they can be promoted and marketed to the general public. Additionally, she has worked to improve the shelf-life of many of these underused traditional crops by creating nutrious food products, an effort being funded by The Kenya National Council for Science and Technology.

Habwe did her master's degree research at Maseno University on the iron, copper and vitamin C content of East African indigenous vegetable recipes. That research, which was funded by The World Vegetable Centre-Regional Centre for Africa, led to her first patent, which was also the first patent filed by a Maseno University student.

Now she has contributed to the literature on indigenous foods as the author of one book, the co-author of three book chapters, four journal articles

and six conference-level publications. Her research led to the award of a two-year fellowship by African Women in Agricultural Research and Development. Habwe also teaches the undergraduate students of Maseno University's School of Public Health and Community Development.

DERMATOLOGY IN EGYPT

Mohamed Lotfy Taha Elsaie, 37, received the AU-TWAS Young Scientists National Award 2013 in Egypt in the field of life and earth sciences. The award is given by the African Union, TWAS, the Egyptian Ministry of Science and Technology and Egypt's Academy of Scientific Research and Technology.

Dermatologist Mohamed Lotfy Taha Elsaie, of the National Research Centre of Egypt, is a doctor and a researcher, both treating those with skin ailments and helping medicine find new ways to treat the many diseases that can plague the skin.

Elsaie's studies include a wide range of dermatological concerns, including sexually transmitted diseases, skin cancer, and blister-causing skin diseases. He also has proven expertise in laser treatments for everything from surgery to hair removal to scarring. He also has an immense interest in stem cell research.

His contribution to the medical literature has been significant. He's conducted a large number of clinical trials across a wide number of dermatological conditions and has been the lead researcher for more than 60 studies. He's also written a systemic review article on the use of lasers to treat scars. Systemic reviews are important in medicine because they can help doctors determine what evidence says about a given treatment by drawing from a large number of clinical trials.

He received his basic medical education in Egypt and interned at the Memorial Sloan Kettering Cancer Research Centre in New York as well as Thomas Jefferson School of Medicine in Philadelphia as a visiting resident of dermatology. In Egypt and the Middle East region, he provided medical services as a volunteer, for which received an award from the American Academy of Dermatology in 2007.

Elsaie is the author of 60 scientific publications in peer-reviewed medical journals, 43 of them published internationally. He has also written at least 25 additional dermatology textbook chapters, and edited and authored three internationally distributed textbooks, all three published in 2013, covering topics such as cosmetic surgery and acne. He has editorial roles at several journals, and is editor-in-chief of the *Journal of Hair Therapy and Transplantation.*

The TWAS-Celso Furtado Prize in Social Sciences was given for the first time in 2012. It is named after the renowned Brazilian economist, Celso Monteiro Furtado, whose work focused on the poor in Brazil and throughout South America. The annual prize will be presented for four straight years. It is supported by the Brazilian government and includes a USD15,000 award.

TWAS-Celso Furtado Prize

SOCIAL SCIENCES

Zhang Linxiu, Center for Chinese Agricultural Policy, Chinese Academy of Sciences

For her contribution to research that influences government poverty-alleviation policies and improving human welfare in poor rural areas in China

China's charge into modernity has captured the attention of the world, and urban centres such as Beijing are among the greatest cities on Earth. But the nation's rural areas are another story.

Millions of rural Chinese, including two thirds of the nation's youth, live in rural areas, and more than half of rural Chinese citizens are from poor villages that endure extreme poverty, according to the Rural Education Action Programme (REAP). The work of agricultural economist Zhang Linxiu suggests that for China to truly progress, the educational and employment needs of these young people must be well-understood and government policies must be developed to address their needs.

The key to Zhang's research is exhaustive field work and empirical research. She has travelled to all provinces in China, leading more than 50 surveys of some 500 rural communities and 10,000 rural households in the past 20 years. Her research teams have followed up on 3,200 households for up to 15 years.

About seven years ago, Zhang and her colleagues established REAP, which she now co-directs. Central to the programme's efforts, Zhang has led more than 30 large-scale randomized controlled trials – a highly rigorous method for evaluating the effectiveness of programmes. These trials help Zhang assess the effectiveness of interventions or policies meant to improve the education of rural young people.

The mountains of data generated by these trials have given Zhang the basis for more than 160 scientific publications. REAP's studies have found that 37.5% of children in Guizhou Province are infected with roundworms and that computer-assisted learning programmes help poor Chinese children with their maths scores. The teams have studied how to reduce dropout rates and how better eye care can improve education. They found that affluent urban men have strong advantages over poor, rural women in acquiring a college education.

Her team also submitted numerous recommendations to central and local governments, some of them leading to significant new policies and programmes. One example is the 'School Nutrition Improvement Programme', which was implemented by the Chinese government in 2012 and spends USD2.5 billion each year to cover the nutritional needs of more than 26 million rural schoolchildren.

Zhang's first agricultural economics degree was from Nanjing Agricultural University in 1982. She joined the Institute of Agricultural Economics of the Chinese Academy of Agricultural Sciences as a research assistant before a scholarship allowed her to study at the University of the Philippines at Los Baños and get her master of science degree in 1986. She returned to her institute for a few years and then studied at University of Reading in the United Kingdom until receiving her PhD in 1995. She returned again to China, co-founding a research institution called the Center for Chinese Agricultural Policy, where she is a professor and deputy director.

Candidates for the TWAS-Celso Furtado Prize in Social Sciences must be scientists who have been working and living in a developing country for at least ten years immediately before their nomination. They must also have made an outstanding contribution in both understanding and addressing social science disciplines such as economics, political science and sociology.

TWAS offers more than 300 PhD fellowships a year at some of the most respected institutions in the developing world. These fellowships are hosted in Brazil, China, India, Kenya, Malaysia, Mexico and Pakistan. The fellowships are central to TWAS's mission: With each new PhD scientist, developing countries build a foundation for scientific strength and human prosperity. TWAS programme partners cover all in-country costs such as tuition, fees and living expenses, while the Academy administers the programme and covers travel costs. New fellowships in more countries are expected soon.

PhD Fellowships

FROM PAKISTAN, FINDING USE FOR BRAZILIAN ORANGE WASTE

Brazil is the world's largest orange juice producer, and to get that juice the industry squeezes millions of tons of oranges every year. That means the Brazilian orange juice industry also deals with mountains of peels, seeds and membranes that get left behind. The orange waste typically gets turned into food for farm animals. But is there a better use for it?

Almas Taj Awan, a biotechnologist from Pakistan, thinks so. Awan said food for livestock is easy to obtain from other sources, so she used her PhD project at the University of Campinas in Brazil to explore turning orange waste into something more beneficial to the regional economy: a source of bioethanol.

"The world is shifting," she said. "We're running short on our resources. Petroleum is the major fuel from the past, but we know our resources are going down day by day. So basically we wanted to use the so-called waste and try something new that could be an alternative to fossil fuels."

Awan received her fellowship through a programme run by TWAS and the National Council of Technological and Scientific Development (CNPq) of Brazil. She said that Atta-ur-Rahman, a founding TWAS Fellow and a renowned chemist with University of Karachi in Pakistan, is an inspiration to her. "I had a little talk with him," she said, "and he encouraged me to go for this fellowship – and encouraged me to come back and share my experience with my own people in my own country."

She and her colleagues tested 20 species of yeast on the orange waste, and found that two of them could be commercially useful for turning it into bioethanol. Those two yeast species cut the fermentation time of the waste in half and increased the bioethanol yield.

In Brazil, 60% to 70% of cars run on biofuels produced by sugars and vegetable oils extracted from food crops such as sugar cane, maize, wheat, soya beans and sugar beets, Awan said. But these crops could also be used to make food. That makes orange waste an especially compelling bioethanol source, because it would free up those other crops for feeding people instead.

Awan's work was published in *RSC Advances* and, along with a patent she registered in 2013, and it led to her PhD. She credited the TWAS PhD programme with transforming her life, noting that while with the University of Campinas she has also worked with scientists from Serbia, Chile and Japan. "It was a wonderful experience working with people from different backgrounds, learning from their life experiences and sharing ideas. It literally proved to be a great professional boost in my life."

Awan also has a background hosting television and radio talk shows in Pakistan and is interested in improving the public dialogue between science and society. In developing nations, there's often a large gap between the science community and everyone else, and people don't realize what scientists do or why it's important, she said. "Science should not just be in the laboratories, between the scientists."

Since earning her PhD, Awan has returned to Brazil for a postdoctoral project – unrelated to TWAS – working on developing an anti-malarial drug that could, if it works, be made cheaply by local people in far-flung areas. She plans to return to Pakistan with her newfound expertise in two to three years to share her knowledge.

The University of Campinas also benefited from the fellowship programme, said Ljubica Tasic, Awan's supervisor and a biochemist there. "Our university started an internationalization of the campus and curriculum by having the CNPq-TWAS programme, and our students learned a lot from [Awan's] experience," Tasic said. "We could say that global learning starts by student-exchange programmes."

