ANNUAL REPORT 2012

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The World Academy of Sciences - for the advancement of science in developing countries (TWAS) is an autonomous international organization that promotes scientific capacity and excellence in the South.

Founded in 1983 by a group of eminent scientists under the leadership of the late Nobel laureate Abdus Salam of Pakistan, TWAS was officially launched in Trieste, Italy, in 1985, by the secretary-general of the United Nations.

TWAS has more than 1,000 members from over 90 countries. More than 80% of its members are from developing countries. A 13-member council directs Academy activities. A secretariat, headed by an executive director, coordinates the programmes. The Academy's secretariat is located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

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

The main objectives of TWAS are to:

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

To help achieve these objectives, TWAS collaborates with a number of organizations, most notably UNESCO and ICTP, as well as 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

TWAS COUNCIL

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FOREWORD

The Road Ahead

Jacob Palis
TWAS President

The foreword of the TWAS Annual Report is typically devoted to the president's review of the year just ended. But 2012 is my sixth and final year in this office, and it seems an appropriate time to reflect on all that we have accomplished together in these years, and on some important work that waits ahead, left in very good hands of new President Bai Chunli and the new Board and Council.

Certainly I am proud and honoured to have served in this position, but it is also humbling when I consider the men who have preceded me. Abdus Salam, the founder of TWAS, was a great man, a Nobel laureate with a vision, and such boundless energy that he could seemingly will the vision to life. It was Salam who inspired in me the commitment to work for the advancement of science and technology in my own country, and in the developing world. Salam was succeeded by my fellow Brazilian, the chemist José I. Vargas, and then by C.N.R. Rao of India. Both men are close friends, and they, too, inspired me. I worked as secretary-general from 2001-2006, while Rao was president, and our collaborations helped produce a special rapport. Mohamed H.A. Hassan, who has made such a durable impact as TWAS's long-time executive director and now as its treasurer, has been a leader of admirable skill. When I took the office of TWAS president, I tried to be faithful to their message and their good work, and to build on their accomplishments.

I hope you will agree that we have contributed to some clear progress in these years, and that we have done good service to science in the developing world.

TWAS Postgraduate (PhD) awards rose from 39 in 2007 to 79 in 2011 (+102.6%), and for 2012 we will equal or surpass that number. Postdoctoral fellowships have risen from 35 in 2009 to 56 in 2012 (+58.3%). Postdoctoral awards have risen from 34 in 2007 to 49 (+44.1%). Postgraduate fellowships rose from 66 in 2009 to 78 (+18.2%). Research grants are up from 45 in 2009 to 85 in 2012 (+88.9%). And PhD fellowships granted by the Organization for Women in Science for the Developing World have more than doubled, from 22 in 2009 to 46 in 2012.

I must also note that, over the years, several nations have organized impressive TWAS General Meetings. Brazil, South Africa, India and ICTP-Italy all hosted conferences that showcased the beauty, creativity and problem-solving power of science. Mexico City in 2008 hosted a wonderful meeting that celebrated TWAS's 25th anniversary. We are grateful to the scientific communities and governments.

The 23rd General Meeting held in Tianjin, China, certainly was the high point of 2012. Chinese President Hu Jintao delivered an inspiring address, and in a moment of great

importance for our long-term strength, he announced that the government of China would donate USD1.5 million to TWAS. That donation pushed the TWAS Endowment Fund to its highest level ever, about USD14 million. With the election of new Fellows in Tianjin, the number of women has risen from 51 out of 839 members (6%) in 2007 to 104 out of 1,068 members, just a fraction less than 10% of our Academy.

We awarded the first-ever TWAS-Celso Furtado Prize in the Social Sciences to Ricardo Paes de Barros for his work on public policies to alleviate poverty and inequality. The prize is named for the late Celso Furtado, a highly regarded Brazilian economist who focused on the plight of the poor in Brazil and South America.

Of course we know well how much work remains to be done. By TWAS's count, there remain 81 S&T lagging countries, and we have to also focus our attention – our fellowships and grants, our programmes and our communication – on them.

We need to do more to build the ranks of excellent women scientists in the developing world, and we should elect the very best of them to the Academy. We need to upgrade TWAS's digital infrastructure to allow for electronic applications for fellowships, grants and other programmes. We should continue the quest for our own headquarters building and step up efforts to reach our goal of $25 million in the TWAS Endowment Fund. As Salam often urged, we must think big.

With the election of Bai Chunli as the new president of TWAS, I am very confident that our energy and positive impact will continue and expand. Bai is a brilliant scientist; already we see the commitment he brings to TWAS, and because he also is the president of the Chinese Academy of Sciences, great synergies will be possible. TWAS's pre-eminent prize has been the Ernesto Illy Trieste Science Prize, but in 2013 it will continue as the TWAS-Lenovo Science Prize, underwritten by the Chinese technology firm. This good news has certainly much to do with Bai's effort. I am sure much more will come of his leadership and guidance.

During 2012, and throughout my years at TWAS, we have used all of these tools – fellowships and grants, prizes, the experience and skill of our Board, Council and members – for the ultimate goal of building science in the developing world. Often, it has seemed to me that we were an orchestra playing a beautiful symphony together. In October 2013, our Academy will convene in Buenos Aires, Argentina, celebrating its 30th Anniversary. I expect that this will be the latest in a remarkable sequence of meetings, with great participation and enthusiasm by the members. This reflects the sort of magic we do: bringing people together, celebrating the accomplishments of science and renewing our efforts to promote science and technology for the sake of our societies.

2012: The Year in Review

Romain Murenzi
Executive Director
TWAS

This year has featured a number of initiatives that demonstrate TWAS's current strength along with emerging programmes that offer promising signs for the future.

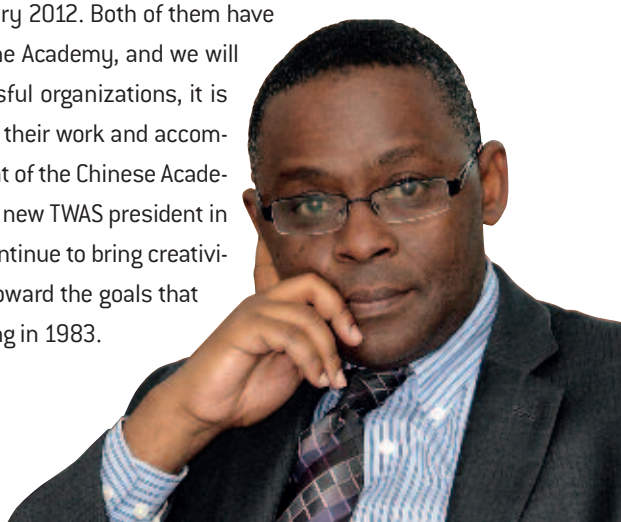
Certainly our 23rd General Meeting, held in 2012 in Tianjin, China, was a reflection of our organization's continuing importance in supporting science for the developing world. Chinese President Hu Jintao delivered a thoughtful and inspiring address on the importance of research in addressing global challenges. Hu also announced a major contribution that will support TWAS's growing Endowment Fund.

My first full year at TWAS has reinforced my belief that, for each developing nation, it is critically important to build a foundation of PhD researchers. Not only do these scientists and engineers conduct advanced research; they bring data and insight to policymakers, they become hubs for international networks, and they teach and become mentors. I am glad to report that TWAS PhD and postdoctoral programmes are doing very well and poised for future growth.

Partnerships, of course, are essential to TWAS's work and its impact. Throughout 2012, TWAS benefited greatly from its long-standing partnerships with the government of Italy, UNESCO and the Abdus Salam International Centre for Theoretical Physics (ICTP). Another longtime partner, the Swedish International Development Cooperation Agency (Sida), awarded significant grants aimed at supporting additional fellowships for women in science, research grants and initiatives in science diplomacy.

Science diplomacy is an area where we are investing new energy. Last year, TWAS agreed with the American Association for the Advancement of Science (AAAS) to collaborate on an International Programme on Science and Diplomacy. This year, we had our first AAAS-TWAS event, and we are planning more. In addition, we have embarked on new science diplomacy projects with other partners.

TWAS remains in a period of transition. Jacob Palis completed his two terms as our president at the end of 2012. Daniel Schaffer, who served 15 years as TWAS public information officer, retired in January 2012. Both of them have made enormous contributions to the Academy, and we will miss them. But as with all successful organizations, it is part of our mission now to build on their work and accomplishments. Bai Chunli, the president of the Chinese Academy of Sciences, begins work as the new TWAS president in 2013. I am confident that we will continue to bring creativity and energy to bear as we work toward the goals that have defined TWAS since its founding in 1983.



These initiatives and accomplishments from 2012 are clear signs of our continuing progress:

General Meeting in Tianjin, China

- The 23rd General Meeting was attended by over 400 TWAS members and other invitees from 40 countries; 49 eminent scientists were elected as new members, bringing TWAS membership to 1,074. Five of the new members are women.
- In an address opening the convention, Chinese President Hu Jintao announced that his government would donate USD1.5 million to TWAS.
- Bai Chunli, an accomplished and influential scholar in chemistry and nanotechnology, was elected to a three-year term as TWAS president.
- Members approved a name change. Henceforth, we will be called "The World Academy of Sciences – for the advancement of science in developing countries".

Prizes and Awards

- At the TWAS General Meeting, the 13 2011 TWAS Prizes winners received their awards; 12 winners for 2012 were named.
- Yuk Ming Dennis Lo from the Chinese University of Hong Kong was awarded the Ernesto Illy Trieste Science Prize. This year the prize's subject was human health.
- Mohamed H.A. Hassan received the Abdus Salam Medal in recognition of his extraordinary commitment and accomplishment as the executive director of TWAS from 1985 to 2011.
- The inaugural TWAS-Celso Furtado Prize in Social Sciences was awarded to Ricardo Paes de Barros from Brazil for his advocacy of evaluating and refining public policies aimed at alleviating poverty and inequality.
- The inaugural Atta-ur-Rahman Prize in Chemistry was awarded to chemist Shamsun Nahar Khan of Bangladesh for her work on enzyme identification and inhibition.

Fellowship and Exchange Programmes

- TWAS awarded a total of 159 South-South fellowships, of which 139 were accepted. Seventy-five of the accepted scholarships were for postgraduates, 44 were postdoctoral, and 20 were for visiting scholars.
- With funding from Sida, we provided 50 grants to individual young scientists and 18 research units in countries lagging in science and technology. The Academy also partnered with COMSTECH to support 17 grants to young scientists in Organization of Islamic Cooperation member states.
- The TWAS-UNESCO Associateship provides scientists in developing countries with opportunities to develop long-term links with centres of excellence in the South. In 2012, TWAS supported 24 visits to institutions in developing countries.
- 19 young African scientists were awarded the opportunity to travel to a host institute in Germany under the TWAS-DFG (German Research Foundation) Cooperation Visits Programme.

Regional Offices

• TWAS's five Regional Offices undertook their regular series of activities: appointing 23 Young Affiliates; announcing the winners of the TWAS Regional Prizes; and also awarding a number of internships and prizes for young scientists. In addition, the offices organized several Regional Conferences for Young Scientists.

Global engagement

• I was among a small group of delegates invited to attend a meeting in Bellagio, Italy, aimed at encouraging and supporting scientific collaboration between the United States and the Democratic People's Republic of Korea.

• TWAS began working with the new Global Research Council (GRC), comprised of the heads of science and engineering funding agencies from around the world. At the Council's request, TWAS convened the GRC Regional Meeting for Sub-Saharan Africa in Addis Ababa, Ethiopia. TWAS Programme Officer Peter McGrath later attended a meeting of the GRC International Steering Committee in Brasilia, Brazil.

• More than 40 physicists and engineers from 20 developing countries attended the 'Workshop on Entrepreneurship for Physicists and Engineers from Developing Countries' at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy. The five-day workshop was jointly organized by the Institute of Physics, the American Physical Society, ICTP and TWAS.

• Mary O'Kane, chief scientist & engineer for the government of New South Wales in Australia, visited Trieste to deliver the first programme under the TWAS-AAAS 'International Programme on Science and Diplomacy'.

Italian engagement

• TWAS was admitted as a formal member of the Trieste Science System after signing a memorandum of understanding endorsed by the Trieste municipal government and 20 local research institutions.

• TWAS played a key role in *TriesteNEXT,* a new research forum that brought thousands of scientists and members of the public together in September for three days of events focused on food production and security. TWAS organized the closing lecture, and a booth at the forum allowed us to explain our work to the public.

• Italian news media – print, broadcast and online – carried 44 stories mentioning TWAS in 2012.

These projects and events, along with many others, demonstrate how TWAS works locally and globally, in the South as well as the North, to offer programmes and build networks that advance science in the developing world. I look forward to expanding these projects and launching new ones in 2013, assuring that TWAS will continue to have an impact on the challenges that define our times.

The TWAS 23rd General Meeting, which took place from 17 to 21 September 2012, included more than 400 scientists from 40 countries, mainly TWAS fellows from developing countries. The meeting was held at the Tianjin Great Hall in Tianjin, China.

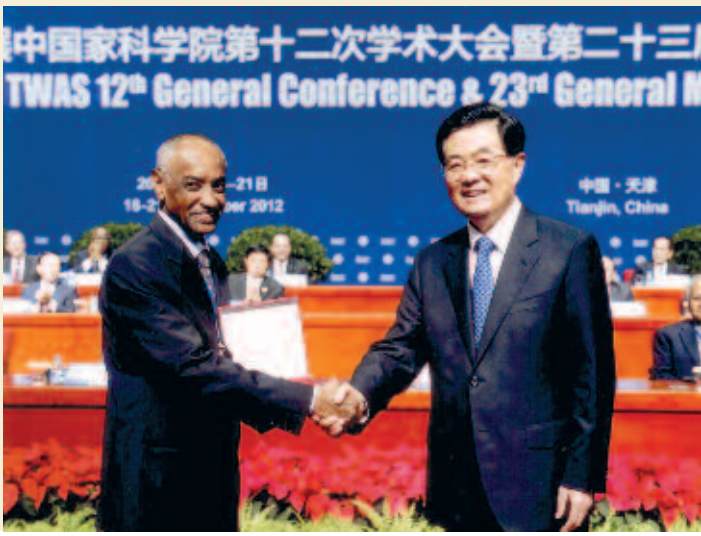
TWAS in Tianjin

The 23rd general meeting of TWAS was an occasion to mark both a happy return and a new beginning. In 1987, TWAS held its annual meeting in Beijing, the first time ever the gathering of scientists from throughout the developing world was hosted outside the Academy's headquarters in Trieste. The Academy returned to China again in 2003, and for a third time in 2012, meeting in the major Chinese port city of Tianjin and naming its first-ever Chinese leader: chemist and nanoscientist Bai Chunli.

The annual meeting 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 with whom they may wish to collaborate in the future. It was also the scene of high-profile presentation on science and technology development in China, featuring a lecture on the progress of China's lunar exploration program and another

on the electron-antineutrino disappearance at China's Daya Bay Reactor Neutrino Experiment.

Brazilian mathematician Jacob Palis, who closed out six years as TWAS president at the end of 2012, spoke at the meeting's opening ceremony about China's importance in providing opportunities to scientists in the global South. "No other country has hosted so many TWAS meetings and this reflects the strength of the relationship that has existed historically between China and TWAS, which is set to grow even stronger," Palis said. "Participants were able to see first-hand China's ongoing efforts to build scientific capacity and apply that capacity to its economic development goals."



Palis was succeeded by Bai, who also serves as head of the Chinese Academy of Sciences (CAS). Bai was unanimously selected as the Academy's new president, slated to begin the job in January 2013. "There is no better indication of the close cooperation between China and the developing world than that between the Chinese scientific community and TWAS," said Bai.

Chinese President Hu Jintao gave a speech before about 2,000 delegates and scientists hailing the importance of science and technology for the advancement of humanity. Hu noted that China is committed to collaborating with developing countries – and China supported TWAS with a $1.5 million contribution. He also discussed advancements in space exploration, hybridized rice and quantum communication that helped support the Chinese economy and its population of 1.3 billion people.

"Every step forward society takes has been closely connected with a revolutionary breakthrough in science and technology: from barbarism to civilization, and from poverty to prosperity," Hu said.

China has a history of providing opportunities for budding scientists from the developing world to advance their careers. The fellowship provides financial support for students from developing countries who are pursuing PhDs full-time at major Chinese universities and institutes.

"This year's TWAS General Meeting and General Conference was a very successful occasion for TWAS and our local hosts, the Chinese Academy of Sciences and the Tianjin Municipal People's Government", said Romain Murenzi, executive director of TWAS. "There is so much high-quality work being done in science and technology now in developing countries, and it is always a great honour to be able to listen to new discoveries that are being made and to learn about work in progress that has the power to change things. It is most gratifying, too, to see young scientists meeting with senior scientists and exchanging ideas and contact details."

At the meeting, the academy elected 49 new members, five of them women. Membership at the end of 2012 stands at 1,074, and some new members are from underrepresented nations including Jamaica and

Argentina. Twenty-three young affiliates were chosen and attended their first TWAS conference.

HIGHLIGHTS OF THE 22ND GENERAL MEETING:

• *Election of new president.* Coming to the end of his six-year term as TWAS president, Jacob Palis opened the General Meeting by welcoming participants and immediately organized the ballot for the new president of TWAS. Bai Chunli, president of the Chinese Academy of Sciences, was unanimously elected by members and will take up office in January 2013. Palis told the meeting that Bai had "already contributed a great deal to TWAS as vice president over the past six years".

• *Brief speeches by representatives of organizations that support TWAS.* Speakers at the opening session included a number of dignitaries, among them Immacolata Pannone, representative of the Italian Ministry of Foreign Affairs; Gretchen Kalonji, UNESCO's assistant director general for natural sciences; and AnnaKarin Jonsson Norling, representing the Swedish International Development Cooperation Agency.

