



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

2008

twas

TWAS, the academy of sciences for the developing world, is an autonomous international organization that promotes scientific capacity and excellence in the South. Founded in 1983 by a group of eminent scientists under the leadership of the late Nobel laureate Abdus Salam of Pakistan, TWAS was officially launched in Trieste, Italy, in 1985, by the secretary-general of the United Nations.

TWAS has 909 members from some 90 countries, more than 70 of which are developing countries. A Council of 13 members is responsible for supervising all Academy affairs. It is assisted in the administration and coordination of programmes by a secretariat, headed by the executive director. The secretariat is located on the premises of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy.

The administration and financial operation of TWAS is undertaken by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in accordance with an agreement signed by the two organizations. A major portion of TWAS funding is provided by the Ministry of Foreign Affairs of Italy.

The main objectives of TWAS are to:

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

To achieve these objectives, TWAS is involved in various activities and collaborates with a number of organizations, especially UNESCO, ICTP, the International Centre for Biotechnology and Genetic Engineering (ICGEB) and the International Council for Science (ICSU).



TWAS COUNCIL

President

Jacob Palis (Brazil)

Immediate Past President

C.N.R. Rao (India)

Vice Presidents

Jorge E. Allende (Chile)

Chunli Bai (China)

Romain Murenzi (Rwanda)

Atta-ur-Rahman (Pakistan)

Ismail Serageldin (Egypt)

Secretary General

Dorairajan Balasubramanian (India)

Treasurer

José L. Morán López (Mexico)

Council Members

Ali Abdullah Al Shamlan

Eugenia del Pino Veintimilla

Reza Mansouri

Keto Mshigeni

Abdul H. Zakri

Ex-officio Member (Director, ICTP)

Katepalli Sreenivasan



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

2008

twas

Contents

Foreword	7
Year in Review	9
TWAS in Mexico - Silver Jubilee celebrations	12
PROGRAMMES	
Core Programmes	
Trieste Science Prize	20
TWAS Prizes: Honouring Scientists	22
TWAS Prizes for Young Scientists	32
Associateships Scheme	36
South-South Fellowships	38
TWAS Research Professors	40
Research Grants for Individuals	42
Research Grants for Groups	44
Public Information	46
Collaborative Programmes	
Partnerships	48
Regional Offices	52
TWAS Family	58
APPENDICES	
2008 in Figures	64



This year marks the silver anniversary of TWAS, the academy of sciences for the developing world. Over the past 25 years, the Academy has emerged as a leading institution in international science and as a respected voice for science in the South.

TWAS began with 42 members. Today it can count on more than 900. Nearly 85 per cent of the Academy's members are from developing countries – a clear sign that scientific capacity in the developing world is growing.

Many factors have propelled this welcome trend, including governments' increasing commitment to invest in science and technology, the rise of new information and communication technologies (ICTs), and better working and living conditions for scientists in the South – all of which have encouraged researchers to pursue their scientific careers in their home countries rather than emigrating to Europe, the United States or elsewhere.

The Academy is proud of the contributions it has made to these advances. It has helped to promote science among both policy makers and the public and, equally importantly, it has helped raise the profile of individual scientists in the South.

Election to TWAS confirms a scientist's contributions to his or her field. It also bestows prestige and recognition. The membership process is highly competitive – fewer than 25 per cent of nominated scientists become members each year. As a result, the Academy can justifiably claim that its members represent the best of science in the South.

Through its research grants programme, TWAS has helped hundreds of scientists at critical junctures in their careers. More recently, it has expanded this programme to fund research teams in 80 scientifically lagging countries. By assisting both individuals and institutions, TWAS's research grants provide broad support for science and society in the developing world. By funding research groups in countries that are least proficient in science, TWAS hopes to narrow the gap between countries' scientific capacities, not just between the North and South, but also within the South itself.

Another long-running initiative, the TWAS Prizes, celebrates the careers of top scientists in the developing world, while the Trieste Science Prize, sponsored by illycaffè, recognizes and rewards the developing world's most eminent scientists. Together with the TWAS Prizes for Young Scientists scheme, such efforts highlight the important work that scientists carry out in developing countries and, perhaps more importantly, provide them with the recognition required for them to progress in their scientific careers.

Foreword

Jacob Palis

President

TWAS

Over the past quarter century, TWAS has also provided a strong voice for the scientific community in the South, helping to shape policy debates within developing countries. TWAS has accomplished this through various means, including support for scientific conferences and meetings, and by sponsoring workshops that offer scientists and decision makers opportunities to share knowledge on such topics as safe drinking water, the conservation and sustainable use of medicinal plants and renewable energy.

The Academy is also involved in projects like the EuroAfriCa-ICT consortium, funded by the European Union, which is promoting collaborative research in ICTs between European, Caribbean and African institutions. Such projects help developing countries build important in-roads into cutting-edge technologies and ensure that they participate in today's most critical scientific advances and debates.

Most importantly, perhaps, TWAS serves as a bridge for South-South cooperation and support in science. The Academy's South-South Fellowships programme is one of the most far-reaching initiatives for scientific capacity building in the South. Each year, more than 250 fellowships are made available in Brazil, China, India, Malaysia and Pakistan to researchers from other developing countries. Indeed, in 2008, we were pleased to add Mexico to this list of partner countries. By sustaining and expanding the number of fellowships offered, TWAS could help train thousands of young scientists, significantly expanding the knowledge base in the scientifically lagging countries.

But while TWAS has achieved much over the past 25 years, big challenges still lie ahead for our Academy.

The Academy must continue to raise the profile of science in developing countries that do not yet fully embrace and promote scientific capacity building. Overcoming this increasing 'South-South' divide is likely to be one of the fundamental issues for science in the developing world in the years ahead. TWAS can address this by continuing to help young and mid-career scientists. The future of science belongs to the next generation of these professionals, and we must help them achieve their full potential.

Finally, the Academy must expand its role as a bridge between the South and North to help advance scientific research and to develop effective international policies.

TWAS's silver anniversary is a time to celebrate, not a time to rest on our laurels. I am confident that the Academy's next 25 years will be even more fruitful as we continue to apply lessons we have learned to meet future challenges for the benefit of science and societies across the developing world.

2008: The Year in Review

Mohamed H.A. Hassan
Executive Director
TWAS



In 2008, TWAS celebrated its 25th anniversary – its Silver Jubilee. Although this provided us with a timely opportunity to look back at our achievements over the past quarter century, it also allowed us to take stock of where we are at present – and what needs to be done over the next 25 years.

Thanks to the dedicated work of the TWAS secretariat and the Academy's colleagues in Mexico – TWAS's 19th General Meeting, which was held in Mexico City and where the 25-year celebrations were held, was a great success and gained world-wide exposure.

Any such high-profile event requires months of behind-the-scenes planning. But, in 2008, TWAS was not focused solely on organizing this event. Indeed, over the past year, TWAS has launched a number of new initiatives, developed in collaboration with a variety of partners, and laid the groundwork for several more to be launched early in 2009. Barring perhaps our very first steps in developing programmes designed to build scientific capacity in the South all those years ago, TWAS has never been so active in launching new programmes.

Those programmes launched in 2008 are outlined below, along with highlights of TWAS's core programmes and other 2008 activities.

As with the TWAS General Meeting, the success of these activities demonstrates how active the Academy is 'behind the scenes' – and sends a clear sign of how dedicated we are to serving the needs of scientists in the South for as long as science in the South lags behind the advances being made in the North.

Among the highlights of TWAS's 2008 activities were:

- *TWAS 19th General Meeting.* The TWAS 19th General Meeting and 25th anniversary 'Silver Jubilee' celebrations were hosted by the Mexican Academy of Sciences on 10-13 November 2008. The event was attended by some 350 scientists from 50 countries. Among the highlights of the meeting was a series of 'Silver Jubilee Lectures' presented by some of the world's most eminent scientists; the election of 41 eminent scientists as new members of the Academy, bringing TWAS membership to 909; the induction of the second group of TWAS Young Affiliates; and the announcement of the winners of the 2008 TWAS Prizes [see pages 12-17].
- *Trieste Science Prize.* TWAS and *illycafé S.p.A.*, the commercial sponsor of the Trieste Science Prize, announced the names of the two 2008 winners: Beatriz Barbuy, an eminent Brazilian astrophysicist, and Roddam Narasimha, an internationally renowned engineer and physicist from India who studies fluid dynamics. Both winners received their awards at a special ceremony in Trieste on 29

September and presented their work at the TWAS 19th General Meeting in Mexico in November (see pages 20-21).

- *Regional Prizes*. In 2008, each of TWAS's five Regional Offices selected the winners of the second round of TWAS Regional Prizes, this time dedicated to the 'Development of educational material and school science curricula'. The names of the winners were announced during the TWAS 19th General Meeting (see pages 56-57).

- *Regional Conferences for Young Scientists*. Organized by TWAS Regional Offices, three Regional Conferences for Young Scientists (RCYS) took place in 2008. The Arab Regional Office linked the TWAS/BioVision Alexandria.Nxt event with BioVision Alexandria 2008 at the *Bibliotheca Alexandrina*, Egypt, and hosted 99 young scientists from 27 developing countries. In sub-Saharan Africa, the Third TWAS-ROSSA RCYS took place in December 2008, and in Latin America, the Fourth TWAS-ROLAC RCYS was held at the Brazilian Academy of Sciences, also in December (see pages 52-57).

- *South-South Fellowships programme*. A total of 134 South-South Fellowships were awarded, the highest ever annual total, of which 125 were accepted (see pages 38-39 and 65). In 2008, the programme continued to expand, with fellowships being awarded to young scientists wishing to carry out research at the *Universiti Sains Malaysia* (USM) for the first time. In addition, TWAS signed an agreement with Mexico's National Council on Science and Technology (CONACYT) to host up to 20 postgraduate students and 10 postdoctoral researchers each year at leading institutions in Mexico.

- *Grants for Research Units from Science and Technology-lagging Countries*. With support from the Swedish International Development Agency (Sida), TWAS provides US\$30,000 grants to research units in 80 science and technology-lagging countries. Some 22 such capacity-building grants were awarded in 2008, as well as another 28 research grants to individual scientists (see pages 42-45 and 65).

- *TWAS-UNESCO Associateship scheme*. This programme provides scientists in developing countries with opportunities to develop long-term links with more than 100 centres of excellence in the South. In 2008, 32 scientists were selected for the award. These scientists will make two visits to their selected host institution during a three-year period (see pages 36-37 and 64).

- *New programmes*. In 2008, these 'traditional' core programmes of TWAS have been supplemented – and complemented – by a number of new schemes. For example, TWAS has obtained its first European Union funding, joining the EuroAfriCa-ICT consortium in a two-year project aimed at increasing collaborative

research between computer scientists in Africa, the Caribbean and Europe. The Academy, together with the African Academy of Sciences, also signed an agreement with Microsoft Research (UK), who will sponsor two programmes aimed specifically at Africa: scientific meetings in the field of computing, and a series of prizes for young African computer scientists. In addition, TWAS has agreed to partner with the OIC (Organization of Islamic Conference) Standing Committee on Scientific and Technological Cooperation (COMSTECH) to provide research grants to promising young scientists in OIC countries, and has joined forces with the International Centre for Genetic Engineering and Biotechnology (ICGEB) and the United Nations Educational, Scientific and Cultural Organization's International Basic Sciences Programme (UNESCO/IBSP) to fund a two-year 'Joint Project on Capacity Building in Basic Molecular Biology'. These latter two programmes will be launched in early 2009. See www.twas.org for details.

- *Capacity building in the geosciences.* Following on from a series of four workshops on 'Capacity building in environmental related issues in the field of geo-mining' held in 2006 and 2007, TWAS again teamed up with FORGEA-International, a geo-mining and environmental training and cooperation centre based in Sardinia, Italy, to organize another three workshops through a project funded by the Italian government's Ministry of Foreign Affairs. The first of these workshops was held in late 2008, with the remaining two scheduled for early 2009 (see page 50).

- *International outreach.* As well as its regular publications, including the *TWAS Newsletter*, the Academy joined forces with *Nature* to produce a special supplement, 'A World of Science in the Developing World', released to coincide with the Academy's 25th anniversary celebrations in Mexico. Many of the articles, which examine critical issues in science, technology and innovation and in science-based international development, were written by TWAS members. In addition, a number of editorials and opinion articles were published in such journals as *Nature* and *Science* during the course of the year, helping to maintain TWAS's high profile in the world of science (see pages 46-47).

- *Endowment fund.* During 2008, the TWAS endowment fund reached US\$11,393,955. The fund, which is intended to bring long-term security to TWAS, now has a target of US\$25 million. A campaign to help the Academy attain this goal was launched in 2008 with the establishment of a campaign committee during the meeting in Mexico.

This brief overview of TWAS's 2008 activities demonstrates that the Academy continues to advance on a variety of fronts but always with the over-riding aim of encouraging countries in the South to strive towards excellence when developing their indigenous scientific capacity and by directly supporting their efforts.