TWAS's Postdoctoral Fellowships provide opportunities to scientists from developing countries who recently have earned their PhD. Each postdoctoral fellowship lasts six months to three years and the recipients can be hosted in Brazil, India, Iran, Kenya, Malaysia, Mexico, Pakistan or Thailand. Fellowship recipients gain invaluable experience working with prominent scientists in a developing country other than their own. Programme partners cover all in-country costs such as tuition fees and living expenses, while TWAS administers the programme and covers travel costs. New fellowships in new countries are expected in 2014.

Postdoctoral Fellowships

FROM ZIMBABWE, DOING EXPERIMENTAL PHYSICS IN PAKISTAN

Modern-day technology depends on electronic parts that are so small, the machines that make them are hard to come by, especially in developing countries with tight resources. But through fellowships that allow scientists from two different countries to share their laboratories and expertise, a growing number of scientists are getting access to such scientific tools and the training it takes to use them.

Experimental physicist Morgan Madhuku of Zimbabwe works on alloys obtained by combining either aluminium, gallium or indium with nitrogen. These alloys are also semiconductors, and are extremely thin, sometimes less than a nanometre. Ion beams – small, straight streams of electrically charged particles – can alter these semiconductors into ideal building blocks for devices such as light-emitting diodes, which are useful for modern lamps.

Madhuku first left Zimbabwe for South Africa in 2000, where he earned his master's degree in physics at the University of Fort Hare in 2001. He went back there in 2004 and earned a PhD at the University of the Witwatersrand in Johannesburg in 2008. Since then, he has been working as a research scientist at iThemba LABS and is now a permanent resident of South Africa.

In 2013, he took advantage of TWAS's postdoctoral fellowship with the National Centre for Physics (NCP) in Islamabad, Pakistan, as its first-ever recipient. The fellowship gave him a chance to work at NCP, which has state-of-the-art equipment he needed to learn about, including a tandem accelerator that fires ion beams.

How does the ion beam work? Crystalline materials have a consistent molecular pattern that ion beams can disrupt in useful ways, Madhuku said. They can rip an atom from the pattern, leaving a conspicuous vacancy behind. They can warp the pattern, creating a string of dislocated atoms in strange places. They can even create zones where two different crystalline patterns come together.

This makes ion beams a very precise, useful tool for fine-tuning matter on a molecular scale. For example, Madhuku said, scientists can attach a semiconductor with an abundance of electrons to another semiconductor with holes that need to be filled by electrons. The boundary between these semiconductors is called a p-n junction, and these junctions are at the heart of nearly all semiconductor-based electronics. When electricity flows across this junction, electrons from one side flow into the holes on the other side, and the junction gives off light. The colour of that light depends on what materials make up the semiconductors on either side, and if that colour is visible to human beings, the light-emitting diode can be used to make a new LED lamp.

Madhuku said he was impressed by the sophistication of the Pakistani lab, especially considering that media reports of terror attacks initially made him nervous about the move. One African company even refused to give him life insurance while he was there. But in the end, his trip was both safe and extremely beneficial to his career. "I was very impressed by the state-of-art Tandem Accelerator facility and the dedicated team of scientists and technical staff who were always ready to assist me during the visit," he said.

He also had access to Rutherford backscattering spectrometry, which scatters ions and then tracks how they bounce to analyse surfaces on a very small scale. Madhuku said he plans to continue his work at iThemba LABS in South Africa.

"It was a tremendous honour to be the first recipient of the NCP-TWAS Postdoctoral Fellowship and I am extremely grateful to TWAS for this award," he said. "It provided the much-needed boost to my research capabilities in ion beam analysis of materials."

TWAS works with hundreds of scientific institutions to give researchers from the developing world the chance to pursue collaborative research in another country for up to a year. These visiting researchers get an opportunity to form international links while raising the profile of science in their home country. Both the host institutions and the Academy provide financial support. One such programme, featured here, is the TWAS-UNESCO Associateship Scheme, conducted with more than 100 scientific institutions in the developing world.

Visiting Researchers

FROM NAMIBIA, IMPROVING AIR QUALITY IN JAMAICA

Jamaica has a problem. Officials there know their local industries are releasing pollutants, such as heavy metal particles, into the air. But they have no way to monitor the pollution. With no effective monitoring strategy, they don't know how much is being released into the air, or where it's going once it's airborne, or even how it's worsening the health of Jamaicans.

The National Environment and Planning Agency (NEPA) in Kingston, Jamaica, has an office handling air pollution issues. But it is relatively new – just a few years old – with only two people working on those issues. The International Centre for Environmental and Nuclear Sciences (ICENS) has all the necessary equipment for monitoring and analysing air quality, but it was tied up for other environmental work. They also needed someone to help them begin monitoring their air quality. So Nnenesi Kgabi went to Jamaica to help.

Kgabi is an atmospheric scientist with Polytechnic of Namibia in Windhoek. She also has experience improving South Africa's air pollution monitoring systems. She visited the island nation with the help of the TWAS-UNESCO Associateship Scheme, which allows researchers from developing countries to make two visits to a centre of excellence, like ICENS, in another developing country to pursue collaborative research. She conducted research through the associateship from December 2012 to February 2013 in Jamaica.

After Kgabi arrived, she found numerous problems that needed solving. Developing countries trying to get a handle on air pollution monitoring often begin by borrowing approaches from other countries, Kgabi said. This can be a problem, because each country deals with a unique environment that presents different problems. "You need to have your own standards," she said. "You need to be able to revise your own standards based on scientific studies. You need to have people who are able to assess whether people are complying to those standards."

Furthermore, most monitoring stations that exist in Jamaica are owned by the industry, not the government. So NEPA, as a government agency, needs their own monitoring system to compare against what the industry reports. They also need to closely monitor the companies for compliance with regulations.

It's also still not clear what the major pollutants are in Jamaica. While some are obvious, such as carbon monoxide from cars, much air pollution also probably comes from the mining industry, and the pollutants released into the atmosphere depend on the industrial activity. But even then, Jamaica still needs to understand the local air dynamics well enough to understand whether those pollutants linger in the air in dangerous concentrations or harmlessly disperse.

Kingston, Jamaica's capital, could even be what Kgabi called a 'cooking point' – a place where toxic particles easily get trapped in and around the city because of the sea, high humidity levels and the surrounding hills.

As for those health problems, those haven't been gauged well either, Kgabi said. Only two studies have looked into health issues related to air pollution, neither providing conclusive information. "Most of those studies are sparse," she said. "There are no continuous studies that can help us point to the real issue."

Jamaicans also frequently burn their household trash, which could worsen the air pollution and present further health issues. "Sometimes people start fires, even in the dumping site," Kgabi said. "So there's a lot of pollution now that comes from the burning, and people are trying to figure out how to monitor those pollutants."

Through the associateship, Kgabi was able to use her expertise to help the Jamaican government determine its next steps. She helped conduct a review of air quality studies done from 1972 to 2012, and advised Jamaican regulators to set up two mobile monitoring stations of their own, rather than just accept what data comes from the industry. She also suggested computer software that would help them determine how pollutants move and become diluted, thus helping determine where pollutants go once emitted and how they affect human health and the environment.

Once all this knowledge is gathered and analysed, Jamaica can determine the greatest and most dangerous sources of pollution and prioritize them. "Then they can focus on the main activities that are causing the pollution, and they then can work together with the communities to reduce it," Kgabi said.

The **TWAS Research Professors in Least Developed Countries (LDC)** programme enables TWAS Fellows to visit a research institution in an LDC for up to three months, three times during a five-year period. The programme has allowed Fellows to share their knowledge with more than 1,000 institutions in LDCs, helping those countries to grow scientifically and form cross-border connections.

TWAS Research Professors

CONNECTING PEOPLE AND MATHS IN BENIN AND TOGO

The world's Least Developed Countries don't have many researchers exploring the edges of mathematical knowledge. So, for students interested in advanced maths, building connections across borders can make all the difference. Such a valuable connection is how Beninese and Togolese postgraduates received the opportunity to learn from Kalian Bidhan Sinha of the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India – and it all started at one of TWAS's annual meetings.

Sinha, a TWAS Fellow, met another TWAS Fellow, Mahouton Norbert Hounkonnou of Benin, at the TWAS General Meeting in Mexico City in 2008. The two mathematicians connected immediately and Hounkonnou convinced Sinha to sign up with the TWAS Research Professors in Least Developed Countries Programme to visit the International Centre for Pure and Applied Mathematics conference at the National University of Benin in Cotonou in 2009 to lecture on advanced mathematics.

At that conference, Sinha met Yaogan Mensah, a young mathematics faculty member at the University of Lome in the neighbouring nation of Togo.

It was the start of lasting ties between Sinha and mathematicians from Benin and Togo. Mensah took advantage of the TWAS Fellowships for Research and Advanced Training to visit Sinha in Bangalore for three months in 2012 for his own education. While there, Mensah persuaded Sinha to expand his work in Benin to Togo as well. So when Sinha returned to Benin as a TWAS visiting professor in 2013, he added a stop at the University of Lome in Togo for a two-day visit with Mensah and some young Togolese mathematicians.

"I gave two seminars in Togo, one at the very elementary level and the other was a little more advanced," said Sinha. "My motive was to expose them to somewhat modern aspects of analysis, how it is done in many places."