• *Ernesto Illy Trieste Science Prize.* This prize, the most prestigious offered by the Academy, carries an award of USD100,000 generously provided by the Trieste-based coffee company, illycaffè. The prize honours a subject area that changes annually, and in 2012 its subject was human health. The winner was Yuk Ming Dennis Lo from the Chinese University of Hong Kong, for his work developing a technology for scanning the whole genome of a fetus from a blood sample from its pregnant mother. Anna Illy, widow of the late Ernesto Illy and the current president of the Illy Foundation, presented the award together with Trieste Mayor Roberto Cosolini.

• *A special 'Forum on National Academies and Open Innovation.'* Invited speakers came from Argentina, Australia, Brazil, China, Germany, India, Nigeria, Senegal, South Africa and the United Kingdom.

LECTURE HIGHLIGHTS

• A symposium by the local organizers of the TWAS General Meeting illustrated the breadth and extent of scientific and engineering progress in China. Zi-Yuan Ouyang, a researcher from the CAS National Astronomical Observatories, outlined advances in China's lunar exploration, reminding participants that earlier in 2012 China not only successfully docked a manned spacecraft with a space station, but also sent a female astronaut into space for the first time. He also detailed the accomplishments of Chinese lunar orbiters Chang'E 1 and 2.



Vivian Wing-Wah Yam, director of the Institute of Molecular Functional Materials and Department of Chemistry, talked on the design, assembly and functions of luminescent metal-based molecular materials, and Yi-Fang Wang discussed the observation of electron-antineutrino disappearance at Daya Bay, giving a whole picture of the experiment in which a new type of neutrino oscillation, which is extremely difficult to detect, was observed. He also explained the structure of the detector located 60 kilometers from Hong Kong.

Chung-I Wu told of China's cutting-edge research on evolution, genomics and cancer and discussed how natural selection affects intra-tumor genetic diversity. Xiaohong Fang presented a study of molecular interaction and dynamics in living cells. Closing the symposium, Jian-Wei Pan from the University of Technology and Science of China reviewed his long experience in stable quantum information processing.

- A second symposium looked at interdisciplinary overlaps, with an inspiring talk from Abdallah Daar on "Innovation in global health: Grand Challenges Canada and its Rising Stars program". Young scientists present at the conference were encouraged to apply.
- Wan Gang, minister of science and technology for the People's Republic of China, outlined how China has so successfully linked its science and technology programmes to development.
- Presentations by three TWAS Fellows included Berhanu Abegaz from Ethiopia, Jinghai Li from China, and Richard Zare from the United States. They presented their TWAS Medal Lectures on "Intra-African cooperation in chemical sciences", "Meso-scale science" and "TB or not TB?".
- The winner of the TWAS Regional Office for East and South East Asia and the Pacific prize for "Building Scientific Institutions", Yin Li, was invited to present his work on "Building up strength in biotechnological manufacturing: from concept to strategic emerging industry".
- Zimbabwe Minister for Science and Technology Development Henry Dzinotyiweyi, spoke about the new coalition government's plans to attract Zimbabwean scientists back to their homeland.

OTHER HIGHLIGHTS

- Members of the Academy elected the previous year were inducted during a special ceremony, where each member is awarded a certificate and signs his or her name in a special book. In 2012, TWAS elected 49 new members (45 Fellows and four Associate Fellows), including five women. These members will be welcomed into the academy next year. That brought membership to 1,074.

TWAS is particularly pleased to report that new members have been elected from countries that are

under-represented in the Academy, including Jamaica and Argentina. Eight new members come from the African continent: Ethiopia (1), Uganda (1), Egypt (2), Kenya (1), Nigeria (2) and South Africa (1). Other new members are from China (16), India (9), Brazil (7), and Taiwan, China (3). The four associate fellows, including one woman, have been elected from Japan, the Netherlands, and the United States.

• TWAS Prize winners from 2011 received their awards and presented lectures on their research. Their work included practical applications of science that have a direct impact on developing economies, such as agricultural innovations in food security and sustainability in Africa and improvements in mobile telephone communications. They also lectured on fundamental work in the basic sciences, such as contributions to non-linear fractional elliptic equations.

• Winners of the 2012 TWAS Prizes were selected and announced at the meeting. Awarded annually, these prizes, worth USD15,000, rank among the highest scientific accolades given to scientists in developing countries.

• The TWAS 2012 Medal was awarded to CAS Vice President Li Jinghai. Some other CAS scientists were also awarded with TWAS Prizes and Medals, including Jiang Lei with the CAS Institute of Chemistry, who won the TWAS 2011 Prize for Earth Sciences together with S.K. Satheesh from the Indian Institute of Science. Li Yin, a researcher from the CAS Institute of Microbiology, won the TWAS Regional Prize for "Building Scientific Institutions" together with five other scientists: Rogério Cerqueira Leite from Brazil, Magdy Madkour from Egypt, Charles Obadiah Wambebe from Nigeria, Jaynat Narlikar from India and Yousef Sobouti from Iran.

• The first-ever winner of a new social science prize was announced. It was donated by the Brazilian government in honour of Celso Furtado, a Brazilian economist whose research contributed to putting Brazil in the strong economic position it is today. The TWAS-Celso Furtado prize was awarded to Ricardo Paes de Barros from Brazil, and underlines the Academy's commitment to honouring and including social scientists as key partners in order to ensure that scientific research and science policy are appropriately and effectively implemented in developing countries.

• The C.N.R. Rao Prize, which from 2012 will be awarded annually, went to Wendimagegn Mammo Deneke, based at the Department of Chemistry at

Addis Ababa University. Deneke presented the C.N.R. Rao Prize Lecture on "The synthesis of conjugated polymers: a contribution from Ethiopia". The prize carries an award of USD5,000, and brings to the public stage those scientists from developing countries that have made significant contributions to global science.

• The Atta-ur-Rahman Prize in Chemistry was inaugurated and awarded to Shamsun Nahar Khan, an outstanding chemist from Bangladesh. Khan was honoured in absentia for her work on enzyme identification and inhibition, cutting-edge research on the borders of chemistry and biology.

• More than 60 seminars took place, at which scientists presented a broad spectrum of investigations, ranging from innovative materials to defensive strategies used by plants against parasites and future plans to exploit solar energy.

• Certificates were presented to TWAS Young Affiliates. Twenty-three young scientists were selected as Young Affiliates, and 19 of these travelled to Tianjin to attend their first TWAS conference, to receive their certificates during the induction ceremony and later, present their research work. 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 such meetings provide.

The Young Affiliates sessions are attended by TWAS members who give support, suggestions and further contacts. Presentations this year were in the fields of medicine, chemistry, Earth sciences, molecular biology, astrophysics and mathematics. The presenters spoke with clarity and confidence, and explained their work in a visually interesting and effective way.

PROGRAMMES

The **Ernesto Illy Trieste Science Prize (TSP)**, instituted by illycaffè, TWAS and the Ernesto Illy Foundation, is an international annual award designed to give recognition to outstanding scientists living and working in the developing world. The prize, in its eighth year, brings a cash award of USD100,000 and rewards a scientist living and working in developing countries, who has profoundly impacted on science, innovation and quality of life. The winner of the 2012 edition is Yuk Ming Dennis Lo, director of the Li Ka Shing Institute of Health Sciences, for his work on non-invasive prenatal diagnosis. In 2012, the Prize was awarded in the area of human health. Previous prizes were awarded in such fields as climate change, renewable energy and materials science.

Ernesto Illy Trieste Science Prize

YUK MING DENNIS LO AND HUMAN HEALTH

High concentrations of fetal DNA float in the maternal plasma of pregnant women, and may be used for non-invasive prenatal diagnosis. This finding revolutionized the field of prenatal testing, making these procedures less stressful for mothers and less dangerous for fetuses. This seminal discovery earned Yuk Ming Dennis Lo the 2012 Ernesto Illy Trieste Science Prize (TSP).

Lo, a native of Hong Kong, is the director of the Li Ka Shing Institute of Health Sciences and the Li Ka Shing Professor of Medicine of The Chinese University of Hong Kong. He earned a bachelor's degree from the University of Cambridge and a PhD from the University of Oxford in 1994. After several years abroad, he made his way back home, and in 1997 started a new research programme in a boundary area: the investigation of extracellular DNA in plasma.

From previous experiments, Lo had already noted that the plasma and the serum of cancer patients contained tumour-derived DNA. This observation prompted him to test whether the same could be true for fetal DNA in mother's plasma, and whether this could be used for prenatal testing.

ERNESTOILLY TRIESTESCIENCEPRIZE

At that time, the two standard medical procedures used to assess the fetus' health conditions were: amniocentesis and chorionic villus sampling. With amniocentesis, also called an amniotic fluid test, "doctors examine a sample of the amniotic fluid taken from the womb in search of fetal cells to grow and test," Lo explains. "With another, even more invasive procedure, called chorionic villus sampling, they remove a placental patch of fetal tissue, which is then sent to a laboratory for genetic analysis." But because these techniques pose a risk of miscarriage due to potential infections, water breaks or prematurely induced labor, Lo said, "a new, non-invasive method was needed."

He began his new course of investigations in a time when new, highly sensitive techniques were being developed. He is thus a true pioneer in this field.

In 1997-98, he and his team explored and perfected the use of a technique called "real-time quantitative PCR", through which they were able to amplify and quantify the minute traces of fetal DNA that circulate in the mother's blood.

Lo was able to follow the physiological fluctuations of circulating fetal DNA, which peaks at a certain point during pregnancy and gets quickly cleared after delivery. This information is critical in pregnancy-associated disorders such as preeclampsia and preterm labour (the latter usually occurring between the 20th and 37th completed week of gestation), two conditions where an abnormally high DNA concentration is a good mark of ongoing problems. It may also be used to predict at-risk pregnancies.

In addition, Lo also proved that monitoring DNA concentrations was useful for sex determination, for non-invasive prenatal testing for sex-linked genetic diseases (diseases transmitted through sex chromosomes), and for fetal blood-group typing. All these applications were rapidly introduced into clinical practice and became part of the daily medical routine.

Almost a decade later, in 2008, Lo and his group turned their attention to a common genetic disorder – Down syndrome, caused by three (instead of two) copies of chromosome 21 in the cells. As a result of the extra chromosome, affected people exhibit a slower psychomotor and intellectual development. After enhancing its technique, Lo's team confirmed that by sequencing DNA molecules amplified from maternal plasma, it was possible to detect the genetic defect, thus bypassing more invasive procedures. China, Europe and the United States, among many others, now use this methodology as non-invasive prenatal testing.

Based on this work, Lo authored more than 300 articles in international journals and filed 28 patents.

His latest scientific achievement, obtained in 2010, successfully produced the "fetal genomic map", a comprehensive picture of fetal DNA, which may be compared with the parents' genome to pick out potentially dangerous mutations. For these internationally renowned accomplishments, Lo was also made a member of the Royal Society in 2011.

Dennis Lo received the Trieste Science Prize on 18 September 2012 in front of an audience of more than 500 scientists, ministers of science and presidents of science academies from around the globe. The audience was convened by TWAS for the 12th General Conference and 23rd General Meeting held in Tianjin, China, and hosted by the Chinese Academy of Sciences.

TWAS Prizes for scientific excellence, awarded annually in the fields of agricultural sciences, biology, chemistry, earth sciences, engineering sciences, mathematics, medical sciences and physics, rank among the highest scientific honours given to scientists in developing countries. Each prize carries a cash award of USD15,000. The 2012 prizes, announced during the Academy's 23nd General Meeting held in Tianjin, China, will be presented in October 2013 at the 24th General Meeting in Buenos Aires, Argentina.

TWAS Prizes

AGRICULTURAL SCIENCES

Dilfuza Egamberdieva, Microbiology and Biotechnology, National University of Uzbekistan, Tashkent, Uzbekistan

For her innovative contributions to the study of plant-microbe interactions under environmental stress conditions and their potential to improve crop production

Drought and salinity in dry regions can make the soil less fertile, causing challenges for farmers and suffering among the people they feed. But there's a clever way to help crops survive: Microbes that often seek out plant roots as a safe haven to thrive in rough conditions know a few ways to help out their host plants, too.

Scientists can use such root bacteria purposefully to help keep ailing crops healthy through trying times of nutrient-poor soil. These microbes, called "plant growth promoting rhizobacteria", have given scientists clues on how to improve crop endurance.

Dilfuza Egamberdieva of the National University of Uzbekistan in Tashkent and her colleagues created new ways to use salt-tolerant bacteria to help boost the health of crops in unfavorable conditions and determined how the bacteria stimulates plant growth under environmental stress. They also discovered that the roots of some plants growing in salt-rich soils contained a high level of potential bacteria that could infect humans, explaining some diseases that commonly infect Uzbek farmers, and were able to discern some steps that would help solve the problem.

Egamberdieva is a native of Tashkent who in 1993 graduated from the National University of Uzbekistan with a master of science degree in biology and chemistry. She continued her research in Leibniz Centre for Agricultural Landscape Research in Germany, and in 2000 obtained her PhD in agricultural science from the Humboldt University of Berlin, Germany.

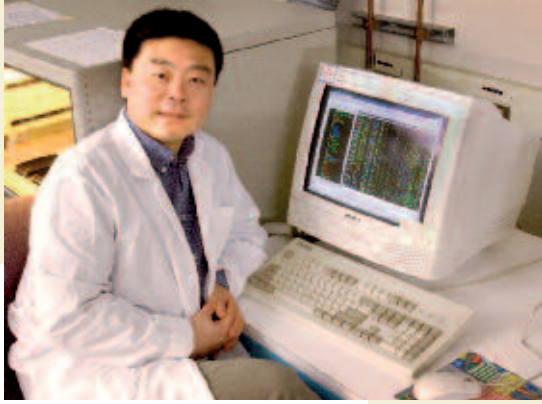
She established the first Culture Collection of Agricultural Microorganisms, which included various fungi and bacteria valuable to agriculture. In 2001, she conducted her first postdoctoral studies at Helsinki University in Finland and her second postdoctoral study in the Department of Soil Science and Plant Nutrition at the University of Florence, Italy, in 2003, where she studied the effect of organic compounds released from plant roots on microbes and enzymes.

After a postdoctoral stint at the Manchester Metropolitan University, UK, Egamberdieva returned to Uzbekistan, where she continued working at the Tashkent State University of Agriculture as an assistant professor and where she established a laboratory dedicated to plant-microbe interactions and soil biology. After two years of postdoctoral work at Leiden University in the Netherlands, she established her own research group at the National University of Uzbekistan's Department of Microbiology and Biotechnology, where the main focus of the research has been to understand how plants interact with microbes under stressful conditions.

Jun Yu, Beijing Institute of Genomics, Chinese Academy of Sciences, Beijing, China

For his fundamental contribution to a better understanding of plant genomes and agronomic traits, which has been contributing to the improvement of food security around the world

Jun Yu, a geneticist with the Beijing Institute of Genomics in China, has been a leader in the study of plant genomes, particularly rice, for which he and his colleagues built a series of databases. His research contributed not only to the stronger understanding of basic structure of the rice genome, but insights into how to build vigorous hybrid species and how rice genomes vary.



All DNA is made of four molecules, called nucleotides, and once the rice genome has gone through several rounds of duplication, it builds up an unusually high rate of two of those nucleotides: guanine and cytosine. Yu pointed out that the abundance of those nucleotides is expressed unevenly in the genome in a manner known to suggest that the genome is accumulating a large number of mutations through its repair mechanisms.

Research by Yu and his colleagues on rice genomes also revealed that plant genomes are organized differently from animal genomes in three basic ways: plant genes are smaller, plant genomes have a wide variation in the nonfunctional strings of DNA that exist between genes, and genome duplication is prevalent in most plants but limited among animals such as lower vertebrates like fish and amphibians.

Yu received his biochemistry degree from Jilin University in China and his Ph.D. in biomedical sciences from the Sacker Institute at New York University School of Medicine in 1990. Afterward, he served as a research assistant professor at New York University in the United States. In 1993, Yu joined the University of Washington Genome Center, leading a physical mapping effort for the early stage of the Human Genome Project. He returned to China in 1998, where he brought a part of the Human Genome Project effort to China, which was the beginning of genomics research in China and made the Beijing Institute of Genomics a reality.

He's been working on plant genomics since 2000, when the Chinese Hybrid Rice Genome Project produced a 14-page cover story in *Science* now approaching 2,500 citations. Yu's research has involved rice genome sequencing and better understanding how plants express hybrid rice genes.

BIOLOGY

Ann-Shyn Chiang, Department of Life Science and Brain Research Center, National Tsing Hua University, Taiwan, China

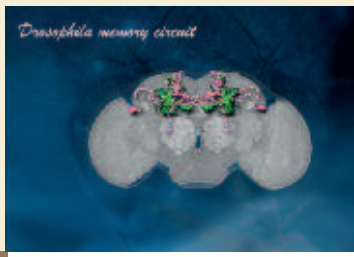
For his outstanding contribution to our understanding of memory formation using a connectomics approach

It is difficult even to imagine what it's like in the brain of a fruit fly. But neuroscience research by Ann-Shyn Chiang and his colleagues gave science

tremendous insight into the minuscule *drosophila* brain and its 130,000 neurons. Their research also helped bring Taiwanese science into prominence with a string of publications in prestigious journals.

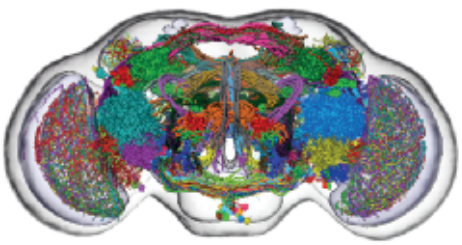
Born in Taiwan, Chiang graduated from National Chung-Hsing University in 1981, received his Master of Science from National Taiwan University in 1983, and obtained his PhD from Rutgers University in New Jersey (USA) in 1990. He returned to Taiwan in 1992 to be an instructor at National Tsing Hua University, and in 2001 took his sabbatical to study fruit fly memory at Cold Spring Harbor Laboratory in New York.

In 2004, Chiang founded the Brain Research Center at National Tsing Hua University, aiming to understand how genes and neural circuits combine to create the fruit fly behavior scientists can observe. He has constructed a comprehensive map of connections among fruit fly neurons that govern the insect's sense of smell and in 2007 published the first paper from Taiwanese scientists in the influential journal *Cell*.