TWAS's 19th General Meeting was held at the Mexican Academy of Sciences, Mexico City, from 10-13 November 2008. Nearly 350 scientists from more than 50 countries – the majority of whom were members of TWAS – attended the event that also celebrated the Academy's 25th anniversary.

TWAS in Mexico - Silver Jubilee celebrations



TWAS'S 19th General Meeting and 25th anniversary Silver Jubilee celebrations were held on 10-13 November 2008 at the headquarters of the Mexican Academy of Sciences in Tlalpan, overlooking the vast urban expanse of Mexico City. Nearly 350 scientists from more than 50 countries attended the event that examined the state of science in the developing world and analysed TWAS's current and future role in building scientific capacity.

Highlights of the meeting included:

- The opening ceremony that included speeches by Josefina E. Vázquez Mota, secretary, Ministry for Public Education, Mexico; Marcio Nogueira Barbosa, deputy director-general, United Nations Educational, Scientific and Cultural Organization (UNESCO); Barbara Bregato, *consigliere*, Ministry of Foreign Affairs, Italy; Juan Carlos Gutiérrez, director-general, Mexican National Council for Science and Technology (CONACYT); Rosaura Ruiz



Gutiérrez, president, Mexican Academy of Sciences; and Katepalli R. Sreenivasan (TWAS Fellow 1998), director, Abdus Salam International Centre for Theoretical Physics (ICTP).

- An address by TWAS President Jacob Palis, 'TWAS: Then and Now', which highlighted the Academy's accomplishments and outlined the need for TWAS to devote special attention to such issues as South-South cooperation and support for women and young scientists in the years ahead.

- A high-level panel discussion that explored 'Strategies for Promoting South-South Cooperation for Education and Research'. Those participating in the panel included Tan Tieniu, deputy secretary general, Chinese Academy of Sciences; M.G.K. Menon, founding member of TWAS and adviser to the Indian Space Research Organization; Turner T. Isoun, former federal minister of science and technology in Nigeria; Atta-ur-Rahman (TWAS Fellow 1985), coordinator general, the Organization of Islamic Conference's Standing Committee on Scientific and Technological Cooperation (COM-STECH) and former federal minister of higher education in Pakistan; and Mosibudi Mangena, minister of science and technology in South Africa.



- A symposium, led by J.P. Lacleste, immediate past president of the Mexican Academy of Sciences, on the current strengths and weaknesses of different

fields of science and technology in Mexico.

- A series of Jubilee lectures, including presentations by Mario Molina (TWAS Associate Fellow 1996), professor of atmospheric chemistry at University of California, San Diego, USA, and a Nobel laureate in chemistry (1995); Harold Varmus, president of the Memori-



al Sloan-Kettering Cancer Center and Nobel laureate in physiology or medicine (1989); Martin Rees (TWAS Associate Fellow 2007), professor of cosmology and astrophysics, Master of Trinity College, Cambridge, UK, and Crafoord Prize winner 2005; and Srinivasa S.R. Varadhan (TWAS Associate Fellow 1988), professor at the Courant Institute of Mathematical Sciences, New York, and 2007 Abel Prize winner.

- A series of other symposia covering such scientific areas as 'Genes and Human Health', 'New Perspectives in Mathematics', 'Multi-disciplinary Research in Nanoscience' and 'Climate Change and Risks to Biodiversity'.

- The announcement of the winners of the TWAS 2008 Regional Prizes for the development of educational material and school science curricula. The US\$3,000 prizes are awarded by each of the Academy's five Regional Offices (see pages 56-57).

- The granting of TWAS Young Affiliate status to promising scientists under the age of 40 who live and work in developing countries. Twenty-four scientists (up to five chosen by each of TWAS's Regional Offices)



were selected, 16 of whom attended the conference where they were officially welcomed to TWAS and given an opportunity to present their research.

- The election of 41 new members to the Academy. The new members, chosen from 167 candidates, include two scientists from Ethiopia and one each from Cuba, Jamaica and Uzbekistan. The Academy's membership now totals 909, representing 90 countries.
- The awarding of TWAS Prizes to eight eminent scientists from the developing world (see pages 22-31) and of the C.N.R. Rao Prize for Scientific Research – to Maurice Tchuente of Cameroon (TWAS Fellow 1999).
- Presentations by the 2008 Trieste Science Prize winners: Beatriz Barbuy (TWAS Fellow 2007), professor at the *Universidade de São Paulo*, Brazil, who won in the category of earth, space, ocean and atmospheric sciences, and Roddam Narasimha (TWAS Fellow 1988), chair of the Engineering Mechanics Unit at the Jawaharlal Nehru Centre for Advanced Scientific Research in Bangalore, India, who won in engineering sciences. Barbuy and Narasimha had previously spoken about their award-winning research at the Trieste Science

Prize 2008 ceremony in September in a public event that was held in conjunction with the 75th anniversary of illycaffè in Trieste (see pages 20-21). The presentations in Mexico, tailored to a more scientific audience, provided an overview of their findings and explored where their research efforts might lead in the future.

- Presentations of TWAS Medal Lectures for 2007 and 2008: José de la Peña (TWAS Fellow 2003), professor, Institute of Mathematics, National Autonomous University of Mexico; M.R.S. Rao (TWAS Fellow 2002), president, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore; Anwar Nasim (TWAS Fellow 1987), science advisor to the Organization of Islamic Conference's Standing Committee on Scientific and Technological Cooperation (COMSTECH), Islamabad; and Keto Mshigeni (TWAS Fellow 1987), vice-chancellor, Hubert Kairuki Memorial University, Dar es Salaam, Tanzania. The latter two scientists had been selected to deliver Medal Lectures in 2007 but were unable to attend the meeting in Trieste.
- The launch of a new endowment fund campaign, with a target of US\$25 million by 2012. To help reach this goal, an endowment campaign committee was established, consisting of Jacob Palis (president), C.N.R. Rao (immediate past president), Mohamed Hassan (executive director), Bai Chunli (vice president), A. Al Shamlan (council member), Philip Griffiths (TWAS Associate Fellow 2000) and Harold Varmus (president of the Memorial Sloan-Kettering Cancer Center and Nobel Prize in physiology or medicine, 1989).
- The announcement by Mosibudi Mangena, Minister of Science and Technology, South Africa, that South Africa will generously host the TWAS 20th General Meeting. The dates and venue have since been set for Durban, 20-23 October 2009.

Like all previous General Meetings, TWAS members were given ample opportunities to express their opinions and concerns during a two-hour General Assembly.



As usual, members had no shortage of ideas and comments on how the Academy might strengthen its activities and programmes. Much of the discussion focused on how TWAS, by building upon 25 years of experience and a growing reputation in the international scientific and development communities, could move forward even more effectively in the future and ultimately exert an even greater impact on the building of scientific capacity in the South.

Farida Habib Shah (TWAS Fellow 2002), consultant/chief executive officer of Novel Plants and BioIT

Technologies, Malacca, Malaysia, asked if the Academy would be willing to dedicate a certain number of openings for new TWAS members to women each year. She noted that only two women had been elected to TWAS this year and said that it might be wise for the Academy to take a more proactive role in ensuring that women scientists were well represented. Jacob Palis, TWAS president, replied that he hoped the current gender imbalance could be addressed without resorting to altering current selection procedures, adding that all TWAS members should do their best to identify and nominate excellent women scientists.

Manju Sharma (TWAS Fellow 1995), Indian Institute of Advanced Research, suggested that, since capacity building was a priority for TWAS, the Academy should consider setting up a 'TWAS Silver Jubilee Centre for Capacity Building in Science and Technology'. The centre, she said, could consist of member states willing to pay annual dues to help fund its activities. Sharma noted that such a centre might help bridge the gap between the natural and social sciences and serve as a vehicle for the promotion of science, technology and innovation.





Ashok Kumar Vijh (TWAS Associate Fellow 1987), research head of the Hydro-Quebec Institute of Research in Canada, asked why no members had been elected to TWAS in the social sciences category during the past two election cycles. He was especially concerned by this turn of events given the Academy's desire to nurture multi-disciplinary collaborations and expand its efforts to make scientific capacity building an integral part of sustainable development efforts in the South.

Ismail Serageldin (TWAS Fellow 2001), director of the *Bibliotheca Alexandrina*, Egypt, and chair of the Academy's social and economic sciences committee,

responded by saying that the nominations had been too few in number and that more attention needed to be paid to soliciting and evaluating potential candidates so that the best researchers and scholars could be elected. Serageldin also remarked

that the initiative posed significant challenges for an organization like TWAS, which had focused on the natural sciences since its inception, stating that the criteria for excellence are different for the social sciences compared to the natural sciences. For example, he noted that the area of 'grey' literature – reports prepared by and for government and international organizations, including the United Nations, did not carry the same weight in academia as articles published in scholarly journals. Nevertheless these publications often exerted a tremendous impact on science-based policy discussions and decisions. Hassan proposed that TWAS members search among their own academies of arts and sciences to identify suitable social scientists for nomination.

Following the discussion on the social sciences, Vijh also asked what outreach activities TWAS was under-

taking to help bridge the gap between science and technology, a gap that often seemed to be larger in the developing world than in the developed world. Hassan replied that TWAS, in collaboration with the United Nations Development Programme (UNDP) and, more recently, also with the United Nations University Institute for Advanced Studies (UNU-IAS), has produced a series of publications highlighting successful experiences in the use of science and technology to address critical social and economic needs in the developing world. Nevertheless, he added, TWAS should not rest on its laurels but instead encourage all centres of excellence to engage in real-life projects. To this end, he continued, TWAS has put together five proposals (on dry-land biodiversity, safe drinking water, renewable energy, medicinal and indigenous food plants, and nanotechnology) aimed at linking centres of excellence in the South.

Dorairajan Balasubramanian (TWAS Fellow 1997 and currently the Academy's secretary general), director of research, L.V. Prasad Eye Institute in Hyderabad, India, informed members that the biology category of TWAS membership, currently divided into four categories, should be divided into only two categories: the first comprised of structural biology, biochemistry, and cell and molecular biology; the second of the biology of organisms and systems. In further changes to membership classification, neurosciences will be merged with medical sciences, and earth sciences with astronomy and space sciences.





Balasubramanian also spoke about the age distribution of TWAS fellows. Of the 880 members, more than 250 were aged over 70, and more than 300 were older than 60. The aim, he said, is to rebalance this skewed demographic over time by increasing the number of ‘younger’ scientists elected to the Academy. As a first step in this process, TWAS will no longer accept nominations of anyone older than 70, and he urged members to nominate younger scientists. Balasubramanian also noted that the Council had decided that the Academy would elect a maximum of 45 new members in 2009, with at most five of these being Associate Fellows.

Hassan added that nominations were especially being sought for scientists from scientifically and technologically lagging countries, which continue to be under-represented in TWAS. He noted that, just as the Academy had a disproportionate number of older scientists, it also had a large number of scientists from Brazil, China, India and other large developing countries. He hoped that this issue could be addressed by making a strong and determined effort to identify candidates from across the developing world. He said such an

effort was critical if the Academy was to be true to its mandate to serve science throughout the South.

In a closing ceremony, the text of the Tlalpan Statement was read out, calling for science and technology to play a more important role in public policies or decision-making; a reduction in the brain drain from poor to rich countries; and increases in science funding from the private sector. In addition, the Statement called on governments in developing countries to steadily increase investment in science and technology to at least of 1 per cent of their gross domestic product (GDP); urged governments, universities, research centres and private industry to promote and encourage the production of problem-solving scientific knowledge in such critical areas as health, climate change, energy and sustainability; and encouraged the creation of both basic and applied knowledge by balancing academic values with economic and social goals and by reconciling the role of entrepreneurs with the objectives of higher education and research institutions.

Concluding the proceedings, Palis noted that TWAS deserves credit for helping to raise the profile of both science and scientists in developing countries over the past 25 years, and that it has done so by assisting thousands of scientists at various stages in their careers and serving as a voice for the scientific community in ways that have showcased the importance of science and technology for development.

The Academy’s past, he observed, speaks to its success. But on the occasion of its Silver Jubilee anniversary, he maintained, it is the future that should be foremost in our minds. In that spirit, Palis added, “TWAS must continue to work to help raise the profile of science in developing countries that have yet to fully embrace policies for scientific capacity building. It must also continue to assist young and mid-career scientists at critical junctures of their careers and to serve as the champion for science-related issues not just in the South but throughout the world.”



PROGRAMMES

The fourth set of Trieste Science Prize laureates were announced in 2008. This prestigious prize, administered by TWAS and funded by illycaffé S.p.A., the internationally renowned coffee manufacturing company that, like TWAS, has its headquarters in Trieste, Italy, is designed to give international recognition and visibility to outstanding scientific achievements made by scientists living and working in the developing world. Each award includes a trophy and a US\$50,000 monetary prize. The two 2008 winners – in the fields of engineering and space sciences – attended a ceremony in Trieste on 29 September 2008 at an event commemorating illycaffé's 75th anniversary. The two winners also presented their work at the TWAS 19th General Meeting held in Mexico in November 2008.