"It was a great honour for us to have received, in our department, a mathematician of such level," Mensah said. "The students appreciated the visit and the lectures a lot. His visit has motivated a lot our students. As for me, Professor Sinha is a mentor."

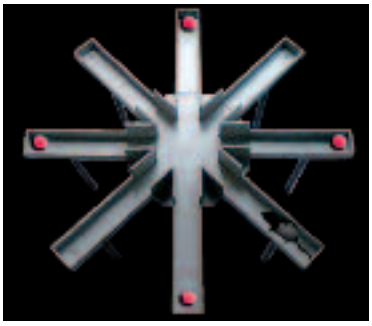
Sinha works in a field in mathematics called operator theory, greatly advanced by Hungarian mathematician John von Neumann on quantum mechanics in the early 20th century. Sinha's current research focuses on how operative theory interacts with geometric objects. Using the mathematical language of one field to describe a completely different field is what excites Sinha about mathematics, and he tries to instill that excitement in his students and audiences. He wanted to bring that potential for excitement and inspiration to Benin and Togo.

Two of the Togolese students seemed "quite keen" on the lesson, Sinha said, which was promising. "You may not understand everything. You're not expected to understand everything," he said. "But it should somehow excite you. You can do good mathematics, probably, if you get excited by it."

It was a memorable experience, Sinha said, to participate in furthering mathematics study and research in those two smaller nations, both of them among the world's Least Developed Countries. "This I did to, at least, give them some exposure," he said. "I'll do my bit, in a sense, as much as possible."

The **TWAS Research Grants Programme in Basic Sciences for Individual Scientists** provides specialized equipment, consumable material and scientific literature to young scientists in 81 countries where financial resources are scarce. It's supported by the Swedish International Development Cooperation Agency (Sida) and provides up to USD15,000 to individual scientists in developing countries. TWAS awarded 44 individual grants in 2013.

Research Grants for Individuals



ALZHEIMER'S RESEARCH IN BANGLADESH

Some of the most successful pharmaceuticals have come from the plants that surround us in nature – the most famous of which being aspirin, which was first discovered in the bark of willow trees. But there are hundreds of thousands of plant species, so it's up to scientists to look into them and figure out how their extracts might be useful to medicine.

One place to start is with plants that are already used in traditional healing practices passed down generation to generation since before recorded memory.

Shahdat Hossain, a neuroscientist with Jahangirnagar University in Bangladesh, is looking into one such practice: Use of a plant called the jamun tree *(Syzygium cumini)*. Native to South Asia, the jamun grows large, berry-like fruits. Traditional healers sometimes crush its seeds into a fine powder and give it to people suffering from digestive and respiratory problems. Hossain is taking the jamun seeds a few steps further. He is testing the seed extracts in rats to see if they help alleviate memory loss in a rat model of Alzheimer's disease, and used a TWAS grant to get the equipment he needed to do it.

"Since ancient times, the people of Bangladesh have used hundreds of herbs and plants as traditional medicine," said Hossain. "The scientific grounds of the uses of these herbs and plants has remained largely unknown until recently. In my personal opinion, Bangladesh is simply a fertile place for doing such research."

Hossain's team force-fed the extract to about half their rats once a day, and compared them to rats who hadn't been fed the extract. They routinely placed rats from both groups in a maze with a small circular central room attached to eight linear corridors. Four of these corridors, the same every time, had food at the end. Rats that repeatedly went into the arms they already visited within the same day had a weaker short-term memory. Rats that went into corridors that didn't contain food the day before had a weaker long-term memory.

Afterward, the team used a special fluorescence microscope to inspect the rats' brain tissues. They paid USD12,000 for that microscope, their largest expenditure and more than 92% of the total grant. It allowed them to look at the rats' brain tissues in great detail to determine whether the walls of brain cells were warped or leaking, and also whether the nuclei of those cells were in working order. Most importantly, they were able to colour-code different parts of the machinery of those cells, and watch to see if those parts were going about their business in the proper way. Their research, Hossain said, showed that the brain cells of rats fed the extract were healthier.

"The changes in the expression of a given protein can be detected by this fluorescence microscope," said Hossain. "These experiments are not possible with a normal microscope."

Hossain wants to continue his research on extracts from various other plants native to Bangladesh to see if they also slow down the memory loss from Alzheimer's disease. In the meantime, they are expecting to publish at least two articles in peer-reviewed journals that would have otherwise been impossible without the grant's help.

"TWAS helped me a lot to enhance our capacity in research, particularly in the visualization of brain slices and its cellular morphology," he said.

Hossain added that the research also aided the careers of his students. "It enabled my MS and PhD students to do more sophisticated research work in neurochemistry."

The **TWAS Research Grants Programme in Basic Sciences for Research Units** assists small research groups in countries lagging in science and technology. Although these groups have conducted important research, scarce resources have prevented them from realizing their full potential. With support from the Swedish International Development Cooperation Agency (Sida), this programme provides research units in 81 countries with an opportunity to achieve that potential. Each selected unit receives a grant of up to USD30,000 with potential to be renewed twice. TWAS awarded 20 grants to units in 2013.

Research Grants for Groups

OBSERVATIONAL ASTRONOMY IN AZERBAIJAN

Science is the common heritage of humanity, and few fields illustrate this fact as well as astronomy. The night sky belongs to everyone, and astronomers study it from all corners of the globe, including the mountains of Azerbaijan.

Azerbaijani astronomer Nariman Ismailov observes star systems at the earliest stages of their formation, when infant planets are assembling in spinning, spiralling discs of cosmic dust. He and his team work from Shamakhy Astrophysical Observatory, 150 kilometres northeast of Baku, Azerbaijan, and 1.5 kilometres above sea level in the Greater Caucasus mountain range. There, they get 150 clear nights a year, optimal for observing the night sky – so long as they have the modern tools to collect the data they need.

Astronomy in his country got its start in 1967 with its first professional-quality telescope, said Ismailov. Today, there are just about 60 professional astronomers, only about half of them with a scientific degree. They typically are paid the equivalent of about USD300 to 400 per month.

Through a research grant received from TWAS, Ismailov and his team received USD10,671 in equipment, including a USD6,948 charge-cou-

pled device (CCD) camera, a standard piece of equipment for astronomers observing stars at broad wavelengths of light. At least five young Azerbaijani astronomers gained experience from the research work that the grant enabled, he said.

There are several reasons why providing modern tools to developing world astronomers is important. The stars Ismailov studies are in the vicinity of the constellations Taurus, Aurigae and Orion, which are also well-known cosmic nurseries rich with gas and dust, a sort of fertilizer from which young stars can sprout. The stars are not far, relatively speaking – only about 43 light years away from us. But they're so dim they require special equipment to see.

"Our stars have very weak brightness," he said. "The brightest of them is nearly 100 times weaker than faintest star which we can see with the naked eye."

These stars also do some mysterious things that adult stars don't. For example, they emit excessive ultraviolet and infrared light, which the human eye can't normally see no matter how bright it shines. Some have particularly massive accretion discs full of dust and gas – which swirl around the star while portions of it clump and form planets. But there are also other, 'naked' young stars with no discs.

Ismailov wants to know why these stars randomly but strongly emit infrared and ultraviolet light. But in order to learn that, astronomers must watch them, track them, and catalogue their activity first. They can't do that without a camera that can see and capture that light.

Ismailov has been studying such infant stars for 35 years. He went to Moscow State University for his PhD in astronomy in the 1980s and returned to Azerbaijan in 1992 to work at Shamakhy while teaching students at Baku State University, where he is now an astrophysics professor. He is currently working on a new method of classifying the stars using the light they emit over time.

"Research of such stars allows us to understand the mechanism of formation of our solar system and star and planet formation processes as a whole," Ismailov said. "To explain the observed physical characteristics of our Sun and other similar stars, we must study an early stage of the physical condition of these stars."

"We are very grateful for TWAS's support for our project," he added. "This equipment opened up new possibilities for us to observe young stars. Our young scientists have very high interest in CCDs for this and future scientific projects. We will continue our relationship and collaborations with TWAS in future."

To enhance its impact in global science and science policy, TWAS must effectively communicate its ideas and activities to an international audience that includes a wide range of constituents. The audience includes not just TWAS Fellows, but also project partners and other international organizations, funding agencies, government bodies, academies, universities, young scientists and students. This vital mandate is the responsibility of the TWAS Public Information Office.

Public Information Office

2013 was an important year in the evolution of TWAS communication strategy and efforts to tell the Academy's story to a diverse global audience. With new staff and new initiatives, the Public Information Office (PIO) moved to build on the excellence previously achieved by the office.

Under new Public Information Officer Edward Lempinen, the year was characterized by efforts to solidify core TWAS communication operations and a strong commitment to innovation in Internet, multimedia and social media communication. This strategy in support of TWAS programmes and other initiatives brought a series of initial successes, while offering a promising course for the future.

As TWAS celebrated its 30th anniversary, the Public Information Office worked with Nicole Leghissa, a filmmaker from Trieste, Italy, on a documentary about TWAS support for four Kenyan scientists whose work is advancing agriculture and clean water. The documentary, *Seeds of Science*, was produced in partnership with the Italian national public broadcasting company RAI-FVG (Friuli Venezia Giulia).