Chiang later published another map revealing brain-wide neural networks in the fruit fly. The study managed to barcode 16,000 neurons in the *drosophila* brain and in 2010 *The New York Times* called the work the first step toward decoding the human brain. (An open-access database of images showcasing the fruit fly brain down to individual cells is available at www.flycircuit.tw.) He became the adjunct International Faculty of the Kavli Institute for Brain and Mind at the University of California, San Diego, in 2011.

With help from this connectomics map, Chiang and his colleagues discovered that long-term memory formation requires the creation of new proteins in only a small number of neurons in the fruit fly brain. This finding was published in *Science* in 2012 and was the first full article in *Science* from Taiwanese scientists.



CHEMISTRY

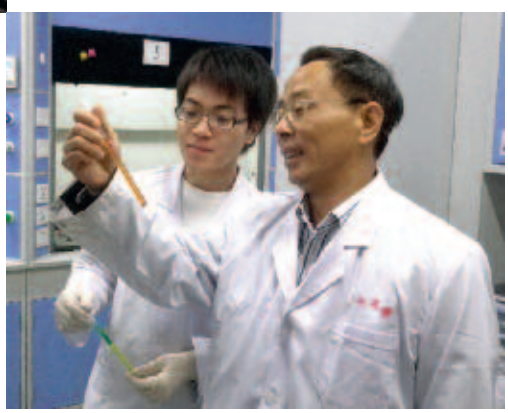
Xiao-Ming Chen, School of Chemistry and Chemical Engineering, Sun Yat-Sen University, Guangzhou, China

For his outstanding contributions to functional coordination chemistry and crystal engineering of coordination polymers

Since 1993, Xiao-Ming Chen's research has focused on the creation, structures and properties of coordination polymers, which are interlinked networks of metallic atoms and organic molecules.

Chen pioneered the study of how the metal atoms assemble with binding organic molecules called ligands to create coordination polymers. His group discovered a series of reactions between metals and ligands in heated chemical solutions under pressure, and uncovered the mechanisms behind some complicated reactions. His research has particularly focused on coordination polymers that either behave like magnets or have porous structures useful for storing other molecules.

His team has explored new coordination polymers for many years, and discovered several new strategies for building and unique structures that could find potential use for the storage, separation and sensing of small organic molecules. Chen's group also created the first example of the "Star Lattice" antiferromagnet and observed its unique magnetic behavior.

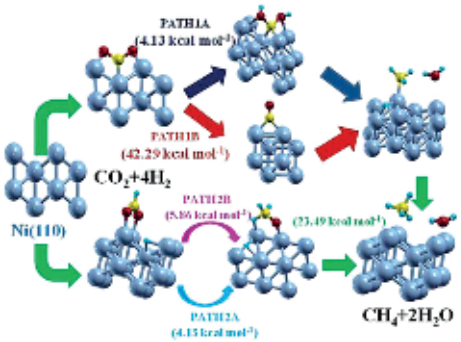


Chen is a graduate of the chemistry programme at Sun Yat-Sen University in China and went on to teach biochemistry at another university. He then got his PhD in chemical crystallography at the Chinese University of Hong Kong and returned to Sun Yat-Sen as a lecturer in 1992. He was promoted to chemistry professor in 1995.

He won the National Natural Science Prize of China, second class, in 2007 and was elected to Chinese Academy of Sciences in 2009. His publications include a textbook, five book chapters and 350 articles, which have received more than 20,000 citations and an *h*-index of 80. He has supervised 32 PhD and 10 master's theses, served as vice president of Chinese Crystallographic Society, and as an advisory and editorial board member of several mainstream international journals.

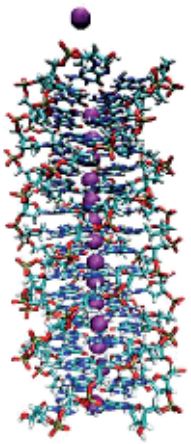
Swapan Kumar Pati, Theoretical Sciences Unit and New Chemistry Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India

For his significant contribution to our understanding of properties and phenomena of molecular systems and novel materials

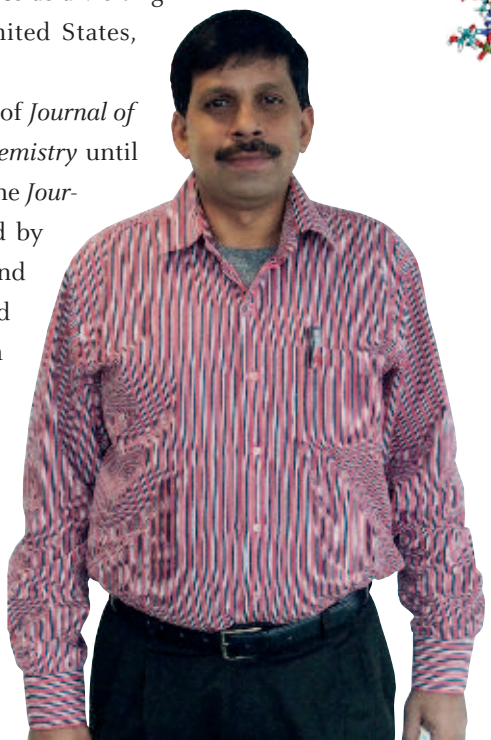


Graphene, the extremely light two-dimensional pure-carbon substance, has opened up many new possibilities for miniaturized electronic devices. Swapan Kumar Pati, a materials chemist with the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India, studies the properties of graphene by observing how electrons behave when released into thin nanometer-scale strips of graphene and its nanoribbons.

He and his team have also studied what happens with graphene under various other circumstances, such as introducing boron atoms and holes to the graphene strips, which in turn makes the strips behave like a magnet. His work has made progress toward designing room temperature, half-metallic substances that could become useful parts of tools such as electronic memory storage devices. Pati is also actively involved in developing new quantum mechanical methods for understanding molecules and larger objects.



Pati's colleagues know him as someone who is always inquisitive, frequently asking why things are, how things work, and what is possible even when the answers seem obvious. He received his PhD at the Indian Institute of Science in Bangalore and later did postdoctoral work in the United States in the physics department at the University of California, Davis, and in the chemistry department at Northwestern University near Chicago. As a professor at the Jawaharlal Nehru Centre, he often serves as a visiting faculty member to several universities in the United States, Europe and Japan.



Pati served as an editorial advisory board member of *Journal of Materials Chemistry* and the *Journal of Physical Chemistry* until 2011. He is currently an editorial board member of the *Journal of Scientific and Industrial Research*, published by the National Institute of Science Communication and Information Resources in India. In 2010, he received the prestigious Shanti Swarup Bhatnagar Prize, given by the government of India for his enormous contributions to chemical sciences. He has published over 165 research articles along with two book chapters and has co-edited a book about graphene called "Graphene and Its Fascinating Attributes".

EARTH SCIENCES

Patrick George Eriksson, Department of Geology, University of Pretoria, Pretoria-Tshwane, South Africa

For his fundamental contribution to our understanding of Precambrian sedimentation systems within a broader chronological and geodynamic framework

Many geologists contend that a "great oxidation event" took place about 2.4 billion years ago, a tipping point at which oxygen produced by living organisms began to accumulate in the atmosphere. Some suggest that this was quickly followed by the first "snowball Earth" event, with the globe becoming encased in ice.

Patrick George Eriksson, the current head of the geology department at the University of Pretoria in South Africa, and his colleagues have recently begun to challenge concepts like the "great oxidation" and "snowball Earth" events. He has argued that the concepts are far too simple and assume uniform conditions across the globe at any one time.

Eriksson has a long history of key findings in the study of Earth's deepest, most shrouded history. He contributed heavily to the global cooperative effort to understand sedimentation patterns during the Precambrian period, which spans from the creation of Earth about 4.5 billion years ago to about 540 million years ago, and how the sedimentation patterns have changed throughout the period, partially due to the variable speeds that different tectonic plates move and how deep-Earth plumes of molten rock interacted with those shifting plates.

Eriksson and co-workers also research Precambrian basin evolution, focusing mostly on rivers, deserts and coastlines, and the role of microbes in sedimentary beds composed chiefly of fragments of older rocks.

Eriksson he has been a professor at the University of Pretoria since 1994 and a lecturer since 1982. He received his PhD in geology in 1984 from the University of KwaZulu-Natal. He teaches sedimentology, basin analysis, historical geology and crustal evolution. He is a fellow of the Geological Society of South Africa, the Royal Society of South Africa, the Geological Society of Africa, and a member of the Academy of Science of South Africa. He has won several awards and co-authored 205 papers and book contributions, which have been cited over 1,800 times.

ENGINEERING SCIENCES

Abdul Latif Ahmad, School of Chemical Engineering, Universiti Sains Malaysia, Engineering Campus, Pulau Pinang, Malaysia.

For his contribution to sustainable environmental protection and healthcare in developing countries via membrane-based technology

Abdul Latif Ahmad engineers membranes – thin films that only allow certain chemicals from any given substance to pass through them – for uses that range from medical diagnosis to environmental protection.

Some of Ahmad's most significant work has been on membrane technology to better control the release of effluent from palm oil mills into the environment. Many Malaysian palm oil mills don't meet the country's standards for controlling the discharge of the pollutant, but Ahmad's invention allows wastewater contaminated by palm oil mill effluent to be recovered as clear, safe drinking water that meets even strict standards set by the U.S. Environmental Protection Act.

The membrane technology can also be used to recover antioxidants such as beta-carotene, effectively turning agricultural waste into valuable products that can be marketed to the public. His invention is currently under final assessment by the palm oil industry before being officially put into use.

Ahmad's research has also benefited the health care sector, producing a cardiovascular drug precursor, which has been especially beneficial to developing countries because of its low cost. He has also developed a membrane widely used in diagnostic tests. Easy-to-use and accessible, membrane-based diagnostic tests are especially valuable to developing countries, which often lack diagnostic centers where a nurse or doctor can assess citizens' health.

Ahmad's innovative inventions and ideas have made him one of the leading researchers in Malaysia. He received his doctorate in membrane technology in 1995 at the University of Wales. He became one of the youngest professors at Universiti Sains Malaysia and has held important positions there such as the dean of research, Fundamental Science Platform, and dean of the School of Chemical Engineering.

He is a chartered engineer, appointed as a fellow of the Institute of Chemical Engineers (United Kingdom) and the Malaysian Scientific Association. His publications include seven book chapters and over 240 articles; to date he has received 42 personal awards and 56 research product awards.

Kalyanmoy Deb, Department of Mechanical Engineering, Indian Institute of Technology, Kanpur, India

For his contribution to the development of efficient evolutionary multi-objective optimization techniques for scientific and applied problem-solving tasks

How problem-solving works is, one might say, a major problem that needs solving. Kalyanmoy Deb's main research interest is in algorithms that emulate evolution and how they can optimize machine learning – the ability of artificial intelligence to learn from information. He is widely known for his influential research using evolutionary principles to develop decision-making procedures that take multiple criteria into account, or Evolutionary Multi-Objective Optimization (EMO).

An optimization task finds special "optimal" solutions to problems, which are one of many possible solutions available to the artificial intelligence presented with the puzzle. An AI capable of optimization can identify two conflicting goals, such as "cost" and "quality" and solve the problem using the EMO algorithm and determine the trade-off for each decision. The AI can then interpret the various options, and mines data to pick up on hidden relationships in the information.

Deb is currently a professor in the Department of Mechanical Engineering at the Indian Institute of Technology (IIT) Kanpur, India. At IIT Kanpur, Deb developed the Kanpur Genetic Algorithms Laboratory in 1997, and it is now well-known for its pioneering research contributions to the EMO field.

He also collaborates with researchers from universities and industries around the world, including Michigan State University, United States; Aalto University School of Economics, Finland; University of Skovde, Sweden; University of Dortmund, Germany; Honda Research and Development, Japan; India Science Laboratory, India; John F. Welch Technology Centre in Bangalore, India; and STMicroelectronics, Italy.

Deb received his bachelor's in mechanical engineering from Indian Institute of Technology Kharagpur in India and his master's and PhD in engineering mechanics from the University of Alabama in Tuscaloosa (United States).

Deb's research has earned him a number of prizes, including the Infosys Prize in 2012 and the CajAstur Mamdani Prize in 2011. He has written two

textbooks on optimization and more than 330 international journal and conference research papers. He is on the editorial board for 18 major international journals.

MATHEMATICS

Fernando Codá Marques, National Institute of Pure and Applied Mathematics, Rio de Janeiro, Brazil

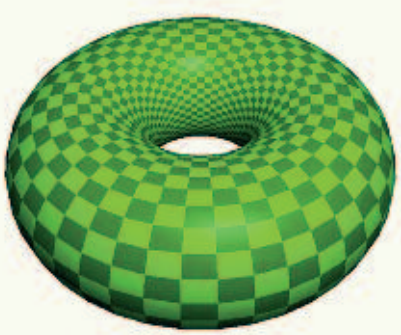
For his fundamental contributions to the field of differential geometry, particularly for his work on variational problems in conformal geometry, the solution to the Willmore conjecture and applications of the theory of Ricci flow

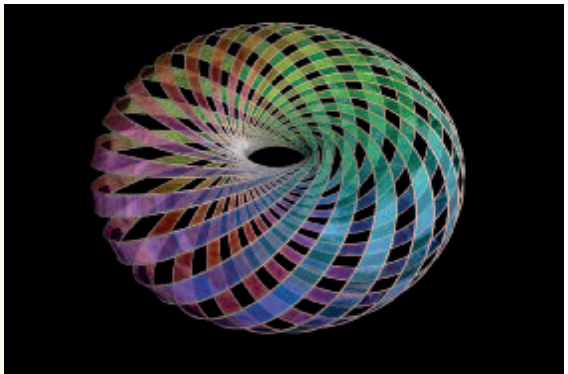
Fernando Codá Marques, a native of Brazil, has made several major contributions to differential geometry, solving and yielding results from numerous problems mathematicians have been working on for decades.

Marques' latest and perhaps most prominent work, done in collaboration with André Neves of Imperial College London, is a complete proof of the Willmore Conjecture he released in 2012. The Willmore Conjecture predicts the equilibrium state of a curved surface with one hole – like an innertube – when it is subject to forces similar to those on soap bubbles, in which the only forces in play are the surface tension and the amount of air contained in the soap film. The Willmore Conjecture has deep connections to fundamental questions in general relativity – the curvature of spacetime by gravity – as well as cell biology and lens design. The work by Marques and Neves offered a final proof of the conjecture.

Marques has also made progress on a series of other problems in geometry, including obtaining results on the Yamabe Problem, and completely solving Schoen's Conjecture. In a paper published in *Inventiones Mathematicae,* he presented some counterexamples to the Rigidity Conjecture of Min-Oo, which is also relevant to general relativity. In 2010, he spoke at the prestigious International Congress of Mathematicians, held in Hyderabad, India, and delivered a lecture on his contributions to conformal geometry.

Marques earned a bachelor's degree in mathematics from Universidade Federal de Alagoas in 1999, simultaneously with a master's in mathematics





from the Institute of Pure and Applied Mathematics (IMPA) in Rio de Janeiro. He received his PhD in mathematics from Cornell University in New York (United States) in 2003, where in his thesis he established a special case of the Compactness Conjecture – an important problem in conformal geometry. Today, he is a mathematics professor at IMPA.

In addition to the TWAS Prize in Mathematics, in 2012 Marques has received the Ramanujan Prize and the UMALCA Prize (from the Unión Matemática de América Latina y el Caribe) in recognition of his contributions to geometry.

MEDICAL SCIENCE

Quarraisha Abdool Karim, the Centre for the AIDS Programme of Research in South Africa, in Congella, South Africa

For her exceptional and distinguished contributions to HIV prevention and women's health

Of the 33 million people living worldwide with HIV, the majority are in Sub-Saharan Africa, with the virus spread mostly through sexual intercourse. About half the adults living with HIV/AIDS are women, and women younger than 24 in sub-Saharan Africa are eight times more likely to have HIV than young men of the same age range. In South Africa specifically, more people suffer from HIV infection than any other nation in the world — an estimated 5.7 million, according to 2007 figures from the U.S. Agency for International Development. However, thanks to increased access to antiretroviral treatments in Africa, AIDS is no longer a certain death sentence, but rather a chronic yet manageable condition.

Research by Quarraisha Abdool Karim of South Africa has had a massive influence on understanding the spread of HIV in that country, and especially its effect on women. She also led the trial that provided the first clinical evidence that tenofovir gel, an antiretroviral drug, can prevent sexually

transmitted HIV and genital herpes in women. This finding has been one of the key findings in the AIDS prevention field and is the culmination of two decades of research.

Karim's contributions in programmes and research have been characterized by her passionate promotion of human rights. She has extensive policy experience that stems from her term as the first director of the South African National HIV/AIDS and STD Program established by the Nelson Mandela government shortly after the country's first democratic elections in the mid-1990s.

Karim directs the Columbia University-Southern African Fogarty AIDS International Training and Research Program, which trained more than 300 young scientists in HIV and tuberculosis research in South Africa, Namibia, Swaziland and Lesotho. The program has enabled and supported the growth of scientific study in South Africa, and trainees now play leading roles in almost every major AIDS research center in South Africa.

She is also an associate professor and clinical epidemiologist at Columbia University in New York and a global leader in HIV prevention. She was the international scientific program co-chair of the XIX International AIDS Conference in Washington, D.C., in 2012 and is an editorial board member of *AIDS*, *JAIDS*, *HIV Clinical Trials* and the *South African Medical Journal.* She is a consultant to numerous United Nations organizations and AIDS-related expert committees on HIV prevention, TB-HIV treatment, gender, ethics, treatment access in low-resource areas, and research capacity-building.

Karim is the recipient of numerous prizes, including the "Distinguished Woman in Science Award" from the South African Department of Science and Technology, and most recently, the African Academy of Science's "Olusegun Obasanjo Prize."