Trieste Science Prize



SPACE SCIENCES: BEATRIZ BARBUY

The 2008 Trieste Science Prize for Earth, Space, Ocean and Atmospheric Sciences was awarded to:

- **Beatriz Barbuy**, professor at the Institute of Astronomy, Geophysics and Atmospheric Sciences at the University of São Paulo (IAG/USP), Brazil

Beatriz Barbuy was honoured for her contributions to astrophysics and, in particular, for enhancing our understanding of the evolution of the chemical composition of stars.

Hydrogen and helium were the only elements produced in abundance during the formation of the first generation of stars. Heavier elements, including metals, were subsequently produced by stars through nuclear fusion. 'Metal-poor' stars, therefore, are old, 'first-generation' stars and their composition presents a celestial 'fossil-like' record, giving clues to the formation of the Milky Way.





Barbuy's skills in both observational astronomy and the analysis and interpretation of spectroscopic data have allowed her to assemble a large library of synthetic spectra. These data have allowed her to shed light on the formation of the Milky Way through studies of its oldest elemental components.

ENGINEERING SCIENCES: RODDAM NARASIMHA

The 2008 Trieste Science Prize for Engineering Sciences was awarded to:

- **Roddam Narasimha**, chair of the Engineering Mechanics Unit at the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, and Pratt & Whitney professor of science and engineering at the University of Hyderabad, India

Roddam Narasimha was recognized for his contributions to fluid dynamics and, in particular, the role that turbulence plays in aerospace technology and atmospheric events.

Understanding turbulence carries both scientific and practical significance. Narasimha's contributions have

extended to aircraft design, monsoon predictions and the prospects of using wind energy in rural India. He has also conducted important work on shock wave structure and turbulent shear flows. He is best known for his research on the transitions between laminar and turbulent flows. 'Laminar flow' is the smooth movement of fluid (for example, air or water) in parallel layers or paths (streamlines), while turbulence is the chaotic movement of fluid.

A search for the hidden order in chaos has been a fundamental motif of Narasimha's work. His path-breaking research includes examinations of the ways in which chaos can arise from ordered motion and the structure and 'memory' of fully turbulent flows.

Narasimha has also played a key role in the development of aerospace technology in India, including as director of the Indian National Aerospace Laboratories (1984-1993) and as a member of the Scientific Advisory Committee to the prime minister of India.

TWAS Prizes for scientific excellence are awarded annually in the fields of agricultural sciences, biology, chemistry, earth sciences, engineering sciences, mathematics, medical sciences and physics, and rank among the highest scientific accolades given to scientists in developing countries. Each prize carries a cash award of US\$15,000. Of particular note in 2008 is the prize in Medical Sciences won by Abdool Karim Salim, which marks the first TWAS Prize won by a South African scientist, and the prize in Physics that is shared between Ali Hani Chamseddine, only the second TWAS Prize winner from Lebanon, and Predhiman Krishan Kaw from India. The TWAS Prizes for 2008 were announced during the TWAS 19th General Meeting held in Mexico City, Mexico. The prizes will be presented at the TWAS 20th General Meeting 11th General Conference, scheduled to take place in Durban, South Africa, in October 2009.

TWAS Prizes: Honouring Scientists

AGRICULTURAL SCIENCES

Shaw Jei-Fu, National Chung Hsing University, Taichung, Taiwan, China, won the TWAS Prize in Agricultural Sciences:

for his outstanding contributions in biotechnology for extending the shelf-life of and adding value to agricultural produce.



Born in 1948 and raised on a farm in Tainan county, Taiwan, Shaw Jei-Fu has always had an understanding of the needs of farmers and producers. He now uses his training in biochemistry to develop enzyme-based methods to improve and enhance agricultural and industrial production.

Shaw's research into the biochemistry and biotechnology of lipases and esterases – which are able to break down fatty substances – has led to the invention of new methods for the lipase-catalyzed synthesis of many compounds with industrial uses, including propylene glycol esters and fatty acid esters. Conventional chemical methods for producing these compounds require high temperatures and produce undesirable byproducts. The high catalytic efficiency and specificity at ambient temperature of Shaw's enzymatic methods could replace conventional chemical methods and thus save energy and help reduce pollution.

In the field of agricultural biotechnology and plant functional genes, Shaw has investigated several enzymes involved in the synthesis and effects of ethylene, a plant hormone that helps regulate senescence. For example, his team cloned and characterized the first broccoli ethylene receptor and transferred the mutated gene to other species of plants, including flowers grown for their blooms, with the effect of delaying senescence and hence reducing post-harvest losses of perishable agricultural produce.

Shaw also discovered an enzymatic method for the simultaneous production of syrup and high-protein food from crops. By transferring the amylo-pullulanase gene into rice, he produced transgenic 'sweet rice' that expresses high amounts of the enzyme amylopullulanase. The starch in these rice grains was completely degraded into syrup while the protein remained. This method has great promise for improving the nutritional value of low protein crops while, at the same time, producing syrups for industrial uses, which can greatly increase the value of agricultural products.



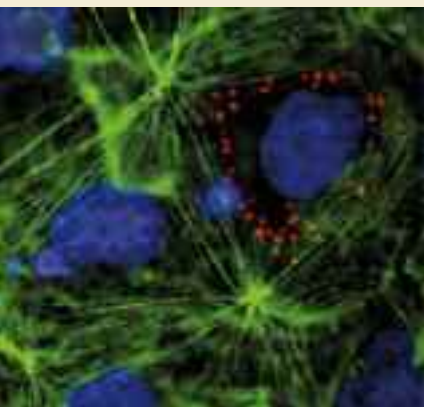
BIOLOGY

Susana López and **Carlos F. Arias**, *Instituto de Biotecnología*, National Autonomous University of Mexico (UNAM), Cuernavaca, Morelos, Mexico, won the TWAS Prize in Biology:

for their fundamental contributions to the understanding of virus-host cell interactions.

Rotaviruses are the single most important causes of severe diarrhoeal disease in children under two years of age. It is estimated that they cause 500,000 deaths a year in developing countries.

From early in their careers, Carlos F. Arias and Susana López have formed a research team focused on studying the molecular biology of viruses, especially rotaviruses.



Following different research lines, the pair have studied the epidemiology of rotaviruses and the immune response they elicit in infected children, characterized the molecular biology of different steps of the replication cycle, and developed diagnostic tests.

Among their most important contributions has been the molecular characterization of the events that occur early in the process of infection of the cell by the virus. For example, Arias and López described and characterized different cell surface molecules that function as receptors for the virus during distinct, sequential virus-cell surface interactions that eventually lead to the virus' entry into the cell's interior. They also described the functional domains in the rotavirus surface proteins as well as in the cellular receptors that are responsible for various virus-cell interactions.

The Arias-López team was also one of the first groups to show that it is possible to silence the expression of animal viruses in mammalian cells using the RNA interference (RNAi) system. They proceeded to use this gene silencing technique to characterize the functions of several viral proteins that previously had obscure or ill-defined roles in the replication cycle and to define the mechanism by which rotaviruses take over the protein synthesis machinery of the cell.

More recently, Arias and López have made important contributions to the molecular mechanism that drives the release of astroviruses (the second most important group of gastroenteritis viruses in infants) from infected cells.

CHEMISTRY

Zhao Dongyuan, Department of Chemistry, Fudan University, Shanghai, China, won the TWAS Prize in Chemistry:

for his outstanding research in the field of mesostructured materials and his discovery of families of ordered mesoporous molecular sieves.

The large internal surface area of mesostructured materials means that they can be effective catalysts, and thus they have potential uses in a number of industrial applications.

Dongyuan Zhao has made many significant contributions to the synthesis of ordered mesoporous materials, including advances relating to two families of novel mesoporous molecular sieves, namely SBA and FDU materials. First, he discovered highly ordered, large pore, thick walled





and highly stable mesoporous silica SBA-15, which was regarded as a milestone in the development of mesoporous materials. Such mesoporous silica SBA-15

materials have since been used extensively by materials scientists working on catalysis and adsorption, as well as on biological problems and the production of devices.

Since 1998, Zhao has created the series of FDU materials. He has demonstrated a generalized non-aqueous 'acid-base pair' approach for the synthesis of a group of highly ordered, thermally stable and large-pore mesoporous materials with different mesostructures, including metal oxides, mixed metal oxides and metal phosphates. In addition, he has advanced our knowledge of pore engineering and the control of the morphology of mesoporous materials – a necessary foundation for applications of mesoporous materials.

Recently, Zhao has developed a novel organic-organic assembly approach to synthesize highly ordered mesoporous phenolic resin polymers and a direct transformation to homologous carbon frameworks without defects. By using this approach, he and co-workers have discovered a family of novel ordered mesoporous polymers and carbons with highly ordered structures, thus expanding the range of known mesostructured materials from those of inorganic composition to those with organic frameworks. The derived ordered mesoporous carbons with thick walls and large pore size are considered the first examples of molecular sieves with ultra-high stability. Such mesoporous carbon materials have been used in fundamental investigations of adsorbents and catalysis by other researchers.

EARTH SCIENCES

Sun Jimin, Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China, was awarded the TWAS Prize in Earth Sciences:

for his fundamental contributions to the studies of desert evolution and aeolian deposits and to the understanding of long-term Cenozoic climatic changes in China.

Throughout his career, Jimin Sun has used geological evidence to model changes in the ancient climate and their environmental effects.

In 1988, he reconstructed maps of Chinese deserts during the last glacial maximum (the peak of the last Ice Age, about 20,000 years ago) and the Holocene climatic optimum (a warm period that occurred roughly 5,000 to 9,000 years ago). He also studied, over geological time-scales, the expansions and contractions of Chinese deserts, in particular the evolution of the Takli-





makan Desert in northwest China, the world's second largest shifting-sand desert. These pioneering works on desert evolution are important for understanding the palaeoenvironment in arid and semi-arid China.

In 2001 and 2002, Sun used multiple methods to study the provenance and pathways of aeolian dust and demonstrated that the desert regions in southern Mongolia and the adjoining regions of China are the most important sources of the fine sands accumulated on the Chinese Loess Plateau, an arid area that covers some 640,000 square kilometres of north-central China. He showed that such processes as frost weathering and glacial grinding have played an important role in producing loess-sized material and that long-term changes in the source of the aeolian deposits mirror the upper crustal evolution in the aeolian dust-source regions.

Since 2002, Sun has studied the Cenozoic (65.5 million years ago to the present) tectonic uplift and its environmental effects on the high mountains along the northern edge of the Tibetan Plateau. Based on sedimentological, structural and palaeomagnetic methods, he has demonstrated a dynamic link between the uplift of the mountains, long-term climatic changes in the region, and environmental changes.

In 2006, he used high-resolution records of aeolian deposits in the northern Loess Plateau to study the evolution of the East Asian monsoon during the last glacial-interglacial cycle. The well-defined cycles that were revealed demonstrated that the East Asian summer monsoon in the tropical Pacific directly affects the climate of mid-latitude areas.

The results of Sun's palaeoclimatic and palaeoenvironmental studies could have relevance with regard to the effects of today's changing climate.

ENGINEERING SCIENCES

Ashutosh Sharma, Centre on Nanosciences, Indian Institute of Technology, Kanpur, India, won the TWAS Prize in Engineering Sciences:

for his fundamental and significant contributions to meso-mechanics, instabilities and self-organization in soft thin films, meso-patterning, wetting, adhesion and interfacial interactions.

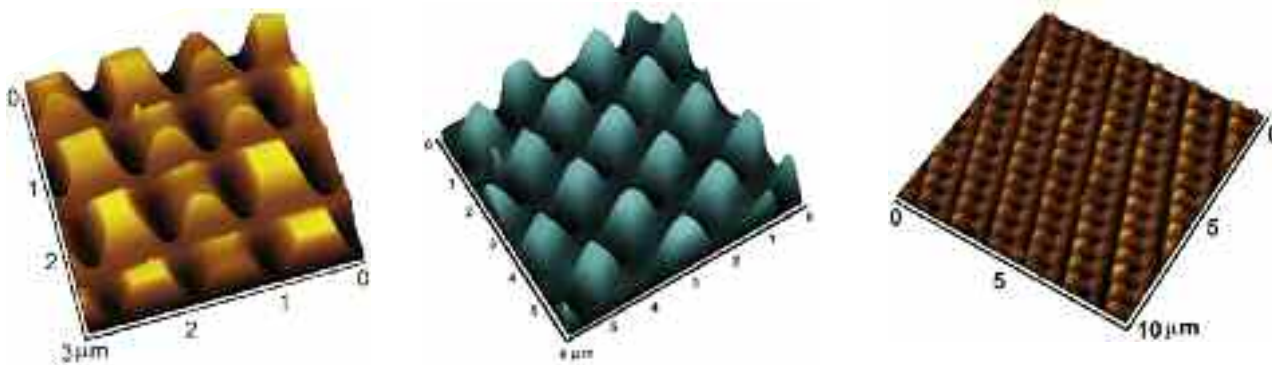
Ashutosh Sharma has spent his career investigating the dynamics of surfaces and thin film coatings – an area that was opened to him during his PhD research on the stability of thin liquid films and their applications in understanding the interactions between films of tear fluid and corneal surfaces. Tear film rupture on the cornea often leads to 'dry eyes' symptoms.