Seeds of Science emerged as a deeply human and optimistic film that illustrates the close partnership between TWAS, Trieste and the developing world. It premiered at the annual TriesteNext science festival, and was warmly received a few days later at the TWAS General Meeting in Buenos Aires, Argentina. It was broadcast twice on RAI-FVG and shown to a select VIP audience at the station's headquarters. *Seeds of Science* can be viewed in English or Italian on YouTube (*tinyurl.com/video-SeedsOfScience*).

The Public Information Office also focused on using social media, especially Facebook and Twitter, to connect with younger scientists who might be interested in TWAS's work and its fellowships and grants. The effort paid dividends: at the start of 2013, 625 people were following the TWAS Facebook page; by year's end, the number had more than doubled to 1,430. TWAS's Twitter community grew 48% to 860 followers.

While these projects were underway, staff worked to redesign *www.TWAS.org*. The new site was set to debut in early 2014 with an updated look, a focus on TWAS opportunities, and enhanced navigation features.

PIO also completed the two-year CATALYST project on disaster risk reduction and climate change adaptation. CATALYST was an ambitious effort to engage researchers and policymakers at the grassroots level worldwide; it was funded by the European Commission and included six other partners across Europe. TWAS oversaw the project's outreach activities, and in that role PIO developed the website (*www.catalyst-project.eu*) and produced four regional best practice papers and a best practices notebook targeted for policymakers.

In addition to these projects, the Public Information Office provided important support through the year for a range of TWAS initiatives and events. For example, the *TWAS Newsletter* and *www.TWAS.org* provided extensive coverage of two joint initiatives from the Chinese Academy of Sciences (CAS) and TWAS: the CAS-TWAS President's Fellowship for PhD studies and a major new CAS investment in five China-based centres of excellence.

Science diplomacy was another key focus. PIO worked with the TWAS Programmes Office, the Italian Ministry of Foreign Affairs (MAE) and the Hungarian Academy of Sciences to promote the high-level roundtable, 'Science and Diplomacy: Central Europe and Southern Mediterranean'. PIO conducted extensive outreach to Italian news media and organized a news conference during the event in Budapest.

Partnerships also were critically important to PIO's efforts at the TWAS General Meeting in Buenos Aires. The communications team worked closely with Argentina's Ministry of Science, Technology and Productive Innovation and the country's National Scientific and Technical Research Council (CONICET) to organize a press conference and generate media coverage. *SciDev.net* provided full coverage of the meeting.

Through the year, TWAS PIO continued ambitious efforts to engage journalists and the public in Italy. TWAS's presence at TriesteNext included the *Seeds of Science* documentary and the photographic exhibit *Around the world in 80 clicks*. More than 35,000 people attended. TWAS was featured in a new edition of the book, *Trieste – City of Science and Higher Education,* which showcases the major scientific institutions of the Trieste System. The elegant volume was presented at a public event featuring top officials from the University of Trieste, the city of Trieste and MAE.

In all, TWAS was the subject of some 30 articles in Italian newspapers, online journals and magazines, and nearly a dozen radio and TV broadcasts.

PIO in 2013 continued to work on its own publications, including the quarterly *TWAS Newsletter*. In partnership with COMSATS, it published the latest volume in the long-running *Excellence in Science* series, a profile of the *Centro Internacional de Física* in Bogotá, Colombia.

TWAS has formed partnerships with organizations in many nations and across a range of fields. These partnerships are essential to achieving the Academy's mission. They amplify our efforts to build science and engineering in the developing world. And they can lead to further productive collaboration in the years ahead.

Partnerships

PROGRAMMES IN CHINA

In partnership with TWAS, the Chinese Academy of Sciences (CAS) in 2013 made a major investment in five centres of excellence that take advantage of China's rapidly advancing scientific strength to elevate scientific expertise in the developing world.

The centres focus on five areas: climate, water, space technology for disaster mitigation, green technology and biotechnology. CAS has pledged to invest USD6.5 million through 2016 in the five centres, with funds flowing to workshops, training, PhD programmes, joint research projects, strategic study reports, and the staff to support them.

The five centres are:

- The CAS-TWAS Centre of Excellence on Green Technology, based at the CAS Institute of Process Engineering;
- The CAS-TWAS Centre of Excellence for Biotechnology, based at the CAS Institute of Microbiology;

• The CAS-TWAS Centre of Excellence for Climate and Environment Sciences, hosted by the CAS Institute of Atmospheric Physics;
• The CAS-TWAS Centre of Excellence on Space Science for Disaster Mitigation, based at the CAS Institute of Remote Sensing and Digital Earth; and
• The CAS-TWAS Centre of Excellence for Water and Environment, hosted by the CAS Research Centre for Eco-Environmental Sciences.

The news followed a major agreement in February founding the CAS-TWAS President's Fellowship Programme. Under this programme, up to 200 early-career scientists per year from the developing world will travel to China for PhD study and research.

SCIENCE DIPLOMACY

Science diplomacy has emerged as a major new area of focus for TWAS, and the early success of the initiative results directly from important partnerships with regional and global science organizations.

In 2011, TWAS and the American Association for the Advancement of Science (AAAS) signed an agreement to implement a joint International Programme on Science and Diplomacy *(www.twas.org/science-diplomacy)*. Later, TWAS received funding from the Swedish International Development Cooperation Agency (Sida) to kick-start science diplomacy activities.

In 2013, TWAS and its partners produced a series of meetings and workshops.

In April, TWAS worked with the Italian Ministry of Foreign Affairs and the Hungarian Academy of Sciences to produce a daylong roundtable, 'Science and Diplomacy: Central Europe and Southern Mediterranean'. The partner organizations invited high-level scientists, diplomats and science policy experts from 14 countries in Central and Eastern Europe and the southern shore of the Mediterranean to Budapest for discussions of how diplomacy might interact with science to boost regional development.

In June, physicist Ivo Šlaus, president of the World Academy of Art & Science, delivered a lecture that

AAAS
ADVANCING SCIENCE, SERVING SOCIETY



called on scholars in all sectors to engage with the political realities of the world.

In December, TWAS hosted a week-long workshop that brought energy-sector scientists and policymakers from throughout the world to the Academy's headquarters in Trieste, Italy, to explore the relationship between science, policy and diplomacy. As part of the energy workshop, Vaughan Turekian, chief international officer at AAAS and director of its Center for Science Diplomacy, spoke on the importance of science diplomacy for addressing challenges, especially in developing countries.

CATALYST FOR CHANGE

TWAS's Public Information Office coordinated the outreach activities for CATALYST – Capacity Development for Hazard Risk Reduction and Adaptation *(www.twas.org/catalyst-project)*. The project aimed to assemble, analyse and disseminate the rapidly expanding knowledge of natural hazards and disasters in order to provide guidelines for best practices, both to help prevent such disasters and to assist with responses when disasters occur. The project included seven European partners, and was funded under the European Union Seventh Framework Programme.

The Academy in 2013 published best-practices case study documents focused on four different regions: East and West Africa; European-Mediterranean; Central America and the Caribbean; and South and South-East Asia. Each document detailed the specific disaster risk reduction and climate change adaptation challenges confronting the regions. Working closely with the partners,

CATALYST

CAPACITY DEVELOPMENT FOR HAZARD RISK REDUCTION AND ADAPTATION

TWAS also produced a notebook for policymakers providing guidance and insights from the project.

Additionally, the final of four workshops in Bangkok, Thailand, for South and Southeast Asia, took place 23-25 January 2013. The results of these regional meetings were further discussed and refined via the online 'Think Tank' forum, and the results were distilled into a series of final reports.

CATALYST began in 2012, unfolding through workshops and 'Think Tank' activities that brought together a diverse range of experts from different regions.

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.

In 2013, from 29 April to 3 May, TWAS and ICTP collaborated with Elettra-Sincrotrone Trieste and Regione Autonoma Friuli-Venezia-Giulia to co-sponsor the 'Workshop on Portable X-ray Analytical Instruments for Cultural Heritage'. The workshop trained scientists in state-of-the-art techniques for materials with interest to archaeology, palaeoanthropology, palaeoarchaeology or cultural heritage.

From 20 to 24 May, ICTP and TWAS collaborated with the Institute of Physics and American Physical Society to sponsor the Entrepreneurship Workshop for Scientists and Engineers in Durban, South Africa. The workshop was designed for scientists and engineers from across Africa who are interested in learning entrepreneurial skills to commercialize their scientific inventions.

ICTP and TWAS also co-sponsored an international workshop on low-cost 3D printing for science, education and sustainable development. The workshop demonstrated a number of available technologies and presentations of ongoing research.

TWAS-COMSTECH GRANTS

In June 2009, TWAS and the Organization of Islamic Cooperation's 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. Through the programme, research grants of up to USD15,000 are 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, and materials science including nanotechnology, pharmaceutical sciences and renewable energy.