George Fu Gao, CAS Key Laboratory of Pathogenic Microbiology and Immunology, Institute of Microbiology, Chinese Academy of Sciences, Beijing, China

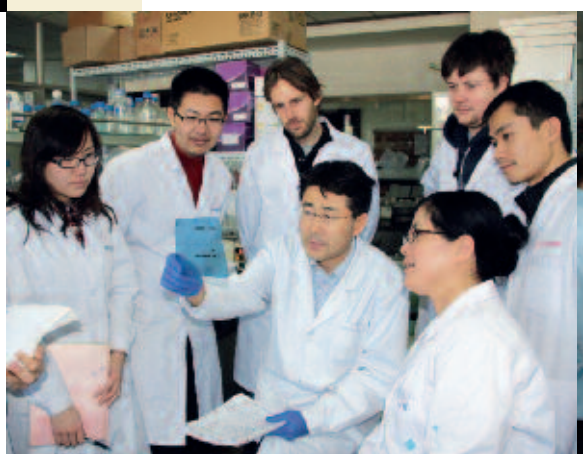
For his contribution to our understanding of the molecular basis of the pathogenicity of influenza viruses and other enveloped viruses, which provides insight into drug development and the prevention and control of infection

Microbiologist George Fu Gao is a pioneer in study of germ transmission – influenza in particular – between inter-species. His team studied the virus H5N1, now commonly known as bird flu, predicting that the virus' spread through the birds' migratory flight paths in a study published in *Science* in

2005. His team has tracked bird flu's spread around the world ever since, publishing studies in the *Journal of General Virology* and *Emerging Infectious Diseases.*

In one study of the 2009 epidemic of H1N1, commonly known as swine flu, Gao and his colleagues identified the virus's surface proteins – molecules on the surface of the virus that allow it to interact with its environment – discovering they are similar to proteins used by the influenza virus that caused the 1918 flu pandemic.

Gao and his colleagues have also made new insights on the means that other viruses, such as herpes and measles, use to spread, as well as some unique methods a bat-derived influenza-like virus uses to spread. He and his colleagues also discovered a new disease caused by the Streptococcus suis bacterium, which can spread from pigs to people and cause streptococcal toxic shock syndrome, which was reported in a study published in *PLoS Medicine* in 2006.



He has published more than 200 peer-reviewed scientific papers on pathogens and immunology. He also has won numerous national and international awards, including Outstanding Young Scientist of China Association for Science and Technology in 1988, Thomson Reuters Research Fronts Award in 2008 and Tan Jiazhen Innovation Prize in Life Sciences in 2008.

Gao was educated in Chinese universities before attending Oxford University (United Kingdom) to get his PhD in 1995. He went on to work in laboratories in Harvard Medical School and Harvard University in the United States and later returned to Oxford as a senior research scientist and lecturer. He then returned to China in 2004 as director-general of the Institute of Microbiology for the Chinese Academy of Sciences. He is currently deputy director-general of the Chinese Center for Disease Control and Prevention, and has been a visiting professor at Oxford since 2010.

PHYSICS

Juan Pablo Paz, Department of Physics, University of Buenos Aires, Buenos Aires, Argentina

For his contribution to developing quantum information and his work to characterize and prevent decoherence

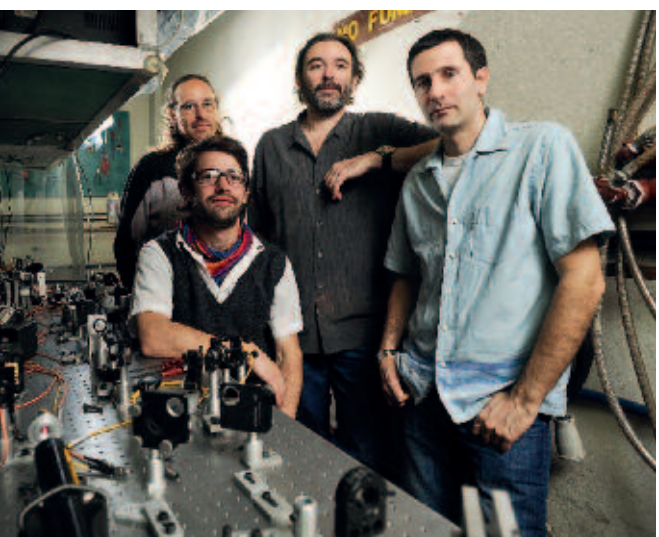
Quantum physics has never quite made sense in the context of the physical world we know and understand in our everyday lives. How do the reliable rules of classical physics emerge from the erratic and random quantum world of the incomprehensibly small? Juan Pablo Paz studies that border between the worlds of the intuitive and counterintuitive.

The centerpiece of Paz's research is a physical process known as 'decoherence,' which is the loss of quantum information into its environment. Studies of decoherence have become essential for developing new technologies that take advantage of quantum physics to process information. In fact, decoherence is the main obstacle for quantum information processing.

Paz joined the University of Maryland (United States), as a postdoctoral fellow in 1989 when he began studying the transition between quantum and classical physics, solving an important model for quantum Brownian motion, the seemingly random motion of one particle immersed in a sea of other, fluid particles. His equation on the quantum state of the Brownian particle allowed him to study decoherence. He began a research program to analyze decoherence on information processing at the University of Buenos Aires.

He also contributed significantly to the foundation of a new quantum optics laboratory in Buenos Aires. The lab hosts some critical experiments with entangled photons implementing new algorithms to help determine how to describe quantum processes.

Paz has published more than 80 papers, among them 15 in *Physical Review Letters* and others in *Nature* and *Science.* He has received important prizes and honours for his research such as the Guggenheim Fellowship, the Bessel Prize from the A. Von Humboldt Foundation and the 2010 physics prize from the Bunge and Born Foundation. He is currently the director of the Institute of Physics in Buenos Aires.



TWAS Prizes for Young Scientists in Developing Countries are awards to scientists no 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 2012, 43 young scientists in 25 developing countries received the award.

TWAS Prizes for Young Scientists

NUTRITION IN GUATEMALA

Mònica Orozco, 37, was named the winner of the 2012 National Council of Science and Technology & the Academy of Medical, Physical and Natural Sciences of Guatemala–TWAS Prize for Young Scientists in biochemistry.

Mònica Orozco's research mainly seeks new, efficient and safe ways to help children and women of reproductive age consume micronutrients — nutrients that people need in small amounts. In Guatemala, those target groups comprise the people most likely to lack those essential nutrients.

Orozco's scientific background is closely tied to her home country and the social struggles her fellow Guatemalans face. She learned the foundations of biochemistry from Universidad del Valle de Guatemala in Guatemala City, and was part of the Forensic Biological Laboratory at the Public Ministry of Guatemala, where she directly confronted the rural poverty and violence that are daily reality for much of the Guatemalan public. Later, she worked for the Center for Studies of Sensory Impair-

TWAS PRIZES TO YOUNG SCIENTISTS AWARDED IN 2012

Name	Country	Awarding Body	Field
S.M. Abdur Razzak	Bangladesh	Bangladesh Academy of Sciences (BAS)	Physical Sciences
Munawar Sultana	Bangladesh	Bangladesh Academy of Sciences (BAS)	Biological Sciences
Tanvira Afroze Sultana	Bangladesh	Bangladesh Academy of Sciences (BAS)	Biological Sciences
Ishtiaque Moyeen Syed	Bangladesh	Bangladesh Academy of Sciences (BAS)	Physical Sciences
Bernardo Uribe	Colombia	Academia Colombiana de Ciencias Exactas, Físicas y Naturales	Mathematics
Jose Alexander Ramirez-Gonzalez	Costa Rica	Consejo Nacional para Investigaciones Cientificas y Tecnologicas CONICIT	Mathematics
Ulises M. González Herrera	Cuba	Cuban Academy of Sciences	Social Sciences
Heydi Méndez-Vázquez	Cuba	Cuban Academy of Sciences	Engineering Sciences
Mònica Orozco Figueroa	Guatemala	Academia de Ciencias Médicas, Físicas y Naturales de Guatemala	Biochemistry
Naderi Nader	Iran, Isl. Rep.	Iranian Research Organization for Science & Technology (IROST)	Physics
Sasan Talebnezhad	Iran, Isl. Rep.	Iranian Research Organization for Science & Technology (IROST)	Engineering Sciences
Batdorj Batjargal	Mongolia	Mongolian Academy of Sciences	Chemistry
Tserendorj Bolortamir	Mongolia	Mongolian Academy of Sciences	Chemistry
Santosh Ghimire	Nepal	Nepal Academy of Science & Technology	Mathematics
Bhim Prasad Kafle	Nepal	Nepal Academy of Science & Technology	Physical Science
Kishor Pandey	Nepal	Nepal Academy of Science & Technology	Molecular Biology
Sajan Lal Shyaula (Shrestha)	Nepal	Nepal Academy of Science & Technology	Organic Chemistry
Sohail Nadeem	Pakistan	Pakistan Academy of Sciences	Mathematics / Abdus Salam Prize
Luis Carlos Mejìa Franco	Panama	Asociación Panameña para el Avance de la Ciencia	Biology
Jose Ernie Capioso Lope	Philippines	National Academy of Science and Technology (NAST)	Mathematics
Nilwala Kottegoda	Sri Lanka	National Science Foundation	Chemistry
Gathsaurie Neelika Malavige	Sri Lanka	National Science Foundation	Biology
Poom Kumam	Thailand	National Research Council of Thailand (NRCT)	Mathematics
Aime' Pela'iz Barranco	Trinidad & Tobago	The Caribbean Academy of Sciences	Physics

ment, Aging and Metabolism, which is dedicated to scientific research in nutrition and health in order to promote awareness and solutions to common malnutrition problems in Guatemala. While there, she learned how to help vulnerable Guatemalans attain essential micronutrients, and she still works with the institution today.

Her earlier studies explored the use of a plant pigment called provitamin A carotenoids, which is derived from palm oil, as a way to supplement vitamin A to impoverished women and children in Guatemala's rural communities. She then received a scholarship from the International Nutrition Foundation-Ellison Medical Foundation, allowing her to attain her doctorate in Nutritional Sciences and Food at the University of Manitoba in Canada.

Putting her education and experience to good use, Orozco is now a biochemistry researcher and professor at University del Valle de Guatemala, where she has taught courses in chemistry and nutrition, and is now the director of the master's programme in Food Technology and Management.

She has written several papers about her results, and some were selected to be presented to international conferences in nations ranging from Scotland and Portugal to the United States.

Her current work focuses on fortifying corn flour by mixing nutrients and essential amino acids into the recipe. She is also researching the toxic and nutritional properties of iron supplements. Her future plans are to evaluate how suitable traditional Guatemalan crops, such as corn and beans, are for biofortification using mineral fertilizers and soil management. The goal is to boost the content of essential minerals such as zinc and iron in order to help Guatemalans consume food that is both culturally acceptable and nutritious.

NANOTECHNOLOGY IN SRI LANKA

Mahavithanage Nilwala Svetlana Kottegoda, 39, was named the winner of the 2012 National Science Foundation of Sri Lanka-TWAS Prize for Young Scientists in chemistry.

Mahavithanage Nilwala Svetlana Kottegoda is currently a senior research scientist and a senior lecturer with the Sri Lanka Institute of Nanotechnology and the University of Sri Jayewardenepura. She researches how nanotechnology can augment agriculture, purify water, and be used to construct rubber composites. She also researches how to make nano-sized objects from natural mineral resources.

Her discoveries in nano-agriculture are some of the biggest science and technology achievements in Sri Lanka in recent years. Her work on nanotechnology-based fertilizers has attracted international commercial interest from Nagarjuna Fertilizer and Chemical Limited, one of the leading fertilizer manufacturers in India. Her work has also been highlighted within the international agriculture community and governments. She was recently invited to participate in a workshop on innovation and efficiency in fertilizer production and use to create a concept paper for the next 30-year fertilizer plan for the United Kingdom.

Kottegoda has a solid scientific education. She received a first-class special degree in chemistry from the University of Peradeniya, Sri Lanka, and entered materials chemistry research in 2002 as a graduate student at the University of Cambridge, U.K. While there, she worked as a tutor and demonstrator and earned a Ph.D. in materials chemistry in 2006.

Kottegoda has six patents and patent applications to her name, and has published numerous scientific studies, including some published in *The Journal of the National Science Foundation of Sri Lanka*, *The Journal of Physical Chemistry C*, *World Agriculture,* and *Current Science.* Her research has also led to presentations in both Sri Lankan and international conferences.

2012 AFRICAN UNION-TWAS AWARDS

Name	Country	Awarding Body	Field
Hippolyte Kamdem Wabo	Cameroon	Cameroon Academy of Sciences	Earth and Life Sciences
Mohamed Mohamed Ahmed Abou-Shady	Egypt	Academy of Scientific Research & Technology (ASRT)	Basic Sciences, Technology and Innovation
Aly Camara	Guinea	Ministry of Higher Education and Scientific Research (MESRS)	Basic Sciences, Technology and Innovation
Christopher Mulanda Aura	Kenya	Ministry of Higher Education, Science and Technology Directorate of Research Management and Development (DRMD)	Life and Earth Sciences
Joseph Maurice Mutisya	Kenya	Ministry of Higher Education, Science and Technology, Directorate of Research Management and Development (DRMD)	Basic Sciences, Technology and Innovation
Thimothy Molefi Thamae	Lesotho	Ministry of Communications, Science & Technology and the Dept. of Science & Technology	Basic Sciences, Technology and Innovation
Fanuel C. Lampiao	Malawi	National Commission for Science & Technology and Ministry of Education, Science & Technology	Life and Earth Sciences
Adedayo Oluwaseun Ademiluyi	Nigeria	Nigerian Academy of Sciences and Ministry of Science & Technology	Life and Earth Sciences
Olugbenga Solomon Bello	Nigeria	Nigerian Academy of Sciences and Ministry of Science & Technology	Basic Sciences, Technology and Innovation
Thokozani Majozi	South Africa	Academy of Science of South Africa (ASSAf)	Basic Sciences, Technology and Innovation
Aletta E. Schutte	South Africa	Academy of Science of South Africa (ASSAf)	Life and Earth Sciences
Altyeb Altaher Altyeb Taha	Sudan	Sudan Institute for Natural Sciences (SIFNS)	Basic Sciences, Technology and Innovation
Ibrahim M. El-Mojtaba	Sudan	Sudan Institute for Natural Sciences (SIFNS)	Basic Sciences, Technology and Innovation
Mohammed M. Hassan	Sudan	Sudan Institute for Natural Sciences (SIFNS)	Life and Earth Sciences
Mohammed O. M. Osman	Sudan	Sudan Institute for Natural Sciences (SIFNS)	Life and Earth Sciences
Naser Eltaher Eltayeb Taha	Sudan	Sudan Institute for Natural Sciences (SIFNS)	Basic Sciences, Technology and Innovation
Yassir I. Y. Ali Dinar	Sudan	Sudan Institute for Natural Sciences (SIFNS)	Basic Sciences, Technology and Innovation
Courtie Mahamadi	Zimbabwe	Ministry of Science & Technology and the Zimbabwe Academy of Sciences	Basic Sciences, Technology and Innovation

She also has edited numerous science textbooks for high schools and won numerous academic awards, including the Science and Technology Award for the "Best Innovation with Commercial Potential" and the Sri Lanka National Science Foundation's Support Scheme for Supervision of Research Degrees Award.

FUNGI IN PANAMA

Luis Carlos Mejía Franco, 38, was named the winner of the Asociación Panameña para el Avance de la Ciencia-TWAS Prize for Young Scientists in biology.

A native of Panama City, Panama, Luis Carlos Mejía Franco's primary areas of research are the biology of plant-microbe interactions and the evolution, ecology and taxonomy of microfungi associated with plants.

Mejía and his colleagues discovered a relationship between trees and the microscopic fungi that live between their cells that helps the trees withstand diseases. He's also developed ways to introduce such fungi into the trees and demonstrated, both in the laboratory and in the field, that the fungi can be used to control plant diseases.

Mejía has discovered and described more than 20 new fungus species. But his work has largely focused on a group of fungi called *Diaporthales*, which are important to agriculture and forestry around the world, and helped increase scientists' knowledge on the geography and taxonomy of the fungi, as well as the host trees' effects on the rise of new fungal species. Mejía's most recent research seeks to discover a basic understanding of mutually beneficial relationships between plants and microbial fungus. He has also contributed significantly to the training of students from Panama and elsewhere in science and technology.

Mejía benefited from a strong graduate education at Rutgers University in New Jersey (United States), where he received his PhD in plant biology and pathology. In 2009, Pennsylvania State University in the United States appointed him as a postdoctoral scholar, and Mejía is currently working as a postdoctoral fellow and research associate with the Smithsonian Tropical Research Institute in Panama, where his associateship is scheduled to last until January 2015.

His research has appeared in peer-reviewed scientific journals including *Proceedings of the National Academy of Sciences*, *Mycologia*, *Studies in Mycology*, and *Fungal Diversity*. Mejía has received numerous awards, including the Backus award from the Mycological Society of America in 2008 and an award for the top-cited article in *Biological Control* from 2008 to 2010.

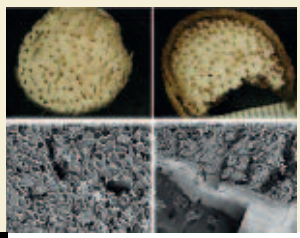
RECYCLING IN LESOTHO

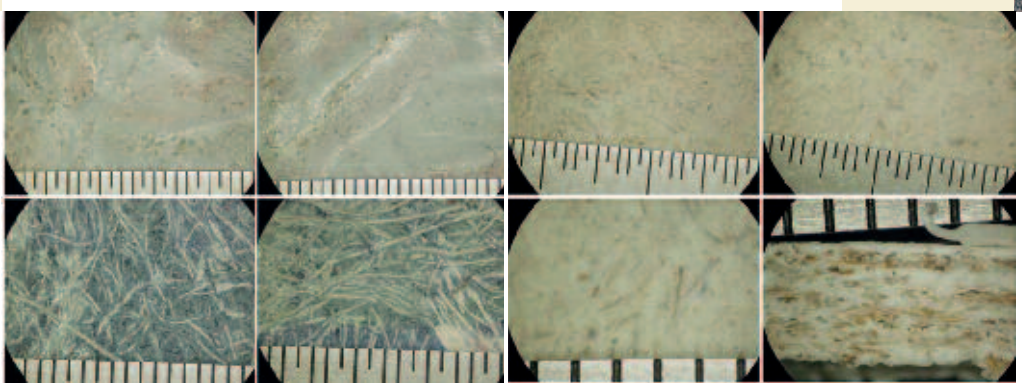
Thimothy Molefi Thamae, 33, received the AU-TWAS Kwame Nkrumah Scientific Award for Young Scientists 2012 in Lesotho, in the field of basic sciences, technology and innovation. The award is jointly given by the African Union, TWAS, and the Lesotho Ministry of Communications, Science & Technology and the Department of Science & Technology.