On returning to India from the United States in 1990, Ashutosh began

investigating instabilities, pattern formation and self-organization in highly confined (less than 100 nanometres) soft films and their applications in wetting, adhesion, coatings and meso-patterning.

Ashutosh's group has since developed several innovative meso-fabrication techniques in soft materials that can be used to create complex three-dimensional objects, for example through the splitting of micro-structures into large-area arrays of nano-channels.

The key to such 'self-organized' patterning was to understand the instabilities and morphological evolution in highly confined complex, nonlinear thin films and to thus regulate the structural evolution to a desired end by controlling various parameters. These simple and rapid methods based on 'physical self-assembly' or self-organization can be used with a variety of soft materials and are especially suitable for large-area patterning for nano-applications where functionalities such as optics, wetting, adhesion and friction are governed by the surface or interior meso-texture. A practical example derived from this research is the development of a novel bio-mimetic adhesive in



which micro-fluidic channels buried under an elastic layer enhance its adhesion by two orders of magnitude while retaining the capability for repeated use.

Recently, Ashutosh's group has also pioneered new methods of synthesis for such functional materials as fractal hierarchal carbon particles that could have applications in super-capacitor or micro-battery applications. Other current research areas have potential in a variety of applications, including the micro- and nano-fabrication and patterning of polymers, ceramics and hydrogels.



MATHEMATICS

Vasudevan Srinivas, School of Mathematics, Tata Institute of Fundamental Research, Mumbai, India, won the TWAS Prize in Mathematics:

for his basic contributions to algebraic geometry that have helped deepen our understanding of cycles, motives and K-theory.

Vasudevan Srinivas has worked mainly in algebraic geometry, with a particular interest in the study of algebraic cycles on singular algebraic varieties.

His early work in the area was the first systematic attempt to generalize the theory of cycles and K-theory on smooth varieties to singular varieties in relation to the K-theory of vector bundles.

Apart from several results on 0-cycles, he obtained the first results on K-regularity and negative K-theory for normal surfaces and gave the first examples of the nontriviality of K_1 for quotient surface singularities.

Another recent highlight of his collaborative work in this area is a formula for the Chow group of a normal surface in terms of relative K-theory, which leads to proofs of analogues of the Bloch Conjecture and the Bloch-Beilinson Conjecture in certain situations. Apart from a reinterpretation via higher Chow groups, this work is the only concrete evidence for the Bloch-Beilinson Conjecture.

Other themes in Srinivas' work include the interface with commutative algebra, for example, on projective modules, divisor class groups, unique factorization domains and Hilbert functions and multiplicity. His collaborative results here include a general finiteness theorem for Hilbert functions of Cohen-Macaulay rings of given dimension and multiplicity, and Lefschetz Theorems for the divisor class group, generalizing results of Grothendieck.

Srinivas has also shown adaptability to work outside his main areas. For example, he was involved in a collaboration that solved Zariski's problem (the Riemann-Roch problem for surfaces) using p -adic analytic techniques.



MEDICAL SCIENCES

Salim Abdool Karim, Nelson R. Mandela School of Medicine, University of KwaZulu-Natal, Durban, South Africa, won the TWAS Prize in Medical Sciences:

for his exceptional and distinguished contributions in medicine and public health, specifically the prevention and treatment of HIV/AIDS.

Salim Abdool Karim's formational studies and early career research spanned the disciplines of virology, epidemiology and public health. He has since combined expertise in these areas to develop an understanding of the unique HIV/AIDS epidemic in South Africa.

Most notably, Abdool Karim has made significant contributions in the field of HIV vaccine trials, including increasing trial efficiency in epidemic situations. Based on this knowledge, he was entrusted with leading the first HIV vaccine trial in South Africa. He is also listed as co-inventor on two patents registered as part of the development of three candidate HIV vaccines. His current focus in HIV vaccine research is based on efforts to better understand the viral and host determinants of HIV disease progression.

Abdool Karim has also made critical contributions in the field of microbicides. For example, he has pioneered methods used in the clinical evaluation of vaginal gels and, since 2002, has headed a trial that indicates that a microbicide gel can reduce a woman's risk of becoming infected with HIV. He has also made significant advances in other aspects of HIV prevention, including the treatment of other sexually transmitted diseases.

Since 2000, Abdool Karim has also focused his research on the challenges involved in treating HIV and tuberculosis (TB) co-infection. He conducted a pivotal TB-HIV treatment clinical trial that demonstrated that initiating anti-retroviral therapy in HIV-TB co-infected patients during TB treatment significantly improves their survival. These findings are already impacting on clinical practice, contributing to reducing mortality in the intertwined HIV and TB epidemics.

Abdool Karim is also widely acknowledged for his role as the scientific chair of the XIII International AIDS Conference, held in Durban, South Africa, in 2000 – a conference that culminated in the release of the 'Durban Declaration' that HIV is the cause of AIDS, regarded by many as a pivotal event in the process that led to anti-retroviral therapy becoming a reality in the developing world.



PHYSICS

Ali Hani Chamseddine, Physics Department, American University of Beirut, Beirut, Lebanon, shared the TWAS Prize in Physics:

for his inventions of ten-dimensional supergravity and its interactions; the minimal supergravity standard model; and the spectral action principle in noncommutative geometry.

Ali Hani Chamseddine can claim a direct link to TWAS – his PhD thesis advisor was none other than TWAS's founding father, Abdus Salam. Indeed Chamseddine went on to carry out postdoctoral research at the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy, where TWAS is hosted.

He returned to Lebanon in 1977, but civil war caused him to emigrate. So, in 1980, he joined the European Organization for Nuclear Research (CERN)



in Geneva, Switzerland. It was there where he did his work inventing ten-dimensional supergravity and its interactions. Years later, this theory was identified as the low energy limit of the superstring.

Following four years in the USA, where he collaborated on the widely cited minimal supergravity standard model of particle physics (SUGRA), he took the opportunity of a lull in the civil war to return to Lebanon. But the ceasefire was short lived and he was forced to leave again, this time to Zurich, Switzerland, where he stayed for more than 10 years. During this period, he invented higher dimensional topological theories of gravity and developed applications of noncommutative geometry to theoretical physics. In 1996 he started a collaboration that still goes on with the Field Medalist and the inventor of noncommutative geometry, Alain Connes. Their first major contribution was the spectral action principle, which is now finding many applications. In particular Chamseddine and Connes have proposed a model that unifies all fundamental interactions, including gravity.

In 1998, he returned to the American University of Beirut as professor of physics and the founding director of the newly established Centre for Advanced Mathematical Sciences. Under Chamesddine's leadership, the centre has quickly become the leading institute of mathematical sciences in the Arabic Middle East.

Predhiman Krishan Kaw, Institute for Plasma Research, Bhat, Gandhinagar, India, shared the TWAS Prize in Physics:

for pioneering contributions to nonlinear plasma physics especially as applied to thermonuclear fusion (tokamaks and laser plasmas) and non-neutral, dusty and quark-gluon plasmas.

Predhiman Krishan Kaw obtained his PhD in plasma physics from the Indian Institute of Technology, Delhi, in 1966. Thereafter his career has been divided between stints at Princeton University, USA, and institutions in India. In 1982, he returned to India, founding the Plasma Physics Programme, which, in 1986, was converted into the Institute for Plasma Research.

Kaw's early work was on the interaction of intense laser pulses with plasmas for laser fusion. During his second visit to Princeton (1975-1982), he initiated original and seminal work on several tokamak physics problems. (A tokamak is a machine that produces a magnetic field used to confine a plasma and is a candidate device for producing controlled thermonuclear fusion power.)

The Institute for Plasma Research in Gandhinagar, of which Kaw is the founding director, has grown into a 500-member strong institute that is making internationally recognized contributions to fundamental plasma physics, fusion research and plasma processing applications for industry. In particular, since 1982, Kaw has been directing the institute's Tokamak Programme. His own research in this period has led to important developments in tokamak edge turbulence and transport, nonlinear laser plasma interactions, and the physics of exotic plasmas such as non-neutral plasmas, dusty plasmas and quark-gluon plasmas.



TWAS Prizes for Young Scientists in Developing Countries are awarded to scientists no older than 40 years of age. The prizes are given in collaboration with national academies of science, scientific research councils and ministries of science and technology in a number of developing countries. TWAS provides the prize money (up to US\$2,000) while the national organizations select the recipients. Winners are chosen from among each of the major fields of natural science (biology, chemistry, physics and mathematics) on a rotating basis. Prizes are presented by a high-ranking official, such as a government minister, at a special ceremony. Some 45 national organizations are currently participating in the TWAS Prizes for Young Scientists programme. In 2008, prizes were awarded to 27 young scientists in 17 countries.

TWAS Prizes for Young Scientists



FLUID MECHANICS IN PAKISTAN

Masood Khan obtained his PhD in fluid mechanics, a branch of applied mathematics, from Quaid-i-Azam University, Islamabad, Pakistan, in 2005, where he now works as an assistant professor in the department of mathematics.

His studies on Newtonian and non-Newtonian fluid mechanics and computational fluid dynamics have led to an impressive 50 publications, many of which have appeared in leading international journals. He is helped in these efforts by collaborations with colleagues in such countries as China, Germany, Romania, South Africa and the United States.

Such work involves analyses of the flow of fluids through porous spaces, including such properties as their slip effects, shearing flows and heat transfer – all of which have potential applications in technology and industry. Masood has also tackled the problem of peristaltic motion, which also has applications in biomechanics. (Peristalsis is the slow, rhythmic wave-like movement that helps move food through the gut.)

In addition to his output of published papers, Masood is supervising a PhD student and has supervised, or is currently supervising, some 12 MPhil students.



YOUNG PRIZE WINNERS

Name	Country	Awarding Body	Field
Muhammad Manjurul Karim	Bangladesh	Bangladesh Academy of Sciences	Biological Sciences
Saleh Hasan Naqib	Bangladesh	Bangladesh Academy of Sciences	Physical Sciences
Dossou Sika Salomé Kpoviessi	Benin	Benin Centre for Scientific & Technical Research	Chemistry
Elder Jesús Villamizar Roa	Colombia	<i>Academia Colombiana de Ciencias Exactas, Físicas y Naturales</i>	Mathematics
Roberto Mulet Genicio	Cuba	Academy of Sciences of Cuba	Physics
Mijail Borges Quintana	Cuba	Academy of Sciences of Cuba	Mathematics
Daniel Ariano Sánchez	Guatemala	<i>Academia de Ciencias Médicas, Físicas y Naturales de Guatemala</i>	Biology
Abdoulaye Mountaga Balde	Guinea	Ministry of Higher Education and Scientific Research (MESRS)	Biology
Lawrence N.M. Kazembe	Malawi	National Research Council of Malawi	Mathematics
Choimaa Lodoiravsal	Mongolia	Mongolian Academy of Sciences	Physics
Munkhuu Bayarjargal	Mongolia	Mongolian Academy of Sciences	Physics
Ajaya Bhattarai	Nepal	Nepal Academy of Science & Technology	Chemistry
Dil Bahadur Gurung	Nepal	Nepal Academy of Science & Technology	Mathematics
Prabin Shrestha	Nepal	Nepal Academy of Science & Technology	Medical Sciences
Rajendra Gyawali	Nepal	Nepal Academy of Science & Technology	Biology
Masood Khan	Pakistan	Pakistan Academy of Sciences	Mathematics
Carlos Vladimir Landauro Saenz	Peru	<i>Academia Nacional de Ciencia y Tecnología (ANCYT)</i>	Physics
Ricardo C.H. del Rosario	Philippines	National Academy of Science (NAST)	Mathematics
Stephanus Esaias	South Africa	Department of Science & Technology of the Republic of South Africa / Academy of Science of South Africa (ASSAf)	Physics
Solomon Ferreira			
Vajira H.W. Dissanayake	Sri Lanka	National Science Foundation	Biology
Panawalage Indra Prasanthi Perera	Sri Lanka	National Science Foundation	Biology
Manjula Deshapriya Hettiarachchi	Sri Lanka	National Science Foundation	Biology
Abdalla Ahmed Elbashir Ahmed	Sudan	Sudan Institute for Natural Sciences	Chemistry
Gamal E. Elabwabi Elfadul	Sudan	Sudan Institute for Natural Sciences	Mathematics
Kamal Mahir Sulieman Khalil	Sudan	Sudan Institute for Natural Sciences	Physics
Satit Saejung	Thailand	National Research Council	Mathematics
Michael Alexander Taylor	Trinidad & Tobago	Caribbean Academy of Sciences -Trinidad & Tobago	Physics

STUDYING GUATEMALA'S LIZARDS

Daniel Ariano Sánchez obtained his BSc and *Licenciatura* degrees in biology from the *Universidad del Valle de Guatemala* in 2003 and went on to do a Master's degree at the *Universidad de Costa Rica*. He graduated in 2007, specializing in ecology and conservation.