In response to the fourth call for proposals, in 2013 TWAS and COMSTECH provided grants to 26 young scientists in ten countries: Algeria, Bangladesh, Cameroon, Iran, Lebanon, Malaysia, Nigeria, Pakistan, Tunisia and Turkey. The supported projects focused on a range of topics, including magma evolution at the

Cameroon Volcanic Line; the use of soil conditioners for improving plant growth during droughts; preparing a domestic air purifier that uses membrane technology; and how an engine oil developed with nanoscale technology affects a diesel engine's emissions.

OPPORTUNITIES IN GERMANY

TWAS's first programme bringing scientists from a developing country to a developed nation to pursue research continued its impressive growth.

The collaboration with the German Research Foundation (DFG) was launched in 2010 and is open to post-doctoral scientists from sub-Saharan Africa (except for South Africa) who graduated with their PhD degrees within the last five years. The programme has grown quickly: After awarding ten fellowships in its first year, it awarded 20 in 2011 and 19 in 2012. Then, in 2013, a new agreement signed between DFG and TWAS allowed the programme to award a record of 30 fellowships to young scientists from ten African countries: Botswana, Burkina Faso, Burundi, Cameroon, Côte d'Ivoire, Ghana, Madagascar, Nigeria, Sudan, and Uganda. Under that agreement, 30 scientists will receive fellowships in both 2014 and 2015.

The fellowship provided support for each scientist to undertake a two- to three-month research visit at their selected host institute in Germany, developing both their own expertise as well as the possibility for more long-term collaborations between the African scientists and their German counterparts. All expenses in Germany are covered by the host institution, while TWAS provides travel and visa support.

GOVERNING SOLAR RADIATION

In January 2013, the Solar Radiation Management Governance Initiative (SRMGI) continued its important work engaging Africa in discussions on geoengineering. A half-day workshop, 'African Involvement in Solar Geoengineering', was held in Ethiopia and emphasized participant dialogue; small-group discussions and exercises focused on whether such research should proceed, what regulations are needed, and the role that African scientists, non-governmental organizations and policymakers can play in global geoengineering discussions. The workshop drew more than 100 participants from 21 different African countries, including academics, policymakers, journalists, NGO representatives, and interested members of the public.

SMRGI was convened by the UK's Royal Society, the US-based Environmental Defense Fund and TWAS in 2010. With little to no progress toward an international 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 consequences. One idea is to reduce the amount of sunlight that reaches the Earth's surface – or solar radiation management.

A summary of the 2013 workshop and two prior workshops held in 2012 was published in October 2013. Participants suggested numerous ideas for future work, including a pan-African expert group overseen by the African Academy of Sciences, increased research into SRM in African universities, and efforts to teach about solar-radiation management in school and university courses. For additional information, see *www.srmgi.org.*

GLOBAL RESEARCH COUNCIL

The Global Research Council (GRC) elevated research integrity and open access publications as priorities, endorsing two documents during a meeting in May 2013 in Berlin. The first document is a statement of principles for research integrity and the second a plan of action for open access to scientific publications.

The GRC is comprised of the heads of science and engineering funding agencies from around the world, and promotes best practices for high-quality collaboration among funding agencies worldwide. TWAS President Bai Chunli chairs the Council, and TWAS Executive Director Romain Murenzi serves on the governing board.

GLOBAL VIRUS NETWORK

TWAS formed a new partnership with the Global Virus Network (GVN) to explore initiatives that could help the world respond to future threats. Dr. Robert C. Gallo, renowned for his co-discovery of HIV and the development of the HIV blood test, is co-founder of GVN.

In a letter of intent, leaders of the two organizations agreed to joint efforts that would increase opportunities for medical virologists from low-income nations to receive training at one of the centres of excellence that are affiliated with GVN. In addition, the organizations agreed to "identify existing programmes under their respective purviews that would support training of medical virologists from low-income nations."

SUPPORT FOR SCIENTIFIC MEETINGS

In 2013, TWAS provided support for 20 scientific meetings in 17 developing countries. Among the meetings supported were:

- Maiden International Student Conference of The TBA African Alumni Group (TAAG), 2-4 July, in Kenya;
- 39th Conference of the French Society of Neuroendocrinology: French-Moroccan-Spanish Conference, 25-27 September, in Morocco;
- The InterAcademy Medical Panel General Assembly and Scientific Conference on Non-communicable Diseases, 15-16 August, in South Africa;
- Developmental Genetics Course 'Uganda DevBio', 25 June-6 July, in Uganda;
- Fourth Biopesticide International Conference (BIOCICON2013), 28-30 November, in India;
- International Conference on Bacterial Expressions, 22-25 October, in India;
- The 2nd Natural Pigments Conference for South-East Asia, 12-13 July 2013, in Indonesia;
- International Conference on Postharvest Technology, Food Chemistry, and Processing: Developing The Supply Chain Towards More Healthy Food, 11-13 November, in Vietnam;
- 8th Conference on Lipid Binding Proteins, 3-6 November, in Argentina;
- First Argentinian Spring Course in Advanced Immunology, 4-6 November, in Argentina;
- IV International Meeting on Signal Transduction, 10-13 November, in Mexico.

The Academy's offices in five major regions perform vital functions: They provide information to scientists throughout the developing world. They nominate scientists for membership and prizes, select Young Affiliates, and organize conferences. In the process, they raise awareness of TWAS and its programmes among scientists in each region.

Regional Offices

EAST AND SOUTHEAST ASIA AND THE PACIFIC

The TWAS Regional Office for East and Southeast Asia and the Pacific (TWAS-ROESEAP) is based at the Chinese Academy of Sciences in Beijing, China.

In 2013, the office teamed up with the Cold and Arid Regions Environmental and Engineering Research Institute (CAREERI) to organize a training course on desertification and its control in developing countries. Desertification is when land dries out and loses its plants, animals and even bodies of water. It can be caused, for example, by climate change. Six young scientists were also selected by TWAS's sub-Saharan Africa office to attend this meeting.

TWAS-ROESEAP awarded the TWAS Regional Prize for science popularization to neuroscientist and molecular biologist Custer C. Deocaris of the Technological Institute of the Philippines (TIP). Deocaris's work and ability to convey scientific ideas to a general audience has led to him being regularly featured in news media in the Philippines and abroad, speaking on issues ranging from dietary practices to neuroscience to climate change. Deocaris also hosts and produces Radyo Agila's 'Pinoy Scientist', a weekly nationwide science radio programme in his home country for which he's received several awards, and is a science reporter for the local weekly newspaper, *Herald News*. His work has inspired physical education teachers on the the Philippine island of Mindanao to push for more support from their

government for physical education in schools. Deocaris is an active science policy advocate in the Philippines and is the chair of 'Luntiang Lunes', the local chapter of the international movement Meatless Monday. He is also a prolific scientist, with 79 studies published in his field in local and international journals. He presently heads a bioengineering research programme at TIP. The prize comes with USD3,000.

Ten young scientists, selected by TWAS-ROESEAP, attended TWAS/BioVision Alexandria.NXT 2013 in Alexandria, Egypt.

- *coordinator: Bai Chunli (TWAS Fellow 1997)*
- *email: president-office@cas.cn*
- *website: www.twas.org.cn*

SUB-SAHARAN AFRICA

The TWAS Regional Office for Sub-Saharan Africa (TWAS-ROSSA) is based at the African Academy of Sciences in Nairobi, Kenya.

In November 2013, the office organized a workshop for young scientists for capacity-building in cell biology and regenerative medicine in Nairobi. The office also worked with the TWAS Arab Regional Office to organize a meeting on water and sanitation in Africa and the Middle East in October in Alexandria, Egypt. Additionally, TWAS-ROSSA held national chapter meetings in Uganda, Ghana, Madagascar and Zimbabwe.

TWAS-ROSSA honoured Anusuya Chinsamy-Turan, a palaeobiologist who leads the Department of Biological Sciences at the University of Cape Town, South Africa, with the 2013 TWAS Regional Prize, this year for science communication. She is a global expert on the microscopic structure of vertebrate bones. Besides authoring two academic books, Chinsamy-Turan has written a popular children's book, *Famous Dinosaurs of Africa,* and served as the chair of the Advisory Board of Scifest Africa, the continent's biggest science festival. Both her research and her efforts in communicating science with the public were celebrated by the South African Woman of the Year Award in 2005. She has also been the director of the Iziko Museum's Natural History Collections. She has been a TWAS fellow since 2009. At 2012's TWAS General Meeting in Tianjin, China, she discussed her work on how the analysis of fossil bones reveals to scientists how dinosaurs lived and grew.

Ten young scientists, including five women, were selected by TWAS-ROSSA to attend TWAS/BioVision Alexandria.NXT 2013 in Alexandria, Egypt.

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

ARAB REGION

The TWAS Arab Regional Office (TWAS-ARO) is based at the *Bibliotheca Alexandrina* in Alexandria, Egypt.

In 2013, the office organized the ninth annual meeting of TWAS members in the region from 29 to 30 December in Alexandria. The conference was about science and technology education for sustainable development and social justice in the Arab Region, and brought together TWAS-ARO members and young affiliates, along with other distinguished speakers. The attendees discussed the connection between science, technology and society, as well as Arab countries' education systems. The office also supported young Arab researchers by holding a poster session where they could showcase their related research.