Natural fibres make for appealing substances to study and perhaps even use because they're cheap, environmentally friendly and available in abundance. Also, many natural fibres are discarded as agricultural waste, which means that if they can be productively recycled, it would relieve the region's environmental burden. Thimothy Molefi Thamae of National University of Lesotho studies how fibres from different waste products can be bound together to create new substances, and then tests their reaction to changing environmental factors such as heat and moisture.

Thamae's emergence as a scientist began with a bachelor's with honors in environmental science from the University of Cape Town, South Africa, and a bachelor's in physical geography from the National University of Lesotho. In 2008, he received his PhD in chemical engineering from Queens University, Canada, where he also received four merit-based Queens University graduate awards, given to PhD students with a first-class average. He is currently a chemical technology lecturer in the National University of Lesotho.

Thamae has since contributed to 15 publications over the past five years, mostly in natural fibres, and the recycling of plastic and paper. He's also, with funding from the United Nations Development Programme, studied the use of locally available natural fibres for commercialization by Lesotho cooperative communities. Thamae has worked with local natural fibres that are normally thrown out as trash, including corn stalks discarded from farms and parts of the agave plant – a spiny, gray-green plant used to skin lotions. His research has also bolstered the wide-scale use and marketing of basalts and sandstones from geological formations in Lesotho.





At University of Cape Town, Thamae was also one of two students selected to research environmental and economic factors affecting chokka squid fishing in Port St. Francis, South Africa. The project was commissioned by the South African Marine and Coastal Management Department and the Bayworld Centre for Research and Education.

Thamae worked at the National University of Lesotho as the acting head of the Department of Chemistry and Chemical Technology for the summer of 2010, and since December 2009 has been a chemical technology lecturer for the same department. His research focus is natural fibre composites. He has co-written the books *Natural Fibre Composites: Turning Waste into Useful Materials* and *Needs and Feasibility A Guide for Engineers in Community Projects – The Case of Waste for Life*.

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 carries a USD15,000 cash award.

TWAS-Celso Furtado Prize

SOCIAL SCIENCES

Ricardo Paes de Barros, Secretariat of Strategic Affairs, Presidency of the Republic, Brasilia, Brazil

For his contributions to understanding of the problems of poverty and inequality in Brazil and for his advocacy of evidence-based evaluations and refinements of public policies

A large number of studies for more than four decades have shown that Brazil has an extremely high and persistent level of income inequality. In 2001, the share of income among Brazil's richest 10% was equal to the income share of the 87% poorest. But since 2001, the country has experienced a sharp, continuous decline in income inequality.

Ricardo Paes de Barros, secretary of the Brazilian Secretariat of Strategic Affairs, received the first ever TWAS-Celso Furtado Prize in the Social Sciences for shedding light on the gravity of poverty and inequality issues in Brazil and for his advocacy of evaluating and refining public policies aimed at alleviating both

problems. The prize was named in honor of Celso Furtado, a highly regarded Brazilian economist whose work focused on the plight of the poor in Brazil and throughout South America. Furtado died in 2004.

Paes de Barros observed that the recent reduction in Brazilian income inequality has done much to lift the poorest groups in Brazil. From 2001 to 2011, the per capita income of the poorest 10% grew 6.7% a year, more than twice the national average of 2.9%. Brazil also reduced extreme poverty by half, and more than 60% of that extreme poverty reduction was because of the reduction in inequality.

He says there are several major reasons behind this historical decrease in income inequality. Among them are an expansion and improvement in social safety nets, greater accessibility to education, and labor markets that became better integrated between sectors and regions, especially between urban centers and rural areas.

The greater generosity of safety-net programs and the fast expansion of education in Brazil were a direct consequence of new policies over the last 15 years, Paes de Barros said. But the extent to which reductions in wage differentials were also influenced by increases in the minimum wage is debatable.

The magnitude of inequality in the country is still high, Paes de Barros notes. Almost two additional decades of similar progress would be necessary for Brazil's level of inequality to align with the world average. So this past decade must be seen as just a first step, he says, and sustaining this progress should be a major concern to Brazilian policymakers. But the very policies that have been so effective in reducing inequality are now beginning to show increasing signs of exhaustion. So Brazilian policies need to adjust quickly to challenges posed by the ever-changing face of poverty to ensure that gaps continue to narrow.

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 prior to 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.

The TWAS-UNESCO Associateship Scheme is conducted in collaboration with more than 100 scientific institutions in the South that have been designated "centres of excellence". The programme enables researchers from developing countries, each of whom is appointed for three years, to make two visits to a selected centre to pursue collaborative research. TWAS provides travel support and contributes to incidental local expenses. Host centres cover living expenses. In 2012, TWAS awarded 24 new associateships to scientists from 13 countries, including Malawi, Mozambique, Namibia, Uzbekistan and Zambia. In addition, 30 TWAS-UNESCO associates travelled to carry out collaborative research at scientific institutions in 13 countries in the developing world: Argentina, Botswana, China, India, Iran, Jamaica, Jordan, Mexico, Nigeria, South Africa, Taiwan, Thailand and Uruguay.

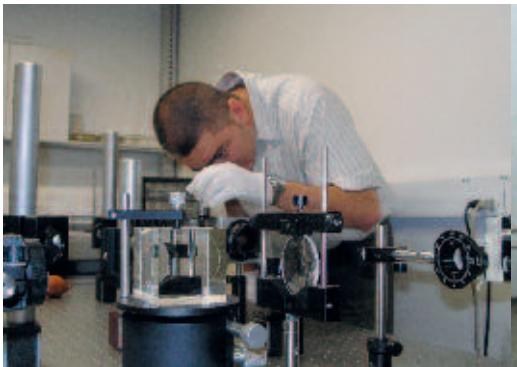
Associateship Scheme

SECURING DATA IN ARGENTINA

John Fredy Barrera Ramirez, an optical physicist working on the use of light to encrypt data, has been a professor of the Physics Institute at Universidad de Antioquia in Medellín, Colombia, since June 2006. But when he received the chance to work at Centro de Investigaciones Ópticas (CIOp) in La Plata, Argentina, he was eager to pursue the opportunity.

Laboratories at CIOp have equipment needed for cutting-edge research, Barrera explained, such as lasers that emit light at different wavelengths, high-resolution cameras, a wide range of lenses, and tools for splitting or combining laser beams. The center also has a vast, up-to-date library of books and journals on optics and photonics that made CIOp a perfect fit for Barrera's interests.

Encryption allows people to protect their information by converting it to apparent nonsense. Someone with the right to that information possesses a secret key that can detangle the nonsense-data, turning it back into the original information, a process called decryption. In optical encryption,

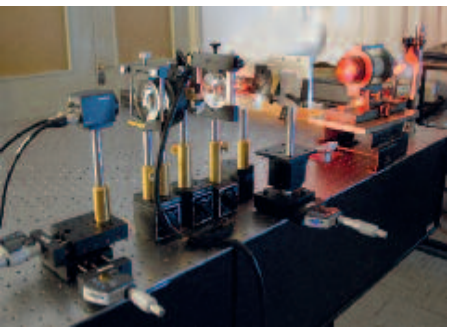


the data is transformed into a random visual pattern, and decryption reverses the process. The technology is useful for security systems that protect data from intruders.

"Everybody is in contact with security systems," said Barrera, "when somebody wants to read their email and has to enter a password or when somebody enters the password in an automatic teller machine. In general, when somebody wants to protect data from intruders, they have to use a security system."

The work by Barrera and his colleagues is on quick response codes, also known as QR codes, the increasingly popular square barcodes that can be read by cameras in smartphones and tablet computers. The barcodes are normally used in advertising and shopping, but Barrera's team has been using QR codes for encryption because, unlike previous methods, they can completely eliminate noise from the recovered information.

During the timeframe of Barrera's last visit to Argentina, from mid-September to mid-December 2012, he and his colleagues explored QR codes as a means of noise-free information retrieval. They also explored a way to encrypting multiple sources of data at once, and an experimental method for encrypting text of any length. "Our work can be adapted in almost any security applications," he said.



The research team is also exploring the use of visual codes for safely transferring digital movie files, and published a study on encrypting movies using light in *Optics Express* in 2012. Research from Barrera's work at CIOp has appeared in journals such as *Optics Letters*, *Optics Communications*, *Applied Optics* and the *Journal of Optics*. His team has also presented their work at ten national and eight international conferences, and their work has even been featured in the Highlighted Research section of *Nature Photonics*.

Barrera said his experience in CIOp's productive work environment will help him bring knowledge and experience back to Colombia. Every day he and his colleagues met to present new ideas, which made for a very innovative environment and was a major reason the research team was able to produce so many advances in the optical encryption field. "I am completely sure that the TWAS Associate Membership Scheme is the best way to support the research in the Third World," he said.

Now that his associateship is over, Barrera plans to continue as a professor in Colombia and promote the study of light physics there, as well as lead further optical encryption research.

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

South-South Fellowships

FROM PAKISTAN TO EXTRACTING MOLECULES IN BRAZIL

In 2009, Pakistani analytical chemist Suryyia Manzoor joined the University of Campinas in Brazil to investigate how to filter medically useful chemicals out of other substances. In that first year, she also celebrated the Pakistani Independence Day with her new Brazilian friends. To Manzoor's surprise, her lab tech and professor showed up in traditional Pakistani dresses called the shalwar kameez. Three of her friends also sang the patriotic song "Jevey Jevey Pakistan."

Manzoor was able to attend the University of Campinas in Brazil because of TWAS's South-South Fellowship, which began in 2009 and lasted four years. It would have been impossible to go to the University of Campinas if

not for the fellowship, Manzoor recalled, because the fellowship covered her living and travel expenses.

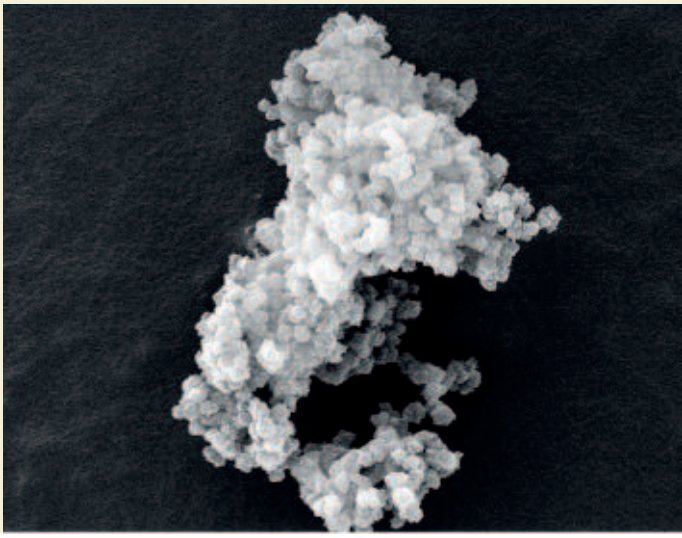
While in Brazil, Manzoor researched how to extract chemicals useful for pharmaceuticals out of other materials. Initially, she attempted to separate molecules called anthocyanins that commonly appear in red-colored fruits such as cherries and fruit products such as wine and grape juice. Anthocyanins can serve as antioxidants, and scientists are also exploring their potential for suppressing cancerous cells.

She tested a purification technique that had, in the past, been used to isolate molecules for fungicides, headache medicines and other pharmaceuticals. Though she failed to extract anthocyanins with that technique, she was able to learn about how it worked. She then used her new knowledge to develop a new method that proved useful for extracting caffeine instead of anthocyanins. She purified the substance by encapsulating it inside polymers, linked networks of molecules, making it possible to extract caffeine from the mixture.

This kind of scientific work is still in its infancy in Pakistan. But in Brazil, Manzoor was able to work with researchers who had decades of experience with the process. With their help, Manzoor also developed a new technique that can be tested for the purification of anthocyanins in the future.

She called her experience at the University of Campinas a superb chance to acquire a doctorate at a prestigious university. The greatest challenge she embraced was learning to understand and speak in Portuguese, the native language of Brazil. "I had to write in Portuguese," she said. "Even my thesis was in Portuguese, and I loved it."

Manzoor also developed a close relationship with her supervising professor, Adriana Vitorino Rossi. Manzoor showed great dedication, said Rossi. Manzoor also organized an event featuring visiting students from Pakistan and other Islamic countries to introduce



the Brazilians to their respective cultures. Manzoor's Brazilian colleagues endearingly nicknamed her "Su."

"Just in four months after arriving in Brazil, Su dominated the Portuguese language, lecturing for undergraduates and establishing friendships with students, staff and faculty of UNICAMP," said Rossi. "More than 50 people from various backgrounds, professions and ethnicities attended the defense of her thesis, which was a mark of celebration of her perfect professional and personal adjustment to our commonwealth."

The **TWAS Research Professors in Least Developed Countries (LDC)** programme was launched in 2005. More than 100 TWAS members have expressed interest in participating in the programme, which enables them to visit a research institution in an LDC three times during a five-year period for one to three months on each occasion. The applicants' areas of expertise have been circulated to more than 1,000 institutions in least-developed countries, allowing the institutions to identify experts with the knowledge that they need.

TWAS Research Professors

TRAINING NEW GEOLOGISTS IN ZAMBIA

When geologist Bishal Upreti of Tribhuvan University in Kathmandu, Nepal, became a TWAS Fellow, he was excited to volunteer for a university in a developing nation in need of his expertise. For five years, he had no takers, until finally he got a request from the School of Mines at the University of Zambia to teach as a research professor in 2012.

Upreti specializes in structural geology and tectonics and works to mitigate the destruction from natural hazards such as landslides and earthquakes. In his home country of Nepal, the threat from such disasters is a fact of life. "It's a mountainous country, and also floods very often," he explained.

Zambia is not prone to landslides or earthquakes. But as in many African countries, demand for geologists is huge because of the continent's fast-growing mining industries. Any mining operation needs a geologist, Upreti said, because geologists can use their expertise to locate sites where the mineral resources are likely to be found. Zambia in particular has a blooming copper mining industry, which creates a need for both geologists and mining engineers. "They are always looking for new mines, new minerals, new places they have to explore," he said. "It's the backbone of industry in Zambia, really. A lot of revenue comes from copper export."

The University of Zambia's School of Mines in Lusaka, the nation's capital, houses three departments: mining, metallurgy, and geology. So when an

opening emerged for a scientist in the geology department to teach the essential principles of the field, the dean of the School of Mines asked for help from TWAS. Upreti answered the call.

Upreti taught about 15 students during his one-month visit, taking them out into the field to hunt for faults and other structures in the Earth's crust and showing the students how to analyse the land. "They were very inquisitive and disciplined students," noted Upreti. "When we go to the field, we show them how to find structural features in the rock, make measurements and study them. We also talk about rock types" and their origins.

He even brought some of his professional tools, which the university lacked, from Nepal to help teach his students how to do structural analysis of the earth. "In addition to what I was teaching in the classroom, I give them exercises in the field and help them interpret the structures," he said. "It was a very packed program because I had to finish the entire curriculum of the semester in one month." Upreti came away impressed by how much Zambia valued its university education system.

The programme arranges for three visits by volunteering research professors. Upreti plans to return to the University of Zambia to teach again in 2014, and at least once more in 2015 or 2016. He said he loves the volunteer work. "That way you make friends in other countries and contribute something you otherwise couldn't," he said. "It's wonderful to be in a new place and have these experiences."

Upreti described the TWAS Fellows as a storehouse of some of the world's most active and eminent scientists and engineers, and noted they have a unique insight into the challenges developing countries face. He encouraged universities in the least developed countries to take advantage of the programme. "The requirements, opportunities, limitations, frustrations and difficulties faced by a scientist and scientific institution in a developing country can only be best appreciated by an expert from a developing country," he said.

The **TWAS Visiting Scientist Programme** provides institutions and research groups in developing countries, especially those with limited outside contacts, an opportunity to establish long-term links with internationally renowned experts. The primary goal is to help build scientific research and teaching capacity in the host country. In 2012, TWAS funding enabled Akier Assanta Maf, a scientist from Canada who specializes in food safety and biosecurity, to visit the Democratic Republic of the Congo.

North-South Collaboration

FOOD SAFETY IN THE DEMOCRATIC REPUBLIC OF THE CONGO

In the Democratic Republic of the Congo (DRC), poor food storage and hygiene practices are common enough that contaminated or spoiled food is sold throughout the country. In recent years, Congolese consumers risked catching diseases including typhoid, amoebiasis, E. coli, parasites, plant toxins and various diseases that cause diarrhea. These ailments contribute to malnutrition and death rates of both children and adults throughout the country. For example, the World Health Organization reported in March 2011 that a cholera outbreak in the DRC had killed 265 people.

So, with help from a grant from the TWAS Visiting Scientist Program, food safety scientist Akier Assanta Maf, with the accordance of Canadian Department of Agriculture and Agri-Food, traveled to help the Congolese address these challenges. Maf is a DRC native, and also a veterinarian, microbiologist, and an expert on food hygiene. Professionally, he creates strategies for controlling disease-causing microbes and spoiled food for Canada. He went to DRC to train Congolese undergraduate students on the essentials of food safety – everything from food inspection procedures to microbial science – while also educating the general public of the African nation on the importance of food safety.

"This opportunity plays an important role in protecting the health of the Congolese population against foodborne pathogens," Maf said.

While thousands of Congolese people lack access to safe food and face fre-

quent foodborne illnesses, Maf said, food safety not only keeps people healthy, but it promotes the economic development of the country as a whole. So the North-South collaboration between Canada and the DRC presented the Congolese with an experienced resource in Maf who could help them to strengthen local food-safety skills.