Ariano's interests are in conservation biology and tropical dry forest ecology, especially in relation to the herpetofauna (lizards and amphibians). In particular, his studies have focused on the endangered Guatemalan beaded lizard (*Heloderma horridum charlesbogerti*), an endangered subspecies of lizard endemic to the dry forests of the Motagua Valley in northeastern Guatemala. It is esti-



mated that less than 300 of these animals exist in the wild, placing it among the world's most endangered lizards. Indeed, Ariano's work on this lizard has been instrumental in gaining full international protection for the species, which is now listed on appendix I of the Convention on International Trade in Endangered Species (CITES). Ariano also reported the first clinical case of envenomation in a human subject by a wild Guatemalan beaded lizard and gathered the first data on egg-incubation in the wild for any species of beaded lizard.

More typically, however, Ariano's studies involve population viability analyses for wild species, modelling of potential distributions for endangered taxa and the use of radio-tracking in behavioural ecology research. Thanks to these efforts, Ariano's work is being used to develop new conservation policies in Guatemala and is also having an impact in the development of environmental education programmes and the prioritization of areas for special conservation within the country.



SPACE SCIENCES IN SOUTH AFRICA

The Academy of Science of South Africa (ASSAf) selected Stephanus Esaias Solomon Ferreira as the winner of its TWAS Young Scientist Prize for 2008.

Ferreira obtained his PhD in physics from Potchefstroom University for CHE in 2002. He is currently an associate professor at North-West University, Potchefstroom, South Africa, where he carries out his research into several areas of astrophysics, including the propagation and acceleration of cosmic rays in the heliosphere and the evolution of pulsar wind nebulae and supernova remnants.

In particular, Ferreira has accomplished groundbreaking work in the heliospheric transport of Jovian electrons. These high-energy electrons are produced within the Jovian magnetosphere and can be detect-

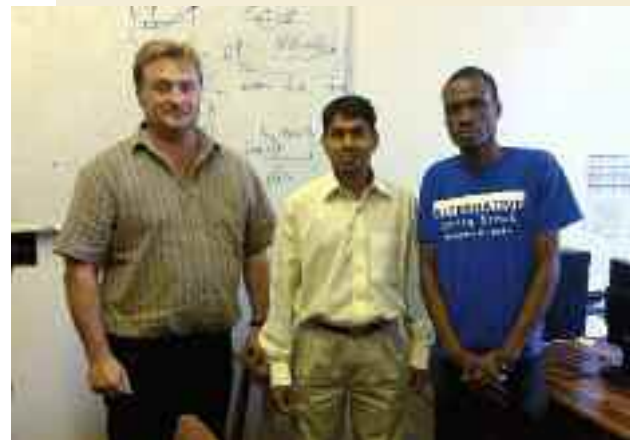




ed by Earth-orbiting spacecraft. Of interest is how these particles propagate along and perpendicular to solar magnetic field lines. For this study, Ferreira has developed a Jovian modulation model that is one of only two such models in the world. Results from this model were compared to observations made by the *Ulysses*, *Pioneer 10* and *Voyager* spacecraft. From these comparisons, a better understanding of the spacecraft observations was achieved – for example, how many of the electron observations are of Jovian and how many of galactic nature.

In addition, Ferreira's work on the transport of low-energy electrons is considered groundbreaking. For the first time, a state of the art mathematical model was utilized to simulate the transport of low-energy Jovian and galactic electrons and to carry out detailed comparisons with the observations from spacecraft. This work is expected to act as a benchmark for all future work in this area.

The results of Ferreira's research have been published in more than 40 peer-reviewed papers. In addition, he received the 2006 South African National Research Foundation's (NRF) President's Award and an NRF 'P-rating', which bases its criteria for selection on research excellence and peer-review for researchers below the age of 35 expected to be future leaders in their field. Ferreira is currently the only physicist in South Africa to have this rating.



STUDYING FISHERIES IN GUINEA

Abdoulaye Mountaga Baldé received his Master's degree from the Higher Institute of Educational Sciences of Lambandji, Conakry, Guinea, in 1990. He then joined the aquatic biology department of the Scientific Research Centre of Rogbané, Conakry. His wide-ranging studies have focused on two main areas: a study of the parasites of fish in Guinea's coastal regions and aquaculture methods for producing oysters – including studies of the protein biochemistry of these molluscs.

In addition, Baldé has contributed to environmental impact studies on a hydroelectric dam on the oyster resources of the Konkouré River estuary, and has been responsible for providing national and regional information on fish species and resources for FishBase, a global open-access database with information on thousands of fish species useful to research scientists, fisheries managers and others.

Baldé was selected for the TWAS Young Scientists Prize by the Ministry of National Education and Scientific Research, Guinea.

The TWAS-UNESCO Associateship Scheme operates in collaboration with more than 100 scientific 'centres of excellence' in the South. The scheme allows researchers from developing countries, each of whom is appointed for three years, to make two visits to a selected centre to develop and carry out collaborative research. TWAS provides travel support for the associates and contributes towards incidental local expenses, while the host centres cover their living expenses. In 2008, TWAS awarded 32 new associateships to scientists from 19 countries, including Bangladesh, Benin, Eritrea, Nepal, Sudan and Tanzania, while a total of 33 TWAS-UNESCO Associates from 15 countries travelled to host institutions in 10 countries in the South: Argentina, Brazil, China, India, Mexico, Pakistan, Peru, South Africa, Syria and Thailand. The TWAS-UNESCO Associateship Scheme is kindly supported by the OPEC Fund for International Development (OFID).

Associateship Scheme



EXCHANGING AGRICULTURAL EXPERTISE

There are thousands of species of nematodes, or roundworms, adapted to just about every conceivable environment, from mountain tops to the deep sea. The diversity of nematode species and lifestyles is matched only by those of the insects.

Many insect species cause significant damage to crops. But there are nematode species that can help control them. Entomopathogenic nematodes (i.e., those that cause disease in insects) are effective biocontrol agents of hundreds of different soil-dwelling insect species and affect their hosts in a variety of ways.

In fact, worldwide, biocontrol of insect pests using entomopathogenic nematodes is second only to the use of the microbial insecticide, *Bacillus thuringiensis* (*Bt*).

Such nematodes were first used commercially as biocontrol agents in Australia in the early 1980s. In west Africa, however, no research has been carried out into the natural occurrence of these nematodes.





To address this lack of both data and expertise, Kossi Hugues Baimey from the International Institute of Tropical Agriculture (IITA), Benin, applied to the TWAS-UNESCO Associateship programme for training at the International Potato Centre (CIP), Peru.

For his first visit of the two envisaged under the scheme, Baimey spent three months (November 2008 to February 2009) at CIP.

Until then, Baimey's experience in nematology, including his PhD research at the University of Pretoria, South Africa (he graduated in 2006), focused on *Scutellonema bradys*, a plant-feeding species that can cause great damage to yam crops.

At CIP, Baimey received training from Jurgen Kroschel and colleagues in the institute's Crop Management Division on how to handle and culture entomopathogenic nematodes, as well as how to identify them, using both traditional morphometric techniques as well as modern biotechnological methods.

In addition, Baimey assessed the pathogenicity of 38 isolates of *Steinernema* and *Heterorhabditis*, the two most common genera of entomopathogenic nematodes, from Bolivia, Ecuador, Germany and Peru.

"As insect hosts, we used the greater wax moth, which is inherently susceptible to most entomopathogenic nematodes," explains Baimey, "and the Andean potato weevil as a test insect and potential biocontrol target."

Having identified the most promising five isolates – in terms of the high percentage mortality they caused and the speed at which they killed the insect hosts – Baimey broadened his experiments to include four other insect pest species, including the pea leafminer and potato tuber moth.

"I have also tested the host-finding ability of these five nematode isolates," adds Baimey, "and, using greater wax moth larvae, assessed the initial concentration of nematodes needed to cause different degrees of mortality."

During his stay in Peru, Baimey also had the opportunity to visit the CIP station at Huancayo and field experiments set up by CIP's Crop Management Division. This trip enabled him to learn techniques for sampling entomopathogenic nematodes in both annual and perennial crop fields. "I then learned how to extract nematodes of interest from these soil samples using wax moth larvae as bait," says Baimey. "The field trip was also useful as it enabled me to learn, first-hand, some of the techniques used when trialling entomopathogenic nematodes under field conditions."

Following this first visit to CIP, Baimey now believes he has the training and expertise necessary to start a research programme on entomopathogenic nematodes in Benin. For example, he aims to start collecting and testing indigenous isolates for their insecticidal activities. Of course, the collaboration with CIP will continue, especially as a second visit to the host institution is envisaged under the TWAS-UNESCO Associateship programme.

"When I return to CIP," says Baimey, "I will undertake the taxonomic identification of the nematode isolates collected in Benin and characterize their biological parameters in relation to those I have already tested in Peru. I also hope to evaluate the insecticidal efficiency of new Peruvian isolates in glasshouse and semi-field trial situations."

Both CIP and IITA are members of the Consultative Group of International Agricultural Research (CGIAR) network of institutions – institutions that are playing a key role in developing techniques to support global food security. "Thanks to TWAS," says Baimey, "we have the opportunity to begin collaborative research on entomopathogenic nematodes between CIP and IITA."

Through the TWAS-UNESCO Associateship programme, therefore, TWAS is playing a small – but potentially critical – role in supporting research into sustainable agriculture with a potential future impact on issues of global food security.

TWAS's South-South Fellowship Programme provides opportunities for scientists from one developing country to carry out research at institutions in another developing country. The programme operates in partnership with the National Council for Scientific and Technological Development (CNPq), Brazil; the Chinese Academy of Sciences (CAS); the Indian Council of Scientific and Industrial Research (CSIR), the Indian government's Department of Biotechnology (DBT), the Indian Association for the Cultivation of Science (IACS), and the S.N. Bose National Centre for Basic Sciences, India; and the National Centre of Excellence in Molecular Biology (CEMB) and the International Centre for Chemical and Biological Sciences (ICCBS) in Pakistan. In 2008, the programme was expanded through agreements with *Universiti Sains Malaysia* in Malaysia and Mexico's National Science and Technology Council (CONACyT). TWAS and its partner organizations now offer some 300 fellowships a year.

South-South Fellowships



CAMEROONIAN CHEMISTS IN PAKISTAN

In 2007, TWAS announced that two organizations in Pakistan – the National Centre of Excellence in Molecular Biology (CEMB) and the International Centre for Chemical and Biological Sciences (ICCBS) – had agreed to host young scientists from other developing countries. The first such fellowships were awarded in early 2008 and, soon after, two Cameroonian postgraduate scholars – from different institutions – spent time carrying out research and training activities at ICCBS.

ICCBS itself is composed of two institutions: the H.E.J. Research Institute of Chemistry and the Dr. Panjwani Center for Molecular Medicine and Drug Research (PCMD), both of which are located in Karachi.

Indeed, the H.E.J. Research Institute of Chemistry has a long history of accepting TWAS awardees through such programmes as its Fellowships for Research and Advanced Training and the TWAS-UNESCO Associateships scheme (see pages 36-37 and 64). It was no surprise, therefore, that both Georges Eric Ngounou (Department of Organic Chemistry, University of Yaoundé I) and Ramsay Kamdem Soup Teoua (Higher Teachers' Training College, University of Yaoundé I), both budding young natural products chemists, opted to spend six months at the H.E.J. Research Institute of Chemistry under the tutelage of Muhammad Iqbal Choudhary (TWAS Fellow 2002).

While in Pakistan, Ngounou managed to isolate some 15 compounds from the leaves of four *Antidesma* species, small trees native to tropical west Africa. Some of these he has already identified, using gas chromatography equipment available at the H.E.J. Research Institute of Chemistry, as triterpenes.

“In my home lab in Cameroon,” adds Ngounou, “it is extremely difficult to work efficiently because of the lack of mass spectroscopic and nuclear magnetic resonance (NMR) instruments. Usually, we have to send samples to laboratories outside Cameroon for analysis and wait several weeks or even months before we get the results. Even then, because of potential degradation such as oxidation, the results are sometimes not what we expect.” The opportunity to have direct access to mass spectrometers and NMR equipment at ICCBS meant that Ngounou could analyse his compounds immediately after they had been isolated.

“Because these plants are used in traditional medicine, I also carried out phytotoxic and brine shrimp assays on crude extracts to determine their toxicity,” says Ngounou. “Fortunately, they only seemed to have detrimental effects at the highest doses.” He also tested other biological properties of some of the extracts, two of which were identified as having either moderate or significant anti-cancer effects in tests on breast cancer cells.

Kamdem Soup also used his time at the H.E.J. Research Institute of Chemistry to extract compounds from Cameroonian and, in this case, also Nigerian medicinal plants.