The office's Regional Prize for science communication went to Farid A. Badria of Mansoura University's Faculty of Pharmacy in Egypt. Badria has contributed much to the development of medical sciences in Egypt, including establishing a drug discovery unit for the Egyptian University's faculties of science, pharmacy, agriculture and medicine to use their common

resources for research. He's also the head of a centre in Mansoura for monitoring pollution in the Mediterranean Sea, Nile River and Lake Manzala. He has also developed new therapies for liver and skin disorders, and invented numerous medical devices that have earned him 16 patents, with another 26 submitted to the Egyptian Academy of Sciences. He also has over 100 publications. In 2011, Badria was awarded the Gold Medal from the World Intellectual Property Organization, naming him the best inventor in Egypt in 2011. In 2001, he was awarded Egypt's State Recognition Outstanding Award in Medicine, and in 2000 he was recognized in Kuwait as an Outstanding Arab Scholar and in Iran with the Khwarizmi International Award.

Additionally, the office selected 10 young scientists to attend TWAS/BioVision Alexandria.NXT 2013 in Alexandria, Egypt.

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

CENTRAL AND SOUTH ASIA

The TWAS Regional Office for Central and South Asia (TWAS-ROCASA) is based at the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India.

In 2013, the office funded two national chapters, one in Pakistan and the other in Bangladesh, to organize meetings in their countries. The office also organized a meeting for young scientists in the region on challenges and opportunities in science and technology in developing countries, held in Bangalore from 21 to 23 November.

The winner of TWAS-ROCASA's Regional Prize is Bangladeshi nuclear physicist Mohammad Shamsher Ali, who has worked as a science communicator for over 30 years in radio and television, including a series on BBC on science and culture. Shamsher Ali also produced two TV series about science: 'Bigyan Bichitra' (Varieties of Science) and 'Notun Diganta' (The New Horizons) which were widely popular and ran for more than 12 years. He has been a TWAS Fellow since 1989. His experience using electronic media for science communication made him an advocate of the Open University system, which enables education over long distances. He was the founder vice-chancellor of the Bangladesh Open University from 1992 to 1996.

TWAS-ROCASA selected 10 young scientists to attend TWAS/BioVision Alexandria.NXT 2013 in Alexandria, Egypt.

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

LATIN AMERICA AND THE CARIBBEAN

The TWAS Regional Office for Latin America and the Caribbean (TWAS-ROLAC) is based at the Brazilian Academy of Sciences in Rio de Janeiro, Brazil.

The office organized the 13th TWAS-ROLAC Meeting in May 2013 in Rio de Janeiro and the 14th TWAS Young Scientists Conference in Cancun, Mexico, in December 2013.

TWAS-ROLAC's Regional Prize went to Diego Andres Golombek, a chronobiologist with *Universidad Nacional de Quilmes* in Argentina, who is probably the most renowned science popularizer in the country. He has written numerous popular science reports in national newspapers and magazines. He's also the author of 13 books popularizing science. He has organized science festivals, science education programmes, TEDx events and a teenage science boot camp. Golombek has even won the comedic IgNobel prize in 2007 for a study on synchronizing hamsters' sleep cycles using Viagra, and has written and hosted science TV shows, including productions for the Discovery Channel and the History Channel. He's the director of the science show 'Project G' and editor of the popular book series 'Science that barks'. Golombek received his prize at TWAS's 24th General Meeting is Buenos Aires, Argentina, and gave a lecture on science communication.

The office also selected 10 young scientists to attend TWAS/BioVision Alexandria.NXT 2013 in Alexandria, Egypt.

- *coordinator: Vivaldo Moura-Neto (TWAS Fellow 2008)*
- *email: contact@twas-rolac.org*
- *website: www.twas-rolac.org*

YOUNG AFFILIATES

Starting in 2007, each TWAS Regional Office has annually selected up to five Young Affiliates, who must be excellent young scientists aged 40 or below. In 2013, the following 24 young scientists were selected in 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
Fayçal Djeffal (Algeria)	S.M. Abdur Razzak (Bangladesh)	Hernán Edgardo Grecco (Argentina)	Achille Ephrem Assogbadjo (Benin)	Li Chunshan (China)
Ahmed E. Abdel Moneim (Egypt)	Satish Amrutrao Patil (India)	Federico Brown (Brazil)	Ackmez Mudhoo (Mauritius)	Decibel V. Faustino-Eslava (Philippines)
Monther AbdelJabbar Khanfar (Jordan)	Reza Kerachian (Iran)	Joao Trindade Marques (Brazil)	Bolanle Ade Ojokoh (Nigeria)	Jeng-Da Chai (Taiwan, China)
Wassim Abou-Kheir (Lebanon)	Ajay Kumar Jha (Nepal)	Daniel Pellicer (Mexico)	Henok Kinfe (South Africa)	Nguyen Tuyet Phuong (Vietnam)
Adil Belhaj (Morocco)	Sammer Yousef (Pakistan)	Fernando Febres Cordero (Venezuela)	Alta Schutte (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 2013 activities of these organizations follow.

The TWAS Family

ORGANIZATION FOR WOMEN IN SCIENCE FOR THE DEVELOPING WORLD

With over 4,300 members, OWSD is one of the largest organizations in the world advocating for women in science. It is the first international group to unite prominent women scientists from across both the North and South aiming to strengthen their role in global development and their presence in scientific leadership positions.

In 2012, the Swedish International Development Cooperation Agency (Sida) increased funding to OWSD, doubling the number of PhD fellowships awarded under the flagship Postgraduate Fellowship Programme for Young Women. In 2013, OWSD was able to award 46 fellowships. In addition, Sida provided funding for additional career development opportunities, including a travel fund for each postgraduate, ensuring that awardees can attend conferences and workshops, undertake short study visits, or work in laboratories, as approved by their supervisor.

OWSD (in partnership with TWAS) administers a high-profile awards scheme for early career women scientists in the South, funded by The Elsevier Foundation. The selection process takes place in November each year, and the awardees receive USD5,000 and a certificate during an awards ceremony held the following February at the annual meeting of the American Association for the Advancement of Science. In February 2013, in Boston, Massachusetts, USA,

five medical and life science researchers were honoured for work that could contribute to life-saving knowledge and therapies worldwide: Nasima Akhter (Bangladesh); Namjil Erdenechimeg (Mongolia); Dionicia Gamboa (Peru); Huda Omer Ba Saleem (Yemen); and Adediwura Fred-Jaiyesimi (Nigeria).

In August 2013, the newly created post of OWSD Programme Coordinator was filled by Tonya Blowers, formerly of the TWAS Public Information Office.

The TWAS-OWSD Advisory Panel made recommendations to the TWAS Council in October 2013 to put in place systems that will increase the representation of women at TWAS conferences and workshops and raise the percentage of women among TWAS Fellows to at least 15%.

To learn more, please visit *www.owsd.net*

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.

Between 25 and 27 February 2013, the IAP General Assembly and conference were hosted by the Brazilian Academy of Sciences in Rio de Janeiro, Brazil. More than 100 delegates representing 70 national academies of science attended the conference, titled 'Grand Challenges and Integrated Innovations: Science for Poverty Eradication and sustainable Development'.

The main outcome of the conference was the 'Letter from Rio-2013 on the Role of Science Academies in Grand Challenges and Integrated Innovations for Sustainable Development and Poverty Eradication', which underlined that poverty eradication and sustainable development require addressing key grand challenges in health, food, water, energy, biodiversity, climate, disaster management, education and governance.

The IAP conference was followed by the IAP General Assembly, where elections took place for the 2013-2015 Executive Committee. Co-chair Mohamed H.A. Hassan (Sudan) was re-elected for his second term, while Volker ter Meulen (Germany) was also elected. During the meeting, IAP membership grew to 106 when the application of the *Academia Nacional de Ciencias del Uruguay* was formally accepted.

The first meeting of the newly elected Executive Committee was hosted by the Australian Academy of Science (AAS) in Canberra, Australia, from 31 October to 1 November 2013. Following an annual call and review process, the Executive Committee approved

iap
the global network of science academies

funding to projects submitted by member academies and its affiliated regional networks that will run into 2014. These networks are:

- the European Academies Science Advisory Council (EASAC);
- the Association of Academies and Societies of Sciences in Asia (AASSA);
- the InterAmerican Network of Academies of Science (IANAS); and
- the Network of African Science Academies (NASAC).

Among their activities in 2013 was the launch by EASAC of a report on 'Planting the Future: Opportunities and Challenges for Using Crop Genetic Improvement Technologies for Sustainable Agriculture', and the organization by AASSA of four regional workshops and an international symposium that collectively drew over 170 participants from 31 countries. Meanwhile, IANAS focused on working towards the inclusion and empowerment of women in science and technology. In particular, IANAS published a book of biographies of 16 outstanding women scientists: 'Women Scientists in the Americas: Their Inspiring Stories', which was released on 8 March, World Women's Day. As well as hosting discussions on adaptation to climate change on the African continent, NASAC held both its board and general assembly meetings in Addis Ababa, Ethiopia, hosted by the Ethiopian Academy of Sciences.