Maf's students learned about food inspection, food microbiology, detection of hazards and how to monitor and control health threats. While in the DRC, Maf lectured and participated in conferences at The Superior Institute of Applied Techniques in Agri-Food Chemistry, where he could teach the food-safety essentials to more than 80 students. He also taught a course at the University of Lubumbashi to more than 180 students.

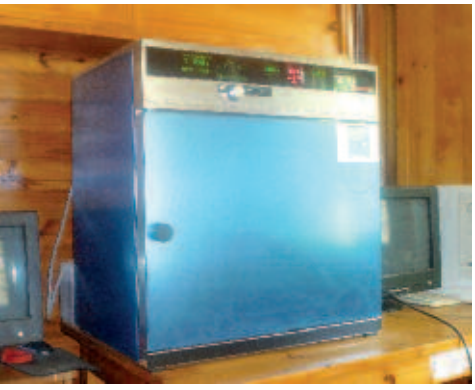
The combined help of Canada and TWAS helped introduce the Congolese students to an approach called "hazard analysis and critical control points," which helps identify tainted food while it's being manufactured. The approach was even built into a production plant for Chikwangue, a popular Congolese dish made from tubers of the Cassava plant.

Teaching students in the DRC was a unique, enriching and rewarding experience, Maf said, but it was just one of many projects. For example, Maf and his colleagues created a French-language comic strip called "Hygiene of Our Food" depicting a character becoming ill from eating unsafe food and offering advice on preventing foodborne illness. "It is gratifying to see that, through the courses that I taught, the conferences that I gave, the meetings I organized, the television programs I participated in, I was able to share with the Congolese the knowledge and the expertise on the food safety practiced in Canada."

Mahangaiko Muyumba, the dean of the Faculty of Veterinary Medicine at the University of Lubumbashi, said Maf not only helped to train new food safety specialists in the DRC, but also established a close connection between the North and South. "The contribution of this scientist in our faculty is not debatable," Muyumba said. "It contributes to the improvement of the Congolese food system in order to ensure the public health of the population."

The **TWAS Research Grants Programme in Basic Sciences for Individual Scientists and Research Units** provides specialized equipment, consumable material and scientific literature to young scientists in 81 countries that are lacking financial resources. It's supported by the Swedish International Development Cooperation Agency (Sida) and provides up to USD15,000 to individual scientists and up to USD30,000 for research units in developing countries. The following example of TWAS-supported research focuses on the work of Tahiana Ramananantoandro in Madagascar, who has used a grant-funded piece of equipment to study wood density in previously unstudied trees.

Research Grants for Individuals



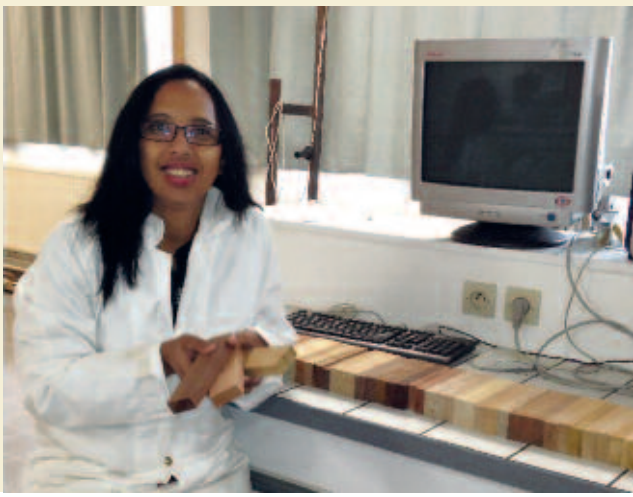
WOOD SCIENCE IN MADAGASCAR

Madagascar's forests are full of unique tree species that wood science has barely touched. About 80% the island nation's woody plants – roughly 4,000 species – exist in no other country. Of those purely Malagasy species, only 200 have been studied by scientists interested in the density of their wood.

Knowing the density of local plants is extremely useful, wood scientist Tahiana Ramananantoandro explains. That figure is an essential part of the equation to work out how much carbon is packed into the wood, which is helpful for assessing how much total carbon is in any given forest. Knowing the carbon content is useful for Madagascar's ability to sell carbon offsets from its forests in the international carbon market.

It's not all about carbon, though. Dense wood is typically strong wood, and can be used to build load-bearing objects such as floors, building mate-

rials, and furniture. Outdoor load-bearing structures, such as bridges, also have to deal with the ravages of nature. "Outside, there are termites or fungi or insects," said Ramananantoandro, "we want to know which wood is adequate for each use. For furniture, craftsmen in Madagascar must limit themselves to just 20 to 30 species because they don't know the wood quality of so many native trees."



Most wood research in Madagascar took place in the 1960s and 1970s, when a French laboratory collaborated with a Malagasy research center, Ramananantoandro said. Since then, Malagasy wood science has been practically nonexistent. So Ramananantoandro went to France to learn the techniques in the field and prepare her PhD. After 5 years working in France, she then returned to her home country of Madagascar to use her new expertise on the local plant life. Now she is an associate professor at the School of Agronomy, University of Antananarivo, in Madagascar, studying the wood of native and exotic plants.

To understand the density of a plant's wood, Ramananantoandro has to take samples from the local forests, either by cutting the tree or extracting a wooden core from its trunk. Then the scientists remove the moisture from the wood and determine its density. But to remove the moisture, she and her colleagues needed an expensive piece of equipment they did not have: A climatic chamber.

A climatic chamber is like an oven, only four times the size. It allows researchers to dry out wood samples – a necessary step because the standard in the field is that no more than 12% of the natural moisture can remain in a wood sample before its physical traits, like density, can be scientifically described. But the chamber costs USD16,500. Ramananantoandro and her university couldn't afford that on their own, so they turned to the TWAS research grant for individual scientists and research units for the funding they needed.

So far, Ramananantoandro has gathered data on 44 Malagasy woody plant species, including 14 that have never been studied before, and also four species of bamboo. She thinks some will indeed be useful for construction. A flowering tree called *Nuxia capitata* is one example. "It seems it has a high density so we can say it can probably be used for furniture or flooring," she said. The high density signifies that it has a high level of carbon, too. These data will also help Ramananantoandro create a database that scientists can use to make more reliable calculations of the contents of Madagascar's forest ecosystems.

Now, Ramananantoandro is teaching and pursuing her research on wood science as well as supervising three PhD students and three master's degree students, and she's hoping to build Madagascar's only wood science research team. She has also presented her research in Austin, Texas (United States), and published her research in the journal *Annals of Forest Science*.

The **TWAS Research Grants Programme in Basic Sciences for Research Units**, launched by TWAS in 2002, assists small research groups in countries lagging in science and technology. Although these groups have conducted important research with noteworthy results, the difficult conditions under which they work have prevented them from realizing their full potential. With support from the Swedish International Development Cooperation Agency (Sida), this programme provides research units in some 81 countries with an opportunity to achieve that potential. Each selected research unit receives a grant of up to USD30,000 that can be renewed twice if the researcher returns a positive report and reapplies. In 2012, 18 research groups in developing countries received support. Here we look at LED lamp research at the Institute of Physics at the National Academy of Sciences of Azerbaijan.

Research Grants for Groups

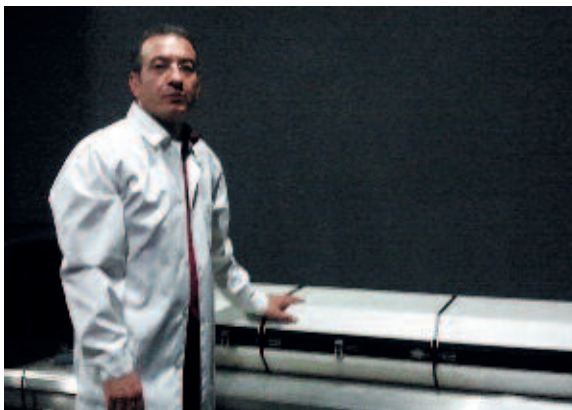
LED LAMPS IN AZERBAIJAN

Light-emitting diodes, more commonly known as LEDs, have become an attractive research subject for their small size, long life, and potential for keeping energy costs low. Many researchers expect they will broadly replace the incandescent and fluorescent lamps that are prevalent today because they consume only one-sixth of the energy an incandescent lamp does and only about half the energy of a fluorescent lamp.

Physicist Rasim Jabbarov of the National Academy of Sciences of Azerbaijan in Baku, Azerbaijan, and his colleagues are working to improve a modern version of LEDs powered by "chip-on-board" technology. The lamps are powered by small semiconductor chips attached to a circuit board that prompt luminescent substances in the lamp called phosphors to emit light.

"Chip-on-board technology is very new technology and the efficiency of our lamps is very high," Jabbarov said. "China's chip-on-board LEDs have a lifetime of about 50,000 hours and do not require an outlet. They just run on this chip."

The overall goal is to get the best visible white light possible by mixing together light across the visible spectrum. Phosphors in LED lamps respond to light of one wavelength by emitting light of another wave-



length. But to test how those phosphors responded to different wavelengths, Jabbarov's team needed a laser – priced at USD25,720 – to study the spectrums of light emitted by each phosphor. The laser is custom-made so that scientists can precisely manage just what wavelength of light to fire. This precision allows Jabbarov's team to test how phosphors respond to all kinds of different wavelengths. But that special power is also what makes it so expensive.

Azerbaijan has only been an independent nation for about 22 years. It was a part of the Soviet Union until its collapse in 1991, and back then the university might have had the resources to fund this research. But now that the country is on its own, scientists such as Jabbarov had to turn to TWAS research grants for the funding to buy the laser, as well as a few other, less-expensive pieces of equipment such as a ventilator that keeps toxic fumes under control.

Jabbarov tested two phosphors. One, made of calcium, gallium, sulfur and europium, emitted green light when hit with blue light. Another, made of the same elements except for gallium and in different amounts, emitted red light when hit with green light. The most common phosphors used by the LED industry are popular because they are particularly stable, but they tend to be weak when it comes to emitting the red part of the spectrum, Jabbarov noted. So it's useful to add other red-light emitting phosphors to the available mix.

"All this equipment is, at the present time, used by my group and my PhD students," Jabbarov said. "It was very useful to have these apparatuses, because it was not otherwise possible to carry out modern experiments and have good results. I and my team are very grateful to TWAS for this opportunity."

Jabbarov and his team have presented their work on LED phosphors at numerous conferences, including the 2011 International Advances in Applied Physics and Materials Science Congress in Antalya, Turkey; the 17th International Conference on Ternary and Multinary Compounds in Baku, Azerbaijan; the February 2012 International Conference on Luminescence and its Applications in Hyderabad, India; and the 2011 LED Conference in Istanbul, Turkey. They have also been published in *Fizika*, the Azerbaijan Journal of Physics.

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

Public Information Office

A focal point for the PIO is organizing press coverage, information displays and publications for the TWAS General Meeting, a major international event where TWAS Fellows and invited guests present their research and receive prizes and new Fellows are inducted. The 12th General Conference and 23rd General Meeting took place in Tianjin, China, from 17 to 21 September 2012 and the opening ceremony was attended by the outgoing President of China, Hu Jintao. Hu's keynote speech generated extensive media attention, both in China and worldwide, as did the election of Bai Chunli, TWAS's first Chinese president.

The PIO prepared a dedicated conference page on the TWAS website, publishing daily articles throughout the week. Special press coverage was organized for the prestigious Ernesto Illy Trieste Science Prize. The online news publication SciDev.net presented a live blog highlighting each day's events. The Italian press covered the conference extensively.

Following an October workshop organized by the International Science, Technology and Innovation Centre for South-South Cooperation (ISTIC) in Penang, Malaysia, the Public Information Office began preparation of the second TWAS-ISTIC book of case studies of entrepreneurship in developing countries. The book will be based on over 20 applicants who were selected to present their research and discuss its connections to industry at the workshop. The book is scheduled for publication in the second half of 2013, and will be disseminated to government ministries, research institutions, acad-

emies of science, nongovernmental organizations and to the private sector throughout the South. The case studies also will be placed on the Internet.

TWAS continues to be one of seven partners on the European Union (FP7) CATALYST project for capacity development and hazard risk reduction. The Public Information Office is responsible for the communication and dissemination aspects of the project and re-wrote and re-structured the CATALYST website. The PIO also published and printed a brochure (in English and Spanish) and posters. PIO staff attended CATALYST consortium meetings in Venice, Italy, and regional workshops in Bari, Italy, and in Addis Ababa, Ethiopia.

TWAS also continues to collaborate successfully with UNESCO, and the PIO presented TWAS programmes to delegates at the UNESCO headquarters in Paris. The PIO also presented TWAS activities on nutrition, agriculture and ecosystems in developing countries to the Trieste UNESCO Week on education and sustainable development (19-25 November).

The PIO participated in a series of activities to celebrate science in its headquarters city – Trieste, Italy – and the city's status as a capital of international science. Importantly, TWAS was officially registered as a member of the 'Trieste Science System', taking its place among the city's other prestigious scientific institutions. TWAS also participated in Trieste Next, a public science communication event that took place for the first time in September, offering presentations, performances and discussions on the theme of 'Save the Food'. TWAS organized two events: a discussion session on climate change; and the closing session focused on water, which will be the central topic for the 2013 event. The PIO invited expert guest speakers, including Lidia Brito, director of Science Policy and Sustainable Development, UNESCO.

2012 also saw the successful launch of TWAS's first photography contest. The theme was 'sustainable energy for all' and 93 photos were submitted by 21 contestants. The winners' photos were published online and in the TWAS Newsletter (volume 24, number 4). The TWAS Newsletter, generously supported by the Kuwait Foundation for the Advancement of Sciences, is the Academy's flagship publication and is produced four times annually.

In June, a PIO staff member was asked to be on the scientific board of Discovery & Innovation (Nairobi, Kenya). While in Kenya, the PIO interviewed Margaret Kamar, the Minister of Higher Education, Science and Technology. The interview appeared on the TWAS website.

TWAS.org on average serves 1,500 pageloads each day, peaking at 3,819 during the conference in China. In 2012, more than 30 news stories relating to academy activities were published on the TWAS website and TWAS continued to receive wider coverage of its activities in the Italian press (over 80 print/TV/radio stories). TWAS has taken increasing advantage of digital media, publishing with news services such as ResearchSEA, EurekAlert!, Galileo and Public Service Review, as well as regular postings on Facebook, Twitter, YouTube and Flickr. To further the TWAS media strategy, a PIO staff member participated in a meeting, 'Social media meets development', in Bonn, Germany.

After Daniel Schaffer's retirement as public information officer in January 2012, Programmes Officer Peter McGrath and Tonya Blowers (staff writer appointed in January) managed the interim process. In October, TWAS held interviews for the posts of public information officer and editorial assistant. In December, Cristina Serra began as the new full-time editorial assistant after working for TWAS for the previous three years, when her duties focused on engaging with the Italian press. Edward W. Lempinen, most recently from the American Association for the Advancement of Science (AAAS), was named the new public information officer, effective January 2013.

Over the past decade, **TWAS has forged a number of partnerships with a diverse group of organizations**. Each partnership extends the impact of TWAS and helps the Academy to achieve its goals through collaboration with like-minded organizations.

Partnerships

PHYSICS COLLABORATION

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

From 16-19 April, for example, TWAS and ICTP co-sponsored the American Institute of Physics (AIP) Industrial Physics Forum 2012, which was attended by more than 100 people from some 30 countries. With the focus on "Capacity Building for Industrial Physics in Developing and Emerging Economies", this was the first time that an AIP forum had been hosted outside the United States.

In addition, in collaboration with both ICTP and the United Kingdom-based Institute of Physics, TWAS also co-sponsored a workshop on entrepreneurship for scientists held at ICTP, Trieste, in April, which was attended by some 40 physicists and engineers from 20 developing countries.

Meetings were also organized outside Trieste, including the 7th International Conference on Mathematical Methods in Physics, held in Rio de Janeiro, Brazil, from 16-20 April 2012, which also featured nine other spon-

ICTP The Abdus Salam International Centre for Theoretical Physics

UNESCO United Nations Educational, Scientific and Cultural Organization

IAEA International Atomic Energy Agency

sors; and two meetings in Cuba: the Joint ICTP-TWAS Latin American Advanced Course on FPGA Design for Scientific Instrumentation (19 November to 7 December), which featured 64 participants, and the Joint ICTP-TWAS Conference and Advanced School on Quantification of Earthquake Hazards in the Caribbean: The Gonave Microplate (10-21 December).

TWAS-COMSTECH GRANTS

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

In response to the fourth call for proposals, in 2012 TWAS and COMSTECH provided grants to 17 young scientists in five countries: Egypt, I.R. Iran, Malaysia, Morocco and Pakistan. Among the projects supported were those aiming to study coral reefs as potential records of environmental pollution, light-trapping in thin film photovoltaic cells using cascaded nanostructures, and the expression of multidrug efflux pumps in the opportunistic pathogenic bacterium, *Acinetobacter baumannii*.

OPPORTUNITIES IN GERMANY

In collaboration with the German Research Foundation (DFG), TWAS launched its first South-North fellowship programme. The programme is open to postdoctoral scientists from sub-Saharan Africa (except South Africa) who graduated with their PhD degrees within the last five years. In 2011, the programme was expanded to provide support to 20 young African scientists (compared to 10 in its first year of operation in 2010). In 2012, 19 awards were made to young scientists from eight African countries: Burkina Faso, Burundi, Cameroon, Kenya, Mauritius, Nigeria, Uganda and Zimbabwe.

Each was supported to undertake a two- to three-month research visit at their selected host institute in Germany with the idea that this will lead to more long-term collaborations between the African scientists and their German counterparts. As with the TWAS South-South fellowships programme, TWAS provides travel and visa support, while all expenses in Germany are covered by DFG.

In addition, based on the success of the programme to date, a new agreement was signed between DFG and TWAS in November 2012 that increases the number of fellowships available to 30 per year.