“Fourteen compounds were isolated and we have elucidated the structures of ten of them,” he says. “Of these, four are new compounds.”

Kamdem Soup then took several of these compounds and slightly altered their structures, making ‘semi-synthetic’ derivatives. “We then investigated the bio-



logical activities, including their immunomodulatory and antileishmanial properties, of these compounds and their semisynthetic derivatives,” says Kamdem Soup, who plans to return to Pakistan in 2010 to investigate the wound-healing properties of these compounds, especially in relation to diabetic patients.

“My ultimate goal is to develop affordable and sustainable local medicines that can be used to treat illnesses such as diabetes and its side effects,” he says.

“Both these Cameroonian students spent a lot of time working very hard in the laboratory during their fellowship here in Pakistan,” confirms Iqbal Choudhary, director of ICCBS. “They have learned new techniques and been exposed to a vibrant scientific culture here at H.E.J.”

Indeed, perhaps speaking on behalf of both fellowship awardees, Kamdem Soup adds that: “As a future lecturer, I will share the knowledge I have gained during my fellowship in Pakistan with my students and colleagues who have not had the same opportunity as I have had. This experience will certainly assist in the development of scientific research in my country.”



The **TWAS Research Professors in Least Developed Countries (LDCs)** scheme was launched in 2005. More than 100 TWAS members have since expressed an interest in participating in the programme, which allows them to visit a research institution in an LDC three times during a five-year period for one to three months on each occasion. The areas of expertise of each of these TWAS members has been circulated to more than 1,000 institutions in LDCs so that they can select their preferred expert. Five TWAS Research Professors travelled in 2008 (see page 66), including Norbert Hounkonnou of Benin, whose experience is highlighted below.

TWAS Research Professors



ASSISTING ACROSS AFRICA

Mahouton Norbert Hounkonnou (TWAS Fellow 2004) holds the International Chair in Mathematics, Physics and Applications (ICMPA) and the UNESCO Chair in Mathematical Physics and Applications at the University of Abomey-Calvi, Benin. More specifically, he is an expert in quantization, deformation techniques and on quantum gauge field theories in a non-commutative space-time. His work also concerns factorization methods applied to second and fourth order differential/difference operators and coherent states.

Through the TWAS Research Professors in Least Developed Countries (LDCs) programme, Hounkonnou was invited to share this expertise with staff and students in the departments of mathematics and physics at the University of Zambia, Lusaka, Zambia.

The Department of Mathematics at the University of Zambia enrolls about 1,200 students for its first-year courses, with classes of about 100 students following the remaining three years of the degree course. Likewise, the Department of Physics enrolls about 1,000 students, dropping to 30 per class in the following years. Both departments have good computer stocks and reasonable access to the internet, but poor stocks of books and journals. Graduates tend to be employed as high-school teachers, in the government and by banks, as well as in the mining industry, which is Zambia's main economic activity.

“However, the postgraduate programmes are not strong,” says Hounkonnou, “and are just picking up after having been dormant for many years. Even so, both departments offer MSc degrees, but only rarely offer PhD options.”

Hounkonnou visited the University of Lusaka in April 2008.

“During this month I gave an in-depth course on group theory and representations and their associated physical and mathematical problems,” says Hounkonnou.

Some 20 hours of lectures were presented, usually in the morning, attended by ten postgraduate students and six lecturers. Afternoon sessions were devoted to



oped Countries (LDCs) programme, TWAS will assist Hounkonnou to travel to Zambia twice more over the coming four years. However, as both parties considered the first visit so successful – and to speed up the process of carrying out joint research

problem solving and tutorial sessions, during which the masters degree students and young researchers also made short presentations about their work.

“The lectures were generally received with enthusiasm,” remembers Hounkonnou, “and several of the MSc students, in consultation with me and professors of the University of Zambia, have started work on problems that could potentially lead to PhD theses. In all these cases, these problems were offshoots of material discussed in the lectures.”

These long-term studies, explains Hounkonnou, will be supervised by professors at the University of Zambia, Davison Theo in the Department of Mathematics and Habatwa Mweene in the Department of Physics, and co-supervised by Hounkonnou.

Under the TWAS Research Professors in Least Devel-

oped Countries (LDCs) programme, TWAS will assist Hounkonnou to travel to Zambia twice more over the coming four years. However, as both parties considered the first visit so successful – and to speed up the process of carrying out joint research activities and co-supervising the PhD theses that have been launched – plans are being discussed for the possibility of Hounkonnou to visit the University of Zambia every year.

Thanks to the dedication of Hounkonnou, it is clear that the two University of Zambia departments have received a considerable boost to their capacities and have managed to increase the training opportunities and career prospects for their brightest students – certainly one of the goals of TWAS when this programme was established just four years ago.

TWAS offers Research Grants of up to US\$15,000 to young scientists of proven ability from developing countries for research projects in the basic sciences, which cover the costs of specialized equipment, essential consumable material and scientific literature. Awardees must submit a report of their work to TWAS one year after the last piece of equipment has been bought using the grant money. The following example of TWAS-supported research, therefore, is based on a grant provided in 2007, the final report for which was submitted in 2008. In 2008, 28 TWAS Research Grants were awarded to researchers in some 19 developing countries. Among these, nine grants went to scientists working in five countries in sub-Saharan Africa and another three grants went to scientists in Bangladesh and Yemen, both Least Developed Countries. The TWAS Research Grants programme is sponsored by the Swedish International Development Agency (Sida).

Research Grants for Individuals



OF MOSQUITOES AND MALARIA

Malaria kills more than one million people each year. Ninety percent of these people – many of them children less than five years old – are from sub-Saharan Africa.

Efforts to control malaria are focused on tackling the disease itself (see, for example, the report on pages 44-45) as well as using a variety of techniques to control the mosquito vectors of the disease. Such techniques, including household residual spraying of insecticides, insecticide-treated bed-nets, and draining marshes and ponds where the mosquitoes breed, must be tailored to the behaviour of specific mosquito vector species. However, the importance of different species can vary from area to area and from season to season.

“Because mosquito species that are regarded as secondary or incidental vectors are generally not considered important targets for malaria control programmes, it is crucial that the status of any mosquito species in relation to malaria transmission be clarified,” explains Luna Kamau, an entomologist at the Kenya Medical Research Institute (KEMRI), Nairobi.

“Recent studies on vectors of malaria in Kenya have excluded the analysis of the potential role of *Anopheles ziemanni* in malaria transmission. Yet during the course of other studies in western Kenya, we found considerable numbers of *An. ziemanni* mosquitoes inside human dwellings,” she adds.



With funding from a TWAS Research Grant, therefore, Kamau set out to determine how populations of *An. ziemanni* vary throughout the year, especially in relation to other vector species. Having chosen the study site, the Ahero Rice Irrigation Scheme in western Kenya, mosquitoes were collected for four days during the first week of each month between June 2007 and May 2008.

“In total, we collected more than 2,000 mosquitoes, 88 percent of which were collected indoors,” says Kamau.

Determining the exact species that a mosquito specimen belongs to is difficult, even for experts, with some species groups being especially tricky. “We used morphological techniques to distinguish between species and recognized species groups,” says Kamau, “and then molecular techniques to further identify those classified as *An. gambiae* s.l. Among these, we found only *An. arabiensis*.”

In fact, *An. arabiensis* accounted for 84 percent of the mosquitoes sampled, with the object of the study, *An. ziemanni*, accounting for less than eight percent, although *An. ziemanni* were particularly abundant in August (at the end of the rainy season), when they accounted for 31 percent of the mosquitoes sampled. However, all *An. ziemanni* sampled were caught outdoors.

But sheer numbers of mosquitoes does not always correlate with malaria transmission. For this reason, Kamau also analysed the trapped mosquitoes for evidence of having taken a blood meal and used antibody-based tests to determine the source of the meal – whether human or bovine. In addition, she inspected the salivary glands of a number of mosquitoes for the presence of sporozoites (the infective stage of the malaria parasite), which would confirm infectivity.

“Of the 549 *An. arabiensis* tested for host choice, 91 and 22 percent had fed on a bovine and human hosts, respectively. However, only two *An. ziemanni* mosqui-

toes contained a visible blood meal and both tested positive for bovine blood,” confirms Kamau. None of the mosquitoes tested for the presence of malaria sporozoites in the salivary glands were positive.

“Thus, we found no evidence that *An. ziemanni* plays a role in malaria transmission because none of the *An. ziemanni* mosquitoes tested were positive for malaria parasites, almost all of them were non-blood fed and those that had a visible blood meal had fed on a bovine host, in addition to all of them being collected outdoors,” says Kamau, summing up. “Indeed, our results suggest that the level of malaria transmission at Ahero is either very low or zero,” she adds. “This may be a result of the sustained malaria control campaigns against *An. arabiensis* and *An. funestus* vectors that have been in place in the country since around 2002, with the Kenya Ministry of Health working in partnership with agencies such as the United Kingdom’s Department of International Development (DFID) and the Global Fund to fight AIDS, Tuberculosis and Malaria.”

As Kamau points out, however, the case is not closed. “The role of these known malaria vectors appears to be changing, possibly under the influence of control interventions,” she warns. “Indeed, determination of the impact of malaria control interventions on vector populations is of interest to scientists so as to ensure that their efficacy is sustained. This is an area of research that I hope to develop.”

In recognition of her work on mosquitoes, in 2008, Luna Kamau was selected as a TWAS Young Affiliate for the sub-Saharan Africa region.



TWAS currently supports 42 Research Units in Science- and Technology-lagging Countries.

This programme, launched by the Academy in 2002, was originally designed to assist small research groups in the least developed countries (LDCs) that have accomplished significant results but, because of the difficult conditions under which they work, have yet to realize their full potential. Thanks to support from the Swedish International Development Agency (Sida), the programme allows the participation of research units in some 80 countries identified by TWAS as lagging in their science and technology capacity. Each research unit selected receives a grant of up to US\$30,000, which can be renewed on the basis of a positive report and re-application. In 2008, 22 research groups in 14 countries were supported, comprising 21 new awards and one renewal.

Research Grants for Groups



NATURAL PRODUCT RESEARCH

Each year, malaria kills more than one million people, most of whom are children under the age of five. Although malaria is curable, the parasite can adapt to new drugs, quickly becoming resistant to them.

For more than a century, quinine was the only effective treatment for malaria, but its overuse has led to problems with resistance. A new alternative, artemisinin, is currently the drug of choice and is being used in combination with other pharmaceuticals in efforts to prevent resistant strains developing. Even so, it seems that pockets of resistant parasites are developing in parts of south-east Asia. The search is on, therefore, for the next effective anti-malarial drug.

Quinine and artemisinin – two of the most successful anti-malarial drugs – are both derived from plants and both were used originally in traditional medicine. With funding through the TWAS Grants to Research Units programme, one team that is investigating its local plant species and traditional medicines for such a new anti-malarial product is led by Euis Hakim, professor of natural product chemistry at the Bandung Institute of Technology (ITB), Indonesia.

Indonesia, an archipelago of some 17,000 islands, covers only 1.3 percent of Earth's land surface but possesses 10 to 12 percent of all known plant species (some 40,000).

"These bio-resources contain a vast number of chemicals with potentially immense value to humankind," confirms Hakim.

For the past fifteen years, Hakim's group has been conducting chemical and biological studies of indigenous Indonesian plants in the hopes of discovering new chemicals that will prove effective against infectious diseases, especially malaria.

"In our efforts to discover a new class of plant-derived chemicals for the treatment of parasitic malaria," says Hakim, "we have studied several tropical plants endemic to Indonesia, in particular *Artocarpus*." The unit has investigated more than a dozen species of the genus *Artocarpus* (members of the Moraceae, or mulberry, family), many of which are used in traditional Indonesian medicine to treat such symptoms as fevers and aches, including the breadfruit (*A. altilis*) and jackfruit (*A. heterophyllus*) trees.

Thanks in part to TWAS support, Hakim's research group has succeeded in isolating many phenolic compounds, primarily flavonoids with novel structural types, from *Artocarpus*. "We have discovered and characterized more than 60 phenolic constituents to date, including 27 new chemical compounds," says Hakim. More importantly, she adds, "preliminary investigations indicate some of the compounds obtained from *Artocarpus* possess anti-malarial activity potentially equivalent to that of artemisinin."

Such positive results show the necessity of continuing to evaluate this class of natural chemicals characteristic of these particular plants.

Over time, Hakim's unit has also expanded its range of studies to include chemical profiling, pharmacology, plant tissue culture and biotechnology. Though they have "a relatively well-equipped laboratory", the TWAS grant allowed the purchase of such additional equipment as an incubator and biosafety cabinet.

"The TWAS grant has benefited our unit significantly," Hakim says. "The research supported by TWAS will allow us to build up our group and continue to develop our chemical and biological inventories of Indonesian plants for their sustainable utilization.