Throughout 2013, IAP continued to interact closely with the Global Young Academy (GYA), including facilitating the participation of some 20 young scientists in September's World Economic Forum Annual Meeting of the New Champions in Dalian, China.

Also in September 2013, IAP released a statement: 'Response to the Report of the High Level Panel of Eminent Persons on the post-2015 development agenda'. Given the technical nature of many of the world's most pressing issues, IAP confirmed that it is critically important that priority-setting and actions are based on sound science, and that the network is ready to provide independent expert advice to the international community.

IAP also worked with IAMP to issue a joint statement, 'Antimicrobial Resistance: A call for action', which was endorsed by a majority of IAMP and IAP member academies. The report, released on 18 November 2013, received added visibility through the concurrent release of a commentary published in *The Lancet*, and through its presentation to the executive board of the World Health Organization (WHO), thus bringing the concerns of the world's academies of science and medicine to the attention of global health leaders.

In collaboration with the InterAcademy Council (IAC), IAP also undertook a fundraising campaign during 2013, requesting both voluntary membership contributions as well as support to develop a large-scale fundraising campaign. Many academies pledged contributions and have offered in-kind support to host workshops or other meetings. This financial and in-kind support strengthens IAP and its mission to help academies of science to work together, which would not be possible without the generous contribution from the government of Italy which ensures the continuation of IAP's core activities.

INTERACADEMY MEDICAL PANEL

Hosted by TWAS at its headquarters in Trieste and supported by IAP, the InterAcademy Medical Panel (IAMP) is a network of 73 of the world's medical acad-

emies and medical sections of academies of science and engineering. IAMP is committed to improving health worldwide, with a special focus on low and middle-income countries.

The 2013 IAMP General Assembly was held in Johannesburg, South Africa, in August, kindly hosted by the Academy of Science of South Africa (ASSAf). Among the main outcomes was the election of a new Executive Committee that will guide IAMP activities for the next three years. Co-chair Lai-Meng Looi (Malaysia) was re-elected, while Detlev Ganten (Germany) was also elected.

Linked to the General Assembly, IAMP and ASSAf organized a scientific conference attended by 148 participants from 38 countries on the theme: 'Changing Patterns of Non-Communicable Diseases'.

IAMP is also a founding member of the M8 Alliance of Academic Health Centres, Universities and National Academies, a collaboration of academic institutions of educational and research excellence which organizes the World Health Summit (WHS) every year in Berlin, Germany. The 2013 WHS, which hosted some 1,000 participants, took place from 20 to 22 October. During the event, IAMP organized a symposium on 'Research Capacity Strengthening in Low and Middle Income Countries'. The symposium was a follow-up to the May 2013 release of the IAMP Statement on 'A Call for Action to Strengthen Health Research Capacity in Low and Middle Income Countries'. Among the conclusions of the symposium were that current health challenges – including emerging and drug-resistant infections, challenges linked to ageing populations, and an increase in non-communicable diseases – are shared by all countries whatever their stage of development. Thus research capacity of the poorest nations must be enhanced so that they can collaborate equally in tackling these challenges.

In 2013, the IAMP Young Physician Leaders (YPL) programme, which aims at "fostering a new generation of leaders in global health for the 21st Century", hosted 20 participants from 17 countries. In addition to receiving leadership training, participants also attended the WHS where they organized a symposium that discussed the challenges they face in their careers and how current leaders could assist the next generation. On 5 April, the first regional YPL workshop was held in conjunction with the regional WHS in Singapore, bringing together ten outstanding physicians under the age of 40 from Asia, including from Laos, Myanmar and Vietnam.

iamp
the interacademy medical panel

APPENDICES

2013 in Figures

TWAS's **South-South Fellowships** are awarded in collaboration with partner organizations in a number of developing countries. In 2013, TWAS offered a total of 207 fellowships, of which 186 have been accepted. Partners include the National Council for Scientific and Technological Development (CNPq), Brazil; the Chinese Academy of Sciences (CAS); the Council for Scientific and Industrial Research (CSIR), India; the Department of Biotechnology (DBT), Government of India; the S.N. Bose National Centre for Basic Sciences, India; the Indian Association for the Cultivation of Sciences (IACS); the Iranian Research Organization for Science and Technology (IROST); the International Centre of Insect Physiology and Ecology (icipe), Kenya; the *Universiti Sains Malaysia* (USM); *Universiti Putra Malaysia* (UPM); the National Science and Technology Council (CONACyT), Mexico; the National Centre of Excellence in Molecular Biology (CEMB), Pakistan; the International Centre for Chemical and Biological Sciences (ICCBS), Pakistan; the COMSATS Institute of Information Technology (CIIT), Pakistan; the National Centre for Physics (NCP), Pakistan; and the National Centre for Genetic Engineering and Biotechnology (BIOTEC), Thailand.

Programme partner	PhD fellowships		Postdoctoral fellowships		Visiting scholars	
	Awarded	Accepted	Awarded	Accepted	Awarded	Accepted
CNPq, Brazil	33	30	19	18	-	-
CAS, China	74	74	-	-	-	-
CSIR, India	14	14	3	3	-	-
DBT, India	4	4	3	2	-	-
IACS, India	0	0	0	0	-	-
S.N. Bose, India	1	1	1	0	-	-
IROST, Iran	-	-	4	pending	-	-
icipe, Kenya	0	0	0	0	1	1
USM, Malaysia	10	10	6	6	2	1
UPM, Malaysia	-	-	5	pending	5	pending
CONACyT, Mexico	-	-	10	10	-	-
CEMB, Pakistan	0	0	0	0	-	-
ICCBS, Pakistan	10	10	1	1	-	-
CIIT, Pakistan	0	0	0	0	0	0
NCP, Pakistan	-	-	0	0	1	1
BIOTEC, Thailand	-	-	0	0	-	-
TOTAL	*146*	*143*	*52*	*40*	*9*	*3*

In 2013, 44 **TWAS Research Grants for Individuals** of up to USD15,000 each were awarded to researchers in countries lagging in science and technology.

Geographical area	Biology	Chemistry	Mathematics	Physics	*TOTAL*
Africa and Arab region	16	6	0	2	*24*
Asia and Pacific region	5	8	1	2	*16*
Latin America and the Caribbean	2	1	0	1	*4*
TOTAL	*23*	*15*	*1*	*5*	*44*

In 2013, 20 **TWAS Research Grants for Groups** were funded in science-and-technology-lagging countries with grants of up to USD30,000 each.

Geographical area	Biology	Chemistry	Mathematics	Physics	*TOTAL*
Africa and Arab region	3	3	0	1	*7*
Asia and Pacific region	6	3	0	2	*11*
Latin America and the Caribbean	1	0	0	1	*2*
TOTAL	*10*	*6*	*0*	*4*	*20*

Under the **TWAS-UNESCO Associateship Scheme**, TWAS appointed 28 developing-world scientists from 16 countries as associates in 2013. Algeria, Botswana, Ghana, Iraq, Sudan, Tanzania and Vietnam were among the home countries of scientists appointed under the programme. In addition, 35 TWAS-UNESCO associates travelled to carry out collaborative research at scientific institutions in 11 countries in the developing world: Argentina; Botswana; China; Taiwan, China; Egypt; India; Indonesia; Jordan; Mexico; South Africa; and Thailand.

Geographical area	Awarded	Hosted
Africa and Arab Region	11	6
Asia and Pacific	14	17
Latin America and Caribbean	3	5
TOTAL	*28*	*28*

Under the **TWAS Research and Advanced Training Fellowship** Programme, nine developing-world scientists from five countries – Cameroon, Central African Republic, Iran, Kenya and Nigeria – were able to visit research institutes in four host countries: Cameroon, China, India and South Africa.

Geographical area	Awarded	Hosted
Africa and Arab Region	*7*	3
Asia and Pacific	2	6
Latin America and Caribbean	0	0
TOTAL	*9*	*9*

In 2013, TWAS provided financial support to 20 **scientific meetings** in the developing world.

Geographical area	*TOTAL*
Africa and Arab region	*7*
Asia and Pacific region	*7*
Latin America and the Caribbean	6
TOTAL	*20*

In 2013, in response to a 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 Cooperators awarded 26 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	1	0	0	1	3	2	*7*
Asia	1	4	5	5	4	0	*19*
TOTAL	*2*	*4*	*5*	*6*	*7*	*2*	*26*

Under the **TWAS Research Professors in Least Developed Countries** programme, two TWAS fellows travelled to host centres in least developed countries in 2013.

TWAS Fellow	Country of residence	Field of expertise	Host institution in LDC	Year of appointment
Mahouton Norbert Hounkonnou	Benin	Physics	Department of Physics, University of Zambia, Lusaka, Zambia	2011
Kalyan Bidhan Sinha	India	Mathematical Sciences	International Chair in Mathematical Physics and Applications, ICMPA-UNESCO Chair, Cotonou, Benin	2009

Under the **TWAS Visiting Scientist Programme**, seven scientists travelled to host centres in 2013.