SCIENCE ENTREPRENEURS IN THE SOUTH

TWAS and the Malaysia-based International Science, Technology and Innovation Centre for South-South Cooperation (ISTIC), which operates under the auspices of UNESCO, launched a second search for the best examples of how research in science and technology has led to new products, processes and services.

Following a successful call for applications, the authors of 25 case studies were invited to attend a workshop in Penang, Malaysia, on 20-21 October 2012. During the workshop, a high-level international committee judged the presentations and selected the best three studies to receive the second round of ISTIC-TWAS Entrepreneurship Awards. The three winners were:

- Umme Aminum Naher from Bangladesh for her work at the *Universiti Putra Malaysia*, Kuala Lumpur, Malaysia, on the development of a biofertilizer that functions under tropical conditions;
- Arnaldo Soltermann, a chemist from the *Universidad Nacional de Rio Cuarto*, Argentina, for his project that is deriving useful products from agricultural wastes; and
- Xianzhi Dong, Institute of Biophysics, Chinese Academy of Sciences, China, for the development of a natural-product formulation that can aid weight loss.

Descriptions of all the selected case studies are currently being edited for publication.

SCIENCE DIPLOMACY / SCIENCE POLICY

In November 2011, at the World Science Forum in Budapest, Hungary, TWAS and the American Association for the Advancement of Science (AAAS) signed an agreement to implement a joint International Programme on Science and Diplomacy. Subsequently, TWAS received funding from the Swedish International Development Cooperation Agency (Sida) to help kick-start programmatic activities.

Among the activities planned in Trieste, Italy, are regular 'Science Diplomacy Lectures', the first of which was given in March 2012 by Mary O'Kane, chief scientist & engineer of the government of New South Wales, Australia. O'Kane spoke on 'Productivity halos around top research centres' and the importance of supporting clusters of top laboratories to stimulate creativity and the transformation of research results into new products and services.

ISTIC
INTERNATIONAL SCIENCE, TECHNOLOGY AND INNOVATION CENTRE FOR SOUTH-SOUTH COOPERATION UNDER THE AUSPICES OF UNESCO

Also in 2012, the Global Research Council (GRC) – a network of national funding agencies from across the world – requested that TWAS organize a regional workshop for sub-Saharan Africa. The meeting took place on 30 November 2012 in Addis Ababa, Ethiopia, in collaboration with the African Union Commission. A total of 22 people attended the one-day event, including participants from 17 countries across Africa representing research councils, ministries of science and technology or other organizations involved in the administration or implementation of national science policies and programmes. Discussions during the event focused on research integrity and open access publishing. The results of these discussions were fed into a meeting of the GRC's International Steering Committee, held in Brasilia, Brazil, in December 2012, where texts for a "Statement on Research Integrity" and an "Action Plan on Open Access Publishing" were finalized prior to discussion at the 2nd GRC Summit, scheduled for Berlin, Germany, in May 2013.

AAAS
ADVANCING SCIENCE, SERVING SOCIETY

GOVERNING SOLAR RADIATION

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 creates severe impacts. Among the options under consideration is the idea of reducing the amount of sunlight that reaches the Earth's surface – so-called solar radiation management (SRM).

To open up the debate and tackle questions such as how – and by whom – research into SRM might be governed, TWAS in 2010 joined with the UK's Royal Society and the United States-based Environmental Defense Fund in co-convening the Solar Radiation Management Governance Initiative (SRMGI). This initiative resulted in a conference and subsequent report, published in December 2011.

In 2012, the three partners of SRMGI joined forces with the African Academy of Sciences (AAS) in a project funded by IAP, the global network of science academies. The aim of the project was to introduce African stakeholders to the concept and implications of SRM, to seek opinions and ideas on how SRM research might be governed, and to create the conditions for more sustained engagement in Africa on SRM research governance.

Workshops were held in Senegal and South Africa in June and November 2012, respectively, with a third event scheduled for Ethiopia in early 2013. In all, the workshops drew over 100 participants from 21 different

African countries, including academics, policymakers, journalists, representatives of nongovernmental organizations and interested members of the public. Among the ideas suggested by workshop participants were: to establish a pan-African expert group overseen by the AAS; to increase research into SRM in African universities; to teach about SRM in school/university courses; and to increase engagement and sensitization of Africans from all walks of life with the science and policy issues of solar radiation management.

A final summary report is being prepared for publication. For additional information, see *www.srmgi.org*.

CATALYST FOR CHANGE

In October 2011, TWAS joined a consortium of seven European partners in CATALYST, a project funded by the European Union Seventh Framework Programme (FP7/2007-2013). The project is aimed at assembling, analysing and disseminating the rapidly expanding knowledge of natural hazards and disasters in order to provide stakeholders with guidelines for best practices, both to help prevent such disasters and to assist with responses when disasters occur.

During 2012, the project unfolded through a series of online 'Think Tank' activities that brought together a diverse range of stakeholder experts from different regions, as well as through a series of four regional workshops. These workshops were held in Bari, Italy, for the European-Mediterranean region (27-28 September); Addis Ababa, Ethiopia, for East and West Africa (10-11 October); and Montego Bay, Jamaica, for Central America and Caribbean (3-5 December). A final workshop was scheduled for early 2013 in Bangkok, Thailand, for South and Southeast Asia.

The results of these regional meetings were to be further discussed and refined in 2013, via the online 'Think Tank' forum, with results distilled into a series of final reports. TWAS, and especially its Public Information Office, is responsible for coordinating the outreach activities of the project, including publication of four final 'best practices' case study documents and a policy paper, due in late 2013.

CATALYST

CAPACITY DEVELOPMENT FOR HAZARD RISK REDUCTION AND ADAPTATION

EUROAFRICA-ICT

The second phase of the EuroAfrica-ICT project, funded through the European Union's Seventh Framework Programme (FP7), ran from January 2010 to December 2011, with a final review meeting with EU officials in February 2012. During the project, TWAS linked up with a number of institutions in Europe and sub-Saharan Africa with the aim of increasing the number of scientists from sub-Saharan Africa carrying out research in information and communication technology (ICT) who develop collaborative projects with European-based researchers.

During TWAS's four-year involvement in the project, four Euro-Africa Cooperation Forums on ICT Research were organized, in Brussels and Helsinki (2008 and 2010, respectively) and in Addis Ababa and Cape Town (in 2009 and 2011, respectively), each of which attracted over 250 participants.

In addition, EuroAfrica-ICT.org consortium members also organized a series of awareness workshops in Africa, as well as "concertation" meetings in Brussels and Pretoria, South Africa focused on networking and sharing experiences. An online database of African centres of excellence in ICT research also was published.

For more information, see: *www.euroafrica-ict.org.*

MICROSOFT SUPPORT FOR AFRICA

In 2009, TWAS entered into a three-year agreement with Microsoft Research Ltd. and the African Academy of Sciences (AAS). Under the agreement, support was provided for computer science workshops and meetings in Africa.

Those meetings supported in 2012 were:

- ICT Africa Symposium 2012: ICT and Sustainable Development: the Digital City, e-Government, Self-Employment and Health - What strategies for dealing with cybercrime and cybersecurity in developing countries? 10-13 July 2012, Yaounde, Cameroon;
- Joint Conference of the South African Society for Genetics and Southern African Society for Bioinformatics and Computational Biology, 10-12 September 2012, Stellenbosch, South Africa;
- 10th Anniversary of the Eastern Africa Universities Mathematics Programme, 22-25 August 2012, Arusha, Tanzania;
- Workshop on Entrepreneurship for Scientists and Engineers, 5-9 November 2012, Addis Ababa, Ethiopia.

SUPPORT FOR SCIENTIFIC MEETINGS

In 2012, TWAS provided support for 21 scientific meetings in 17 developing countries. Among the meetings supported in 2012 were:

- International Congress on Microbial Biotechnology for Development (MICROBIOD 2), 2-4 October, Marrakech, Morocco;
- IV SEANAC International Conference on Analytical Chemistry for Environment, Health and Water, 8-11 July, Maputo, Mozambique;
- International Training Workshop on Bioinformatics and Computational Biology: South Asian Perspective, 19-21 July, Chittagong, Bangladesh;
- Conference on Semio-chemicals: the Essence of Green Pest Control, 1-5 October, Bursa, Turkey;
- V International Symposium on Biochemistry and Molecular Biology, 9-12 October, Havana, Cuba;
- International Workshop on Non-communicable Diseases in Developing Countries, 5-19 October, Cape Town, South Africa;
- 2nd Meeting of the Latin American Association of Chemical Ecology, 2-5 December, Cordoba, Argentina.

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

Regional Offices

TWAS REGIONAL OFFICE FOR EAST AND SOUTHEAST ASIA AND THE PACIFIC

Headquarters: Chinese Academy of Sciences, Beijing, China

In 2012, the TWAS Regional Office for East and Southeast Asia and the Pacific (TWAS-ROESEAP), played a key role in promoting the scientific growth in the South, hosting the 23rd General Meeting of TWAS in Tianjin, China.

For the general meeting, the office organized committee meetings, frequently met with the Tianjin government, held two press conferences, provided USD250,000 in travelling expenses for attending scientists, and organized interviews with *China Science Daily* for TWAS officials, fellows, young affiliates and prize winners.

TWAS-ROESEAP also held an International Symposium on Frontiers in Chemical Engineering from 27 to 31 July in Beijing. The symposium was sponsored by TWAS, the Chinese Academy of Sciences (CAS) and the National Natural Science Foundation of China. Over 140 scientists and students from more than ten developing and developed countries participated in the meeting, which focused on the science of green energy.

"It was really nice to join this kind of great symposium," said Yong-Mook Kang, a materials scientist and professor with Dongguk University in South Korea, who praised its organization, support for invited speakers and the contents of the meeting as highly helpful to chemical scientists. "I wish this meeting will be continued every year."

The office also organized the 11th CAS-TWAS-World Meteorological Organization Forum on Climate Science, themed "Terrestrial Ecosystems under the Changing Climate", held from 27 to 30 August in Beijing. Attendees endeavoured to better understand past signals of climate change and the impacts of climate change on various sectors, such as water resources and agriculture. More than 70 scientists attended the event.

Finally, 50 scientists and researchers from 16 developing countries received the CAS-TWAS Postgraduate, Postdoctoral and Visiting Scholar Fellowships in 2012. The awardees conducted research at institutions affiliated with CAS.

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- *website: www.twas.org.cn*

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

The TWAS Regional Office for Sub-Saharan Africa (TWAS-ROSSA) is hosted by the African Academy of Sciences, which promotes science and technology in the region on behalf of TWAS. Their efforts include training fellowships, grants, and awards.

In 2012, the office selected five young affiliates for the 2012-2016 period. They were: Yahya Choonara in South Africa, who prototypes drug-delivery technologies for the treatment of ailments not effectively treated due to limitations on pharmaceuticals; Asfawossen Asrat from Ethiopia, a geologist, geochemist and petrologist who specializes in the geoscience of his home country; Collet Dandara from Zimbabwe, a biomedical researcher interested in human genetics; Godefroid Gahungu of Burundi, a physical chemist interested in the structures and properties of molecules and materials; and Mohamad F. Mahomoodally from Mauritius, who studies traditional medicines and nutrition-related diseases.

The office also selected 10 young scientists, including three women, to attend TWAS/BioVision Alexandria.NXT 2012 in Alexandria, Egypt. Testimonials from some of these young scientists are available online at bit.ly/18de7J5.

The office also liaised with the Nigerian Academy of Sciences to help disburse a travel grant for scientists from Nigeria, aiming to provide a more efficient way to transmit funds to students and improve cooperation with national academies in the region.

- *coordinator: Berhanu Abegaz (TWAS Fellow 1998)*
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TWAS ARAB REGIONAL OFFICE
Headquarters: *Bibliotheca Alexandrina*, Alexandria, Egypt

In 2012, the major event of the Arab Regional Office (TWAS-ARO) was TWAS/BioVisionAlexandria.NXT 2012 in Alexandria, Egypt, on 21-22 April. The event was themed "Scientific Innovation in the Developing World: from Theory to Practice" and was designed to explore scientific innovation and highlight its importance for sustainable development. It also identified innovative solutions to overcome different problems in developing countries. Among the participants were some 50 young scientists – up to 10 selected by each of TWAS's five regional offices.

The regional office also held its 8th Annual Meeting at the Bibliotheca Alexandrina. The meeting was

themed "Water, Nuclear and Renewable Energy: Challenges Versus Opportunities" and brought together members of the TWAS Arab Regional Office and young affiliates, along with other distinguished speakers, to tackle the role of science, engineering and technology in achieving sustainable human development. The office also selected and sponsored 10 outstanding young researchers from different Arab countries to present their project or research on human development in a poster session.

Finally, TWAS-ARO also set the groundwork for two possible future events. One is a two-day creativity workshop to train and introduce new and creative methods of thinking and education to university students so that they would use that knowledge to train and educate others. The other is a series of public lectures with an environmental-sustainability theme. Speakers will include Arab Regional Office members and other eminent scientists in the Arab region.

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

The main event held by the Regional Office for Central and South Asia (TWAS-ROCASA) was the Meeting of TWAS Fellows, TWAS Young Affiliates & Young Scientists, held from 15 to 17 November at the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore. The topic was "Science Education for Innovation" and the meeting emphasized the role of science education in development in countries in the South.

TWAS-ROCASA also organizes the Summer Research Fellowship programme, a popular science outreach effort that offers three-month fellowships to young graduate students from developing countries in the region. The graduate students get the opportunity to work with distinguished scientists in institutions throughout India. Furthermore, a meeting of young scientists and young affiliates of TWAS was held on 16 November 2012.

The regional office also chose 10 young scientists to take part in the TWAS/BioVision Alexandria.NXT 2012 event in Alexandria, Egypt, extending USD10,000 in financial support to each of them for their travel expenses.

Finally, TWAS-ROCASA has finished the 2012 Directory of Fellows in the region.

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TWAS REGIONAL OFFICE FOR LATIN AMERICA AND THE CARIBBEAN
Headquarters: Brazilian Academy of Sciences, Rio de Janeiro, Brazil

The TWAS Regional Office for Latin America and the Caribbean (TWAS-ROLAC) held its 11th Young Scientists Conference in May, a three-day gathering at the Brazilian Academy of Sciences in Rio de Janeiro.

The event included scientific presentations by 20 early-career scientists from countries across the Latin American region, including Brazil, Ecuador, Trinidad, Venezuela, Uruguay, Argentina, and Barbados. It ended with a forum on science, technology and innovation for sustainable development and discussion of the Rio+20 United Nations Conference on Sustainable Development.

The office also held the 12th Young Scientists Conference in November in Rio de Janeiro, featuring 19 scientific presentations from young scientists hailing from Mexico, Ecuador, Cuba, Argentina, and Brazil.

TWAS-ROLAC offered travel support to young scientists who study either biology or biotechnology to attend TWAS/BioVision Alexandria.NXT 2012 event in Alexandria, Egypt. The office also supported 60 scholarships for fellows with the National Council of Technological and Scientific Development (CNPq) in Brazil, and worked to offer three- to six-month Portuguese language and culture courses to all scientists accepted into the TWAS-CNPq Fellowship Programme. The office chose five young scientists from the region to serve as affiliates of TWAS-ROLAC.

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

REGIONAL PRIZES

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

In 2012, the Regional Prizes for "Building Scientific Institutions" were awarded to:

- TWAS-ARO: Magdy Madkour, Arid Lands Agricultural Research Institute (ALARI), Ain Shams University, Cairo, Egypt.
- TWAS-ROCASA: Jayant Narlikar, Inter University Centre for Astronomy and Astrophysics, Pune, India; and Yousef Sobouti, professor, Institute for Advanced Studies in Basic Sciences in Zanjan, Iran.
- TWAS-ROLAC: Rogério Cerqueira Leite, Brazilian Centre for Research in Energy and Materials (CNPEM), in Campinas, São Paulo, Brazil.
- TWAS-ROSSA: Charles Obadiah Wambebe, International Biomedical Research Institute, Nigeria.
- TWAS-ROESEAP: Yin Li, Institute of Microbiology, Chinese Academy of Sciences, China.

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 2012, 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
Jalila Ben Salah-Abbes (Tunisia)	Elvan Ceyhan (Turkey)	Alexander Eduardo Arbieto Mendoza (Brazil)	Asfawossen Asrat Kassaye (Ethiopia)	Tzu-Ching Chang (Taiwan, China)
Assaad Antoine Eid (Lebanon)	Mubasher Jamil (Pakistan)	Alexander de Luna Fors (Mexico)	Yahya Choonara (South Africa)	Sok Ching Cheong (Malaysia)
Mohamed Faraq (Egypt)	Tapas Kumar Maji (India)	Mauricio Federico Erben (Argentina)	Collet Dandara (Zimbabwe)	Peng Wang (China)
Kamal Abdel Rahim Sweidan (Jordan)	Talatahari Siamak (Iran)	Andrea Cristina Paula-Lima (Chile)	Godefroid Gahungu (Burundi)	
Emad Yousif (Iraq)	Meththika Suharshini Vithanage (Sri Lanka)	Fabian Saenz Calderon (Ecuador)	Mohamad Fawzi Mahomoodally (Mauritius)	

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 2012 activities of these organizations follow.

The TWAS Family

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

With some 4,000 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. Nearly 100 men also are members.

OWSD's flagship Postgraduate Fellowship Programme for Young Women Scientists from sub-Saharan Africa and the Least Developed Countries, sponsored by the Swedish International Cooperation Development Agency (Sida) and launched in 1998, called for applicants in 2012 for its 2013 awards. The 2013 award is for early-career women scientists who have done standout research work in the life sciences.

In June 2012, the second GenderInSITE workshop was held in Paris with support from Sida. GenderInSITE is a joint initiative of OWSD, the United Nations Commission on Science and Technology for Development, and TWAS. Twelve participants from international agencies, science organizations, academies, and civil society attended. The purpose of GenderInSITE is to promote the role of women in science, technology and innovation (STI) and to analyse how STI can help improve women's lives and livelihoods.

In September, the OWSD Executive Board met in Tianjin, China, the location of TWAS's 23rd General Meeting. The board discussed at length strategic

issues such as policy, national chapters and fundraising. The TWAS-OWSD Advisory Panel also met in Tianjin.