"TWAS's support has also allowed us to provide research grants for some of our doctorate students," she says. Without such assistance, she adds, these promising young scientists, who have so much to contribute to their country's future, might never get such an opportunity. One testimony of the group's growing reputation is that it now receives international applications to carry out doctoral and postdoctoral research, with candidates from countries including Bangladesh, China, India and Malaysia.

Hakim's plans for the future include developing the unit into a 'centre of excellence' by continuing its research on structural chemistry, biosynthesis and biotransformation, combined with applied research and increased collaboration with other research groups, both in Indonesia and abroad.

"We hope to continue to push the boundaries of natural products chemistry research into Indonesian bioresources," says Hakim, "and to generate new knowledge, and so maintain our position at the forefront of the study and innovative utilization of these resources."

TWAS – like every organization – needs an effective way of communicating its programmatic activities to its membership and other interested parties. For TWAS, this includes the many international organizations and institutions committed to building scientific capacity in developing countries, as well as government ministries, national research councils and academies of science – a list that is ever-increasing. Within the Academy’s secretariat, such efforts are the responsibility of the Public Information Office.

Public Information



TWAS’s 25th anniversary in 2008 provided an excellent opportunity for the Academy to marshal an extensive public information campaign to describe TWAS’s accomplishments, and to highlight the breadth and depth of its involvement in science and science-based development in the developing world. The TWAS-*Nature* Publishing Group Supplement, ‘A World of Science in the Developing World’, examined the impact of TWAS through the eyes of its members and provided a broad overview of the challenges that lie ahead. The supplement was published with funding from the Swedish International Development Agency, the Wellcome Trust and the Kuwait Foundation for the Advancement of Science. *Nature* issued 10,000 print copies and posted the text on a dedicated website that it linked to its main website. In addition, *Nature* also published an editorial on TWAS in the edition of the journal coinciding with the Academy’s 25th anniversary celebrations in Mexico City as well as a feature article focusing on the Academy’s Second General Conference in Beijing that was part of a series of articles exploring ‘Meetings that Changed the World’. Other articles in the series examined the meetings that led to the birth of CERN (the European Organization for Nuclear Research), the Green Revolution and the sequencing of the human genome.

The journal *Science* published an editorial on TWAS as well as a series of editorials written by TWAS Fellows Sergio Jorge Pastrana, Ismail Serageldin and Ahmed Zewail, TWAS Associate Fellow Michael T. Clegg and TWAS executive director, Mohamed H.A. Hassan.



UNESCO's *World of Science* published an interview with TWAS president Jacob Palis.

The webportal 'Scidev.net' published a number of articles on TWAS and also re-posted many of the articles that were published as part of the *Nature* supplement.

The Public Information Office (PIO) also participated in the Rome book fair, speaking about *Dry: Life Without Water*, published by Harvard University Press in 2006. The PIO also organized a session at the AAAS annual meeting on Africa and helped prepare a major presentation at the African Union's 'Science with Africa' meeting.

The *TWAS Report* on 'Sustainable Energy for Developing Countries' by Dilip Ahuja and Marika Tatsutani was published in 2008.

A new TWAS brochure with updated information about the Academy was produced to celebrate the Academy's 25th anniversary and a booklet for the Jubilee Endowment Fund Campaign was also published and distributed.

Funding from the David and Lucile Packard Foundation enabled TWAS to finish publishing in-depth profiles of five centres of excellence in the South in 2008. The series, entitled *Excellence in Science: Profiles of Research Institutions in Developing Countries*, includes profiles of the following centres: The Institute of Medicinal Plant Development in Beijing, China; the National Institute of Biodiversity in Santo Domingo de Heredia, Costa Rica; the Central Drug Research Institute in Lucknow, India; the Malagasy Institute for Applied Research in Antananarivo, Madagascar; and the Centre of Biotechnology of Sfax, Tunisia.

The flagship publication of the Academy is the *TWAS Newsletter*, which is published four times a year. The *TWAS Newsletter* – with a print-run of 2,500 copies distributed worldwide – is generously supported by the Kuwait Foundation for the Advancement of Sciences (KFAS). Its magazine-like format provides a timely and

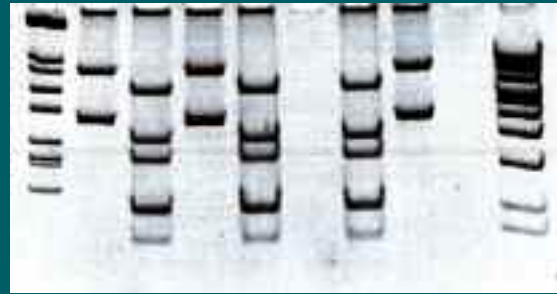


effective way of keeping TWAS members, as well as colleagues and partners in other international organizations, up to date with the work of the Academy and its affiliated organizations, TWOWS, IAP, IAMP and COSTIS (see pages 58-61).

The *TWAS Year Book 2008* contains short biographies of all TWAS Fellows and Associate Fellows and continues to serve as an important source of information for the Fellows themselves as well as those who are interested in the Academy's membership. It was published in August 2008 and distributed to all members.

TWAS also produces a two-page *Fellowships Bulletin*, issued twice in 2008, the *IAP Bulletin* every three months and the *IAMP Newsletter*, issued once in 2008. Each were disseminated widely and made available on the websites of the respective organizations.

In addition to its ongoing responsibilities, the TWAS PIO also maintains the Academy's website, provides editorial and technical assistance for the websites of the Academy's associated organizations, and prepares booklets, leaflets, brochures and posters detailing the activities of TWAS and its partner organizations.



Partnerships



BIOTECH COLLABORATION

The TWAS-International Centre for Genetic Engineering and Biotechnology (ICGEB) Joint Programme in Biotechnology provides three-years' of funding to networks of two to four institutions to carry out research and training activities on tolerance to abiotic stress in plants. In each case, one of the partner institutions must be in a least developed country (LDC) or other science- and technology-lagging country (S&TLC) and a significant part of the allocated funds must go towards training young scientists from these institutions at other, more advanced institutions within the network.

In 2008, four of the five selected networks received the second annual allocation of funding, while one of the project participants dropped out.

The continuing projects are those headed by:

- Andres Zurita Silva, Centre for Advanced Studies in Arid Zones, *Universidad de la Serena*, Chile, working on 'Tolerance strategies of *Quinoa* plants under salt stress' with collaborators from Argentina, Mali and Italy;
- Konstantin Skryabin, Centre "Bioengineering", Russian Academy of Sciences, Moscow, Russia, working on 'Use of bacterial H⁺ pyrophosphatases for the development of salt-tolerant plants' with a collaborator from Uzbekistan;
- Khaled Masmoudi, *Centre de Biotechnologie de Sfax*, Tunisia, working on 'Over-expression of genes encoding ion transport proteins as a strategy to improve salt- and drought-tolerance in wheat' with collaborators from Ghana and Syria; and

- Sabina Vidal Macchi, *Laboratorio de Biología Molecular Vegetal, Universidad de la República Iguá, Montevideo, Uruguay*, working on ‘The identification of key genes involved in salt and osmotic stress tolerance in model plants’ with collaborators from Argentina, Bolivia and Hungary.

In addition, in a new initiative TWAS and ICGEB joined forces with the United Nations Educational, Scientific and Cultural Organization’s International Basic Sciences Programme (UNESCO/IBSP) to fund a three-year ‘Joint Project on Capacity Building in Basic Molecular Biology’. Again, the project will focus on the creation of networks involving institutions from S&TLCs, but in this case the focus is on research on biotic stresses (i.e., pests and pathogens) of crop plants and domestic animals.

For additional information on ICGEB, visit: www.icgeb.org.

EUROAFRICA-ICT

For the first time, TWAS has received funding from the European Union (EU). Funded through the EU’s Seventh Framework Programme (FP7), the EuroAfriCa-ICT project sees TWAS linking up with a number of institutions in Europe, sub-Saharan Africa and the Caribbean.

The two-year project is aimed at increasing the number of scientists from sub-Saharan Africa and the Caribbean carrying out research in information and communication technology (ICT) that become involved in EU-funded research programmes.

The EuroAfriCa-ICT team, including TWAS, hopes to



achieve this through a number of inter-related activities, including:

- information workshops (two were held in 2008, one in South Africa, the other in Uganda), included technical visits to nearby research centres – the Meraka Institute, Pretoria, and the Faculty of Computing and Information Technology, Makerere University, Kampala, respectively;
- ‘concertation’ meetings held in Brussels, Belgium, and attended by representatives from industry, academia and international organizations;
- the organization of two EuroAfrica Cooperation Forums on ICT Research, scheduled for March 2009 and early 2010. TWAS is taking the lead in implementing the first of these, which is being organized by the European Union and African Union Commission;



- a number of web-based support activities such as an on-line ICT community, an updated partner search database and regional help-desks; and
- the identification of a number of ‘flagship projects’ that will be assisted in finding suitable partners and provided with advice on the FP7 application process.

“Ultimately, the success of the EuroAfriCa-ICT project lies with increasing the number of applications that include African and Caribbean partners to FP7 calls for proposals,” says Roger Torrenti, head of France-based Sigma-Orionis, lead partner of the EuroAfriCa-ICT consortium.

For additional information on EuroAfriCa-ICT, visit: www.euroafrica-ict.org

PERMIT

TWAS is also participating in a EU-Turkey funded project: PERMIT (Promote Education and Reciprocal Understanding through Multicultural Integrated Teaching). This 18-month project is bringing together young teachers from various backgrounds in Turkey (both state schools and private schools) with other teachers from Italy and Slovenia with the aim of introducing the Turkish teachers and their students to European culture and the European teachers and students to Turkish culture through a series of workshops designed around the development of exemplar teaching materials on multicultural themes.

Although the project embraces all subject areas, including the arts and humanities, TWAS has ensured a scientific element by selecting young Turkish science teachers. Çigdem Kağıtçibasi (TWAS Fellow 2006), Koc University, Turkey – an expert in cross-cultural psychology – has also been appointed to a scientific steering



committee that will evaluate the results of the project as the exemplar materials developed are trialled in classroom situations.

TWAS’s PERMIT project partners include the University of Venice Ca’Foscari, Italy; the University of Primorska, Koper, Slovenia; and Yildiz Technical University, Istanbul, Turkey.

CAPACITY BUILDING WORKSHOPS

Following on from a series of four training courses on ‘Capacity building in environmental related issues in the field of geo-mining’ held in 2006 and 2007, TWAS has again teamed up with FORGEA-International, a geo-mining and environmental training and cooperation centre





based in Sardinia, Italy. With funding from the Italian government’s Ministry of Foreign Affairs, TWAS and FORGEA International are organizing another three training courses.

The first of these courses, held in Sardinia, Italy, in December 2008, focused on ‘Materials recovery and recycling’ and was attended by 22 participants from ten target countries – mainly in North Africa and the Middle East.

The two remaining training courses, scheduled for early 2009, will focus on ‘Bioremediation and phytoremediation techniques for the reclamation of mine sites’ and ‘Remote-sensing and other environment-related issues’.

For additional information on FORGEA-International, visit: forgea.atspace.com.

SUPPORT FOR SCIENTIFIC MEETINGS

In 2008, TWAS provided support for 15 scientific meetings in 12 developing countries. Among the meetings supported were:

- III Latin American Summer School on Epilepsy: ‘Epileptogenesis in the developing brain: basis for treatment and prevention’, 5-14 February, Sao Paolo, Brazil;

- Regional Conference on Land Degradation Processes and Possible Rehabilitation Methods in Arid and Semi-Arid Zones of Central Asia, September 2008, Dushanbe, Tajikistan;
- Symposium on Agroforestry and Soil Management, 20-23 October, Butare, Rwanda;
- International Conference on Insects as a Tool for Improved Livelihood in Africa, 23-27 November, Nairobi, Kenya;
- Third Conference of Latin American and Caribbean Women in Exact Sciences and Life Sciences: ‘Science-Women 2008’, 27-29 November, La Paz, Bolivia; and
- International Conference on Regulatory and Safety Issues in Commercialization of Biotechnology Research in Developing Countries, 2-4 December, Dhaka, Bangladesh.

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

Regional Offices



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

In 2008, the TWAS Regional Office for East and Southeast Asia and the Pacific (TWAS-ROESEAP) again teamed up with the World Meteorological Organization (WMO) to organize the 7th CAS-TWAS-WMO International Workshop, this time on the 'Development of a Regional Earth System Model and its Application'. The event, held in Kunming, Yunnan Province, China, on 17-19 September, attracted more than 150 participants, including scientists from Australia, China, France, Germany, India, Italy, Japan, Malaysia, Nepal, the Netherlands, Pakistan, South Korea, Thailand, Vietnam, the United States and the United Kingdom.