Visiting Scientist	Country of residence	Field of expertise	Host institution	Year of appointment
Khay Chhor	France	Materials Chemistry	Chemistry Department, Royal University of Phnom Penh, Phnom Penh, Cambodia	2013
Anuradha Dube	India	Chemotherapy and Immunobiology of Leishmania Infection	Department of Parasitology, Faculty of Medicine, University of Colombo, Sri Lanka	2013
Omar El Seoud	Brazil	Chemistry	Faculty of Science, Ain-Shams University, Cairo, Egypt	2012
Carole McArthur	USA	Immunology and Infectious Disease (HIV/AIDS/TB)	University of the Western Cape, Bellvielle, Cape Town, South Africa	2013
Carlos Esteban Suarez	USA	Development of Improved Control Measures Against Tick-Borne Haemoparasites Using Molecular Biology Approaches	National Research Centre, Dokki, Giza, Egypt	2013
Issa Tapsoba	Burkina Faso	Analytical Chemistry, Sensors and Biosensors Conception for Environmental Control.	Faculty of Science, University of Tunis El Manar, Tunis, Tunisia	2013
Aaron Wolf	USA	Water Resources Conflict and Cooperation	International Water Management Institute (IWMI), Southeast Asia, Regional Office, Vientiane, Lao PDR	2013

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 visits of two-to-three months at institutions in Germany. In 2013, 30 young African scientists were supported.

Country of origin	Awarded
Burundi	2
Cameroon	3
Ghana	2
Nigeria	*17*
Botswana, Burkina Faso, Côte d'Ivoire, Madagascar, Sudan, Uganda	6 (1 per country)
TOTAL	*30*

The TWAS Secretariat

Executive Director's Office

Executive Director
Romain Murenzi

Special Advisor
Giusto Sciarabba

Helen Martin
Sandra Ravalico
Vanessa Varnier (from February 2013)

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Antonino Coppola
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Patricia Presiren
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Programme Officer
Peter McGrath (until October 2013)
Lucilla Spini (from November 2013)

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Public Information Officer
Edward W. Lempinen

Tonya Blowers (until April 2013)
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Cristina Serra
Sean Treacy (from May 2013)

OWSD - Organization for Women in Science for the Developing World

Coordinator
Tonya Blowers (from August 2013)

Sara Dalafi
Leena Mungapen

IAP - the global network of science academies

IAMP - InterAcademy Medical Panel

Coordinator
Lucilla Spini (until October 2013)

Peter McGrath (from November 2013)
Muthoni Kareithi
Joanna Lacey

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

Financial Report 2013

FINANCE

The total amount of funds received for activities in 2013 was USD4,870,465. The main contributions from: the Ministry of Foreign Affairs, Italy (USD2,103,118); the Swedish International Development Cooperation Agency (Sida) (USD1,937,430); CONICET, Argentina (USD331,323); COMSTECH, Pakistan (USD179,840); Lenovo Group Limited, China (USD100,000); the Kuwait Foundation for the Advancement of Sciences (KFAS) (USD50,000); the Ministry of Research, Science and Technology, Iran I.R. (USD40,723); African Union, Ethiopia (USD38,000); German Research Foundation (DFG), Germany (USD30,518); the Academia Sinica, China (Taiwan) (USD27,174).

On 31 December 2013, the TWAS Endowment Fund stood at USD12,209,932, with the target set at USD25million. Donation during 2013 totalled USD29,578 including USD25,000 from the Consejo Nacional de Ciencia y Tecnologia (CONACYT), Mexico; plus other contributions amounting to USD4,578. Interest in 2013 totalled USD60,963.

INDIVIDUAL DONATIONS (IN USD)

TWAS gratefully acknowledges the generous contributions to its programmes and Endowment Fund from the following TWAS Fellows:

Michael Philip Alpers, Australia	261.78
Robin Crewe, South Africa	300.00
Salif E. Diop, Senegal	500.00
He Fuchu, China	1,620.00
Salim Abdool Karim, South Africa	5,000.00
Fayzah M.A. Al-Kharafi Kuwait	10,000.00
Li Desheng, China	500.00
Keto Elitabu Mshigeni, Tanzania	500.00
Khavtgain Namsrai, Mongolia	300.00
Atta-ur-Rahman, Pakistan	5,000.00
Harold Ramkissoon, Trinidad and Tobago	482.00
C.N.R. Rao, India	5,000.00[1]
Herbert W. Roesky, Germany	63.86
Bishal Nath Upreti, Nepal	100.00
Hans J Van Ginkel, Netherlands	654.46
Henry Nai Ching Wong, China	634.82
Yongyuth Yuthavong, Thailand	1,000.00
TOTAL (in USD)	**31,916.92**

[1] *in-kind donation for C.N.R. Rao Prize*

A donation to TWAS directly supports the advancement of science, engineering and technology in developing nations and demonstrates commitment to the Academy's vitally important mission.

To make a donation, please visit *www.twas.org/support-twas*

TWAS FINANCIAL REPORT 2013 (IN USD)

INCOME[1]	
Balance	603,783
1) Ministry of Foreign Affairs, Italy	2,103,118
2) Swedish International Development Cooperation (Sida)	1,937,430
3) CONICET, Argentina	331,323
4) COMSTECH, Pakistan	179,840
5) Lenovo Group Limited, China	100,000
6) Kuwait Foundation for the Advancement of Sciences (KFAS)	50,000
7) Ministry of Research, Science and Technology, Iran I.R.	40,723
8) African Union, Ethiopia	38,000
9) DFG, Germany	30,518
10) Academia Sinica, China (Taiwan)	27,174
11) Chinese Academy of Sciences (CAS), China	10,000
12) Atta-ur-Rahman, Pakistan	5,000
13) Other small contributions	17,339
14) Interest income	13,487
15) Exchange difference	6,170
16) Transfer from TWAS Endowment Fund (Interest)[2]	1,560,000
17) Transfer from TWAS Endowment Fund (Ministry of Science and Technology, China)[3]	300,000
18) Transfer from TWNSO account	431
	7,354,336

EXPENDITURE	Spent
1) Prizes	
1.1) Trieste Science Prize/TWAS Lenovo Science Prize	104,698
1.2) TWAS Prizes and Medals	141,021
1.3) Prizes for Young Scientists	22,000
1.4) CNR Rao and Atta-ur-Rahman Prize	5,000
Sub-Total for (1)	272,719
2) Research Grants	2,060,620
3) Fellowships, Associateships and Professorships	
3.1) Fellowship Programmes	244,188[4]
3.2) Associateship, Professorship & Visiting Programmes	130,426
Sub-Total for (3)	374,614
4) Meetings	
4.1) Council and General Meetings	327,189
4.2) Officers and Steering Committee Meetings and Meetings in Trieste	36,656
4.3) Scientific Meetings in the South	58,544
Sub-Total for (4)	422,389
5) Publications	97,152
6) Joint Projects	
6.1) TWAS Regional Offices	439,453
6.2) TWAS-AAS-Microsoft Project	(25,962)
6.3) TWAS/COMSTECH Research Grant	197,090
6.4) Elsevier Women Prizes	50,388
6.5) TWAS – ICGEB Project	(5,000)
6.6) TWAS – ICTP Projects	50,000
6.7) AU – TWAS Young Scientists National Award	85,027
6.8) International Science Diplomacy Programme	66,980
6.9) EU Catalyst Project	28,639
6.10) GRC Meeting, Ethiopia	(3,635)
Sub-Total for (6)	882,980
7) Operational Expenses	
7.1) Staff Costs	1,284,051
7.2) ICTP Services	74,552
7.3) Communications	33,732
7.4) Travels	36,352
7.5) Library, office and other supplies	22,368
7.6) Other general operating expenses	43,860
Sub-Total for (7)	1,494,915
Total	5,605,389
Excess (shortfall) of income over expenditure[5]	1,748,947
Reserve Fund[6]	
Amount available at the beginning of period	2,823,229
End of service entitlements	(32,413)
Reserve Fund balance end of period	2,790,816
Reserve and Regular Fund balances, end of period	4,539,763

[1] *All contributions are expressed in US dollars and have been converted using the UN official rate of exchange in effect at the time the contributions were received.*

[2] *As approved by the TWAS Council and General Meeting in Argentina, October 2013.*

[3] *As approved by the Ministry of Science and Technology, China.*

[4] *The funds for 2013 TWAS/CONACYT Fellowship included in the line 3.1 have been obligated in January 2014 and not prior the closure of 2013 accounts due to delay concerning the final approval of the Fellowships. Hence, this is taking into account in the 2014 proposed budget.*

[5] *2013: The excess of income corresponds to an outstanding amount to be committed in 2014 for contracts relating to the 2013 budget.*

[6] *The purpose of the Reserve Fund is to cover the end of service entitlements of TWAS Staff.*

TWAS Annual Report 2013
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- Lenovo Group Ltd., China
- Kuwait Foundation for the Advancement of Sciences (KFAS)
- Ministry of Research, Science and Technology, Isl. Rep. of Iran
- African Union (AU)
- German Research Foundation (DFG)
- Academia Sinica, Taiwan, China
- Chinese Academy of Sciences, China

THE WORLD ACADEMY OF SCIENCES (TWAS)
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