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

For more information, see www.owsdw.org.

IAP, THE GLOBAL NETWORK OF SCIENCE ACADEMIES

Established in 1993, IAP, the global network of science academies, focuses on promoting cooperation and capacity-building among the world's merit-based science academies. In 2012, the IAP Executive Committee held two meetings, co-chaired by Howard Alper (Canada) and Mohamed H.A. Hassan (Sudan) and including representatives from the Australian Academy of Science; Academia Chilena de Ciencias; Chinese Academy of Sciences; Academy of Scientific Research and Technology (Egypt); Académie des Sciences (France); Indian National Science Academy; Accademia Nazionale dei Lincei (Italy); Akademi Sains Malaysia; Academia Mexicana de Ciencias; The Royal Society (UK), the National Academy of Sciences (United States); and TWAS (as *ex officio* member).

The first 2012 meeting of the Executive Committee was hosted by the Deutsche Akademie der Naturforscher Leopoldina, in Halle, Germany, on 26-27 March. The meeting focused on the IAP Statement on Population

and Consumption, which was launched just before the Rio+20 Summit in June. Several presentations and the Report of the Meeting were dedicated *in memoriam* to F. Sherwood Rowland (1927-2012), founding co-chair of IAP. A joint session was held with the InterAcademy Council (IAC) Board, also including a presentation on the forthcoming IAP/IAC Joint Policy Report *Responsible Conduct in the Global Research Enterprise.*

The second meeting of the Executive Committee hosted by the Akademi Sains Malaysia in Kuala Lumpur, Malaysia, on 15-16 October, focused on the development of the Third Strategic Plan (2013-2015) and the organization of the conference "Grand Challenges and

iap
the global network of science academies

Integrated Innovations: Science for Poverty Eradication and Sustainable Development" and the IAP General Assembly. Those events were to be hosted by the Brazilian Academy of Sciences in Rio de Janeiro in February 2013.

In 2012, the annual IAP competitive call for proposals was issued for projects focusing on science education, science/policy dialogue, science communication and programmes supporting young scientists' activities, in line with the IAP Second Strategic Plan. Among the projects/initiatives approved:

- "Improving Science Education in Sudan and Ethiopia through a Model-based Approach". Lead academy: Sudanese National Academy of Science;
- An international conference, "Entrepreneurship for Young Women and Using of New Technologies: Issues and Challenges". Lead organizer: Network of Academies of Science in Islamic Countries, c/o Pakistan Academy of Sciences.

Among IAP's 2012 activities, two events were particularly important:

- The international conference on inquiry-based science education, *"Developing IBSE: New Issues – the roles of assessment and the relationship with industry"* (Helsinki, Finland, 30 May - 1 June), jointly organized by IAP, All European Academies and the Finnish Academy of Science and Letters;
- The international symposium, *"Enhancing Water Management Capacity in a Changing World: Science Academies Working Together to Increase Global Access to Water and Sanitation"*, (São Paulo, Brazil, 25-28 June), organized by IAP, the Inter-American Network of Academies of Science and the Brazilian Academy of Sciences.

The year saw further regional decentralization through the IAP Affiliated Regional Networks (i.e., the Association of Academies of Sciences in Asia [AASA]; the European Academies Science Advisory Council [EASAC]; the InterAmerican Network of Academies of Sciences; and the Network of African Science Academies [NASAC]). Among the activities implemented was the inaugural meeting of the new Association of Academies and Societies of Sciences in Asia, which was created by the merger of the Federation of Asian Scientific Academies and Societies and AASA in Sri Lanka in October 2012, with the goal of further promoting cooperation and outreach in Asia and Australasia. Another key inter-regional activity was the EASAC/NASAC Science Policy Dialogue Workshop in Halle, Germany, 18-20 October.

As in previous years, the activities of IAP and the IAP Secretariat are funded by a generous contribution from the Government of Italy and are also supported by in-kind contributions from science academies worldwide.

For more information, see www.interacademies.net or contact IAP Coordinator L. Spini by emailing iap@twas.org.

INTERACADEMY MEDICAL PANEL (IAMP)

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

In 2012, the IAMP held two meetings of its Executive Committee (EC), co-chaired by Jo Ivey Boufford (USA) and Lai-Meng Looi (Malaysia) and including representatives from the Brazilian Academy of Sciences; African Academy of Sciences; Academia Nacional de Medicina de Colombia; Académie Nationale de Médecine (France); Deutsche Akademie der Naturforscher - Leopoldina; Academia dei Lincei (Italy); Nigerian Academy of Sciences; Turkish Academy of Sciences; Royal Swedish Academy of Sciences; and TWAS (as *ex officio* member).

The spring 2012 IAMP/EC Meeting was hosted by the Brazilian Academy of Sciences and the Brazilian National Academy of Medicine in Rio de Janeiro, Brazil (29 April – 3 May) back-to-back with the IAMP Regional Workshop on Non-Communicable Diseases (3-5 May). This was an important event focused on the upcoming IAMP 2013 Conference, to be hosted in August 2013 by the Academy of Science for South Africa.

The fall 2012 meeting was held in Berlin, Germany, in conjunction with the World Health Summit (WHS). The meeting came back-to-back with the second edition of the IAMP Young Physician Leaders Programme, an activity made possible thanks to the support of IAP; the Berlin-Brandenburg Academy of Sciences and Humanities (Germany); the Charité-Universitätsmedizin Berlin (Germany); the M8 Alliance; and the WHS. It is important to recall that the 2012 YPLs and the 2011 alumni also organized two WHS sessions: the partner symposia on "Leadership Lessons Learnt from the IAMP/WHS Experience" (22 October) and "IAMP: Young Physician Leaders 2012" (23 October).

IAMP also continued its promotion of the science-policy interface by raising awareness of the IAMP Statements and by developing the IAMP Statement "A Call for Action to Strengthen Health Research Capacity in Low- and Middle-Income Countries" to be launched in conjunction with the World Health Assembly in May 2013.

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

For more information, see www.iamp-online.org or contact IAMP Coordinator L. Spini by emailing iamp@twas.org.

iamp
the interacademy medical panel

APPENDICES

2012 in Figures

TWAS's **South-South Fellowships** are awarded in collaboration with partner organizations in a number of developing countries, including the National Council for Scientific and Technological Development (CNPq), Brazil; the Chinese Academy of Sciences (CAS), China; the Council for Scientific and Industrial Research (CSIR) and the Department of Biotechnology (DBT) of the Government of India; the S.N. Bose National Centre for Basic Sciences, India; the Indian Association for the Cultivation of Sciences (IACS), India; the International Centre of Insect Physiology and Ecology (icipe), Kenya; the Universiti Sains Malaysia (USM), Malaysia; the National Science and Technology Council (CONACyT), Mexico; the National Centre of Excellence in Molecular Biology (CEMB), the International Centre for Chemical and Biological Sciences (ICCBS), and the National Centre for Physics (NCP), Pakistan; and the National Centre for Genetic Engineering and Biotechnology (BIOTEC), Thailand. In 2012, TWAS awarded a total of 159 fellowships, of which 139 have been accepted.

Programme partner	Postgraduate fellowship		Postdoctoral fellowship		Visiting scholar	
	Awarded	Accepted	Awarded	Accepted	Awarded	Accepted
CNPq, Brazil	31	34	10	10	-	-
CAS, China	19	20	14	15	15	15
CSIR, India	6	7	4	4	-	-
DBT, India	3	3	4	8	-	-
IACS, India	-	-	1	1	-	-
S.N. Bose, India	1	1	-	-	-	-
icipe, Kenya	-	-	1	1	-	-
USM, Malaysia	9	10	7	7	5	5
CONACyT, Mexico	-	-	(pending)	6	-	-
CEMB, Pakistan	-	-	-	-	-	-
ICCBS, Pakistan	6	6	2	5	-	-
NCP, Pakistan	-	-	1	1	-	-
BIOTEC, Thailand	-	-	-	-	-	-
TOTAL	*75*	*81*	*44*	*58*	*20*	*20*

50 **TWAS Research Grants** of up to USD15,000 each were awarded in 2012 to individual researchers in S&T-lagging countries.

Geographical area	Biology	Chemistry	Mathematics	Physics	*TOTAL*
Africa and Arab region	11	11	3	3	*28*
Asia and Pacific region	5	6	2	5	*18*
Latin America and the Caribbean	3	1	0	0	*4*
TOTAL	*19*	*18*	*5*	*8*	*50*

In 2012, 18 **TWAS Research Units** 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	2	2	2	0	*6*
Asia and Pacific region	4	2	0	4	*10*
Latin America and the Caribbean	2	0	0	0	*2*
TOTAL	*8*	*4*	*2*	*4*	*18*

Under the **TWAS-UNESCO Associateship Scheme**, TWAS in 2012 appointed as associates 24 developing-world scientists from 13 countries, including Malawi, Mozambique, Namibia, Uzbekistan and Zambia. In addition, 30 TWAS-UNESCO associates, including those appointed in previous years, travelled to carry out collaborative research at scientific institutions in 13 countries in the developing world: Argentina, Botswana, China, India, Iran, Jamaica, Jordan, Mexico, Nigeria, South Africa, Taiwan, Thailand and Uruguay.

Geographical area	Awarded	Hosted
Africa and Arab Region	12	5
Asia and Pacific	9	10
Latin America and Caribbean	3	9
TOTAL	*24*	*24*

Under the **TWAS Research and Advanced Training Fellowship** programme, eight developing-world scientists from seven countries, including Cameroon, Cuba, Iran and Togo, were awarded fellowships in 2012. They visited research institutes in eight host countries: Benin, Brazil, Colombia, India, Indonesia, Mexico, Pakistan and Thailand.

Geographical area	Awarded	Hosted
Africa and Arab Region	4	1
Asia and Pacific	2	4
Latin America and Caribbean	2	3
TOTAL	*8*	*8*

In 2012, TWAS provided support to 21 **Scientific Meetings** in 14 developing countries.

Geographical area	*TOTAL*
Africa and Arab region	8
Asia and Pacific region	6
Latin America and the Caribbean	*7*
TOTAL	*21*

In response to the third call for proposals under the **TWAS-COMSTECH Joint Research Grants** programme, TWAS and the Organization of Islamic Cooperation (OIC) Standing Committee on Scientific and Technological Cooperation (COMSTECH) in 2012 awarded 17 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	0	0	2	*3*
Asia	2	3	1	4	2	0	*14*
TOTAL	*3*	*3*	*1*	*4*	*4*	*2*	*17*

Under the **TWAS Research Professors in Least Developed Countries** programme, two TWAS members travelled to their host centres in 2012.

TWAS Fellow	Country of residence	Field of expertise	Host institution in LDC	Year of appointment
Bishal Nath Upreti	Nepal	Earth Sciences	School of Mines, University of Zambia P.O. Box 32379 Lusaka, Zambia	2011
Huanming Yang	China	Structural, Cell and Molecular Biology	National University of Laos, Dongdok Campus Xaythani District, Vientiane PO Box 7322, Lao PDR	2011

Under the **TWAS Visiting Scientist Programme**, three scientists travelled to their host centres in 2012.

Visiting Scientist	Country of residence	Field of expertise	Host institution	Year of appointment
Akier Assanta Maf	Canada	Veterinary medicine, food microbiology, food safety and biosecurity	Faculty of Veterinary Medicine University of Lubumbashi, Lubumbashi Katanga, Congo, Rep. Dem.	2012
Edwin Freeman	USA	Chemistry, polymer science, materials science and engineering, technology	William V. S. Tubman University Tubman Town, Harper, Maryland Country P.O. BOX 3570, Monrovia, Liberia	2011
Nsalambi Vakanda Nkongolo	USA	Agriculture and forestry research	Institut Facultaire des Sciences Agronomiques (IFA-Yangambi), BP 28 Yangambi, BP 1232 Kisangani Province Orientale, Congo, Rep. Dem.	2012

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 two- to three-month visits to an institution in Germany. In 2012, 19 young African scientists received awards.

Country of origin	Awarded
Nigeria	6
Cameroon	5
Kenya	3
Burkina Faso, Burundi, Mauritius, Uganda, Zimbabwe	1 per country
TOTAL	*19*

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
Alessandra Piani
Patricia Presiren
Paola Vespa
Ezio Vuck

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Sabina Caris
Sara Dalafi
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Payal Patel
Cristina Simões

Public Information Office

Public Information Officer
Edward W. Lempinen (from January 2013)

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Peter McGrath (from February 2012)

Tonya Blowers (from February 2012)
Jennifer Coppola (from February 2012)
Gisela Isten
Cristina Serra
Sean Treacy (from May 2013)

OWSD - Organization for Women in Science for the Developing World

Sara Dalafi
Leena Mungapen

IAP - the global network of science academies

IAMP - InterAcademy Medical Panel

Coordinator
Lucilla Spini (from February 2012)

Muthoni Kareithi
Joanna Lacey

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

Financial Report 2012

FINANCE

The total amount of funds received for activities in 2012 was USD4,912,752. The main contributions were from: the Ministry of Foreign Affairs, Italy (USD2,052,975); the Swedish International Development Cooperation Agency (Sida) (USD2,197,954); illycaffè S.p.A., Trieste (USD100,000); COMSTECH, Pakistan (USD114,685); Elsevier Foundation, USA (USD50,000); and the Kuwait Foundation for the Advancement of Sciences (KFAS) (USD50,000).

In addition, it is estimated that partner organizations in the TWAS South-South Fellowships programme (see pages 46-47) contributed some USD2.5 million in local (host country) expenses and TWAS Regional Offices contributed some USD400,000 in supporting TWAS regional activities (see pages 64-67).

On 31 December 2012, the TWAS Endowment Fund stood at USD13,979,391, with the target set at USD25 million. Donations during 2012 totaled USD1,572,710 including USD1,500,000 from the Ministry of Sciences and Technology, China; USD25,000 from the Consejo Nacional de Ciencia y Tecnologia (CONACYT), Mexico; USD26,560 from the Academia Sinica , Taiwan, China; plus other contributions amounting to USD21,150. Interest in 2012 totaled USD67,696.

TWAS FINANCIAL REPORT 2012 (IN USD)

INCOME[1]	
Balance	42,556
1) Ministry of Foreign Affairs, Italy	2,052,975
2) Swedish International Development Cooperation (Sida)	2,197,954
3) Chinese Academy of Sciences (CAS), China	250,000
4) illycaffè, Trieste	100,000
5) COMSTECH, Pakistan	114,685
6) Kuwait Foundation for the Advancement of Sciences (KFAS)	50,000
7) Elsevier Foundation, USA	50,000
8) African Union, Ethiopia	24,000
9) EuroAfrica-ICT (EC), Belgium	16,409
10) The OPEC Fund for International Development, Austria	46,729
11) CNR Rao, India	5,000
12) Atta-ur-Rahman, Pakistan	5,000
13) Prior year adjustment	568,525
14) Interest income	11,240
15) Miscellaneous income	6,287
	5,541,360

EXPENDITURE	Spent[2]
1) Prizes	
1.1) Trieste Science Prize	101,990
1.2) TWAS Prizes and Medals	147,448
1.3) Prizes for Young Scientists	28,000
1.4) CNR Rao and Atta-Ur-Rahman Prize	10,000
Sub-Total for (1)	287,438
2) Research Grants	1,288,311
3) Fellowships, Associateships and Professorships[3]	
3.1) Fellowship Programmes	519,398
3.2) Associateship, Professorship & Visiting Programmes	257,681
Sub-Total for (3)	777,079
4) Meetings	
4.1) Council and General Meetings	257,430[6]
4.2) Officers and Steering Committee Meetings and Meetings in Trieste	62,019
4.3) Scientific Meetings in the South	71,035
Sub-Total for (4)	390,484
5) Publications	80,669
6) Joint Projects	
6.1) TWAS Regional Offices[4]	198,979
6.2) TWAS-AAS-Microsoft Project	16,062
6.3) TWAS/COMSTECH Research Grant	200,000
6.4) TWAS – ICTP Projects	50,000
6.5) AU – TWAS Young Scientists National Award	65,000
6.6) ISTIC – TWAS Project	10,000
6.7) International Science Diplomacy Programme	16,483
6.8) EU Catalyst[5]	103,649
6.9) GRC Meeting, Ethiopia	22,550
Sub-Total for (6)	682,723
7) Operational Expenses	
7.1) Staff Costs	1,199,620
7.2) ICTP Services	64,500
7.3) Communications	41,500
7.4) Travels	43,391
7.5) Library, office and other supplies	47,988
7.6) Other general operating expenses	33,873
Sub-Total for (7)	1,430,872
Total	4,937,576
Excess (shortfall) of income over expenditure	**603,784**[7]
Reserve Fund[8]	
Amount available at the beginning of period	2,869,783
Reserve for end of service entitlements	(46,553)
Reserve Fund balance end of period	**2,823,230**
Reserve and Regular Fund balances, end of period	**3,427,014**

[1] *For presentation purposes, all contributions are expressed in US dollars and have been converted using the UN official rate of exchange valid at the time the contributions were received.*
[2] *Amount disbursed plus unliquidated obligations*
[3] *Estimated local costs to be covered by host country: USD2,500,000.*
[4] *Estimated local costs covered by Regional Offices: USD400,000.*
[5] *The total cost of EU Catalyst Project will be covered by EU.*
[6] *Chinese Academy of Sciences (CAS) provided a contribution of USD250,000 to TWAS to cover the TWAS General Meeting (tickets, publications, staff cost, etc) plus more than USD500,000 for local expenses.*
[7] *The excess of income is an outstanding amount from Sida contribution since the contribution arrived in December 2012.*
[8] *The Reserve Fund is designed to cover the end of service entitlements of TWAS Staff.*

TWAS Annual Report 2012

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- Swedish International Development Cooperation Agency (Sida)
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- COMSTECH, Pakistan
- Kuwait Foundation for the Advancement of Sciences (KFAS)
- Elsevier Foundation, USA
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TWAS
THE WORLD ACADEMY OF SCIENCES
FOR THE ADVANCEMENT OF SCIENCE
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