On 5 November 2008 TWAS-ROESEAP also organized the Fifth Meeting of Chinese TWAS Fellows in Beijing. The meeting, the purpose of which was to promote close cooperation in the region under the TWAS strategic plan, was attended by more than 80 TWAS Fellows. Indeed, TWAS-ROESEAP actively supports the CAS-TWAS Fellowship programme and the TWAS-UNESCO Associateship scheme. In 2008, 43 scientists from 17 developing countries were awarded CAS-TWAS Post-graduate, Postdoctoral and Visiting Scholar Fellowships and





some 13 associates carried out cooperative research in CAS institutes. In addition, under a new agreement signed with the Third World Organization of Women in Science (TWOWS), three young women scientists from Nigeria and Yemen are being hosted in China.

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

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

In 2008, the TWAS Regional Office for Sub-Saharan Africa (TWAS-ROSSA) continued its efforts towards strengthening the capacity of TWAS National Chapters in Africa. This year, the Zimbabwe Chapter based at the Scientific and Industrial Research and Development Centre, Harare, was awarded US\$3,000 for its activities.

Another activity supported through TWAS-ROSSA is the publication of the peer-reviewed, multidisciplinary and indexed journal, *Discovery and Innovation*, which



provides a vehicle for African scientists to publish their results and to stay informed about scientific developments on the continent. Four issues are published annually.

The Third TWAS-ROSSA Young Scientists Conference took place on 15-17 December 2008 on the theme ‘Alternative Sources of Energy: Potential for renewable energy and biofuels in Africa’. The event, which was attended by 53 participants from 22 countries, focused on the application of research and innovation in tackling energy-related issues in Africa.

TWAS-ROSSA also produces an annual e-newsletter to help increase the visibility of TWAS in the region.

- *coordinator: Tom Egwang (TWAS Fellow 1997)*
- *email: aas@aasciences.org*
- *website: www.nairobi.twas.org*



TWAS ARAB REGIONAL OFFICE
Headquarters: Bibliotheca Alexandrina,
Alexandria, Egypt

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

The main event organized by TWAS-ARO in 2008 was TWAS/BioVision Alexandria.Nxt. The meeting was held within the framework of the biennial international conference , BioVision Alexandria 2008 at the *Bibliotheca Alexandrina* on 11-12 April and focused on 'Funding Research in the Developing World'. TWAS-ARO hosted 99 young scientists from 27 developing countries who shared their ideas and experiences. In addition they met with mentors and eminent scientists who helped increase their knowledge in the fields of research and development. TWAS contributed US\$50,000 to the organization of the event. TWAS-ROCASA also contributed to ensure the participation of young scientists from Asia.

Following the BioVision session on 'Problems Hindering Biotechnology Research in the Arab Region', a task

force of ten eminent scientists was established that will serve as a hub for building a 'Network of Networks' for science and technology in the Arab Region and a platform for international collaboration and understanding. A website for this network is under construction. The TWAS-ARO 4th Annual Meeting was held in October 2008, in parallel with a Network of Networks meeting.

Under TWAS-ARO's Visiting Scholar Programme, Mohamed El-Sharkawi, Electrical Engineering Department, University of Washington, USA, was invited to lecture on the subject of the 'Smart Grid: The Future Distribution Network'. The public lecture, held on 26 August 2008, was attended by some 100 people.

During his visit, El-Sharkawi also held a two-day workshop on 'Technical Writing: How to Successfully Write





Research Proposals, Papers, Theses and Reports' attended by some 50 young students and researchers preparing for their masters, doctoral and postdoctoral studies.

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

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

The TWAS Regional Office for Central and South Asia (TWAS-ROCASA) has instituted the TWAS-JNCASR Summer Research Fellowship Joint Programme to pro-



mote and encourage young undergraduate students in the region to visit renowned institutions in India. Eight students were selected for 2008: from Pakistan (4), Nepal (2), Iran (1) and Sri Lanka (1).

The Regional Office has also updated the regional directory of TWAS Fellows that features the biographical and contact details of TWAS Fellows in the region. It also issues periodical press releases highlighting TWAS events and announcements, for example in *Current Science*, the journal of the Indian Academy of Sciences, and posts news of other TWAS activities and the activities of other regional offices on its website.

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





TWAS REGIONAL OFFICE FOR LATIN AMERICA AND THE CARIBBEAN

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

In 2008, the TWAS Regional Office for Latin America and the Caribbean (TWAS-ROLAC) launched the third edition of the TWAS-ROLAC Young Scientist Prize. Prizes of US\$2,000 each were awarded to young scientists in the fields of engineering sciences, agricultural sciences, medical and health sciences and biological sciences. The award ceremony took place during the Magnum Meeting of the Brazilian Academy of Sciences at which 30 researchers, including young scientists and TWAS Young Affiliates, delivered talks.

TWAS-ROLAC also organized the Fourth Regional Conference for Young Scientists, 'Advances and Perspectives of Science in Brazil, Latin America and the Caribbean', held at the Brazilian Academy of Sciences in December 2008. Focus areas included the basic sciences, engineering and computer sciences and life sciences.

TWAS-ROLAC is also active in contacting TWAS Fellows in the region and seeking nominations for TWAS

membership and awards, regularly updates the Regional Office's homepage, and supports TWAS and the Brazilian National Council for Scientific and Technological Development (CNPq) in the implementation of the TWAS-CNPq Fellowships programme.

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

REGIONAL PRIZES

In 2006, TWAS instigated three regional prizes of US\$3,000 each that are awarded annually on a rotating basis. In 2008, the Regional Prizes for the Development of Educational Material and School Scientific Curricula were awarded to:

- *TWAS-ARO: Saouma BouJaoude, chair of the Department of Education and professor of Science Education at the American University of Beirut (AUB), Lebanon.*





YOUNG AFFILIATES

TWAS-ARO	TWAS-ROCASA	TWAS-ROLAC	TWAS-ROSSA	TWAS-ROESEAP
Walid M. El-Sharoud, Egypt	Govindasamy Mugesh, India	Jorge Lauret, Argentina	Luna Kamau, Kenya	Zeng Xiaodong, China
Mohamed El-Amir F. Hegazy, Egypt	Shiraz Minwalla, India	Carlos Gustavo Moreira, Brazil	Daud Kassam, Malawi	Pan Jian-Wei, China
Rola Naja, Lebanon	Hosein Rahami, Iran	Fernanda de Felice, Brazil	Archana Bhaw-Luximon, Mauritius	Lin Chun-Hung, Taiwan, China
Tahra Ayad, Tunisia	Saima Riazuddin, Pakistan	Santiago Ron, Ecuador	Safiryu Idowu Ola, Nigeria	Yong-Mook Kang, Korea Rep.
	Bakhrom Abdazovich Omirov, Uzbekistan	Laurent Raymond Loinard, Mexico	Albert Thembinkosi Modi, South Africa	Pimchai Chaiyen, Thailand

- **TWAS-ROCASA:** Arvind Kumar, senior professor and centre director, Homi Bhabha Centre for Science Education, Tata Institute of Fundamental Research, Mumbai, India.
- **TWAS-ROLAC:** Carlos Bosch, *Instituto Tecnológico Autónomo de México*, Mexico City, Mexico, founder of Mexico’s Mathematical Olympiad and ‘*La Ciencia en tu Escuela*’ (Science in Your School) programme.
- **TWAS-ROSSA:** Moyra Keane, academic advisor in the science faculty of the University of the Witwatersrand, South Africa.
- **TWAS-ROESEAP:** Gong Peng, head of the Scientific

Education Department, Northeast Yucai School, Shenyang, China.

YOUNG AFFILIATES

Starting in 2007, each TWAS Regional Office has selected up to five Young Affiliates (who must be excellent young scientists aged 40 or below). In 2008, 24 young scientists (see table above) were selected following a nomination and selection process that involves the TWAS Fellows in each region (see table above).



At its headquarters in Trieste, Italy, TWAS now hosts the secretariats of four other international organizations dedicated to serving the needs of science and scientists in the developing world and promoting indigenous scientific capacity as a fundamental component of sustainable economic development. Highlights of the 2008 activities of these organizations follow.

The TWAS Family



THIRD WORLD ORGANIZATION FOR WOMEN IN SCIENCE (TWOWS)

With its more than 3,000 members, TWOWS is the largest organization of women scientists in the world.

The third TWOWS executive board meeting was held in Irbid, Jordan, in April 2008, hosted by the Jordan University of Science and Technology (JUST). The executive board meeting was convened in conjunction with the 'Conference on Arab Women in Academic Sciences and Technology: Towards Sustainable Development', 28-30 April. Conference participants examined the need to create a forum for the exchange of ideas and experiences on issues related to women in academic sciences and explored and identified new dimensions for women's research in science and technology, education and training.

The TWOWS executive board meeting reviewed national and regional activities, including meetings and conferences organized by executive board members; proposals for new projects and programmes; and the TWOWS Fourth General Assembly and International Conference which will be hosted by the Chinese Academy of Sciences (CAS), in June 2010, in Beijing, China.

TWOWS's flagship postgraduate fellowship programme, sponsored by the Swedish International Development Agency (Sida), for young women scientists from sub-Saharan Africa and Least Developed Countries was launched in 1998 and continues to grow. In 2008, 159 eligible applications were



received from 25 countries, of which 24 were selected from 15 countries.

One more young woman scientist (Nadege Okemy-Andissa, University of Marien Ngouabi, Brazzaville, Congo Rep.) completed her higher degree in 2008, bringing the total since the programme began to 72. Okemy-Andissa, was awarded a PhD by University of Lomé, Togo, for her pharmacological chemical studies on the analgesic, antipyretic and anti-inflammatory activities of medicinal plants and preparations.

TWOWS-related meetings were also organized by several executive board members in Bolivia, Egypt, India and Yemen.

For additional information about TWOWS, see www.twows.org or contact info@twows.org.

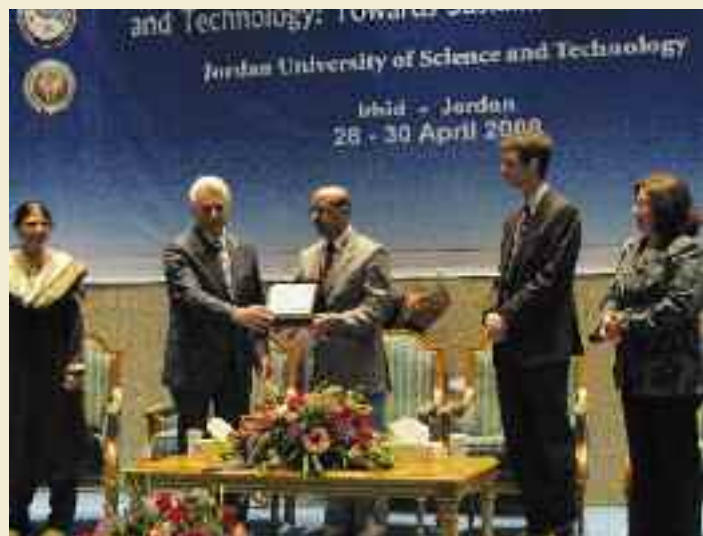
INTERACADEMY PANEL ON INTERNATIONAL ISSUES (IAP)

IAP, an umbrella organization for the world's merit-based academies of science, currently coordinates programmes devoted to capacity building for science academies, covering topics such as science education, water resource management and access to scientific information.

Following an executive committee decision to amend the IAP statutes to allow more than one academy of sciences per country, the *Deutsche Akademie der Naturforscher Leopoldina*, and the Korean Academy of Science and Technology (KAST) joined IAP in 2008. The Kosovo Academy of Sciences and Arts also joined IAP in 2008, bringing the network's membership, during its 15th anniversary celebration year, to 100.

Also to celebrate this anniversary, IAP published a volume containing all the statements it has issued since its creation in 1993.

In January 2008, IAP and the InterAcademy Council



(IAC) organized a first 'Joint Session' in Amsterdam, the Netherlands, where IAP and IAC co-chairs signed a memorandum of understanding (MoU). Through this MoU, IAP provides funds to its regional networks of science academies to hold workshops aimed at implementing the recommendations of IAC studies. In 2008, IAP facilitated two such workshops: in Argentina, organized by the InterAmerican Network of Academies of Sciences (IANAS), and in South Korea, organized by the Association of Academies of Sciences in Asia (AASA). Both workshops focused on the IAC energy study published in October 2007, 'Lighting the way: Toward a sustainable energy future'.

In September 2008, the IAP executive committee met in Ottawa, Canada, where IAP's scientific programmatic agenda for 2009 was adopted. Based on a competitive review process, the following new proposals will receive funding:

- GMOs in Africa: challenges and opportunities;
- Primary connections – linking science with literacy;
- Science education for rural children in Sri Lanka through ICT;



- Global activities of the IAP science education programme 2009;
- IANAS workshop on the science funding landscape in Central and South America; and
- A workshop on strengthening collaboration between the AASA Clean Water Programme and the IAP water programme.

In addition, IAP's flagship programme, 'Capacity Building for Science Academies', which pays particular attention to building the capacity of science academies in developing countries, continues to be led by TWAS. A key objective of the programme is to strengthen the role of academies in providing advice to governments on issues of national and global concern.

Other ongoing programmes currently receiving funding from IAP are:

- Digital knowledge resources and infrastructure in developing countries;
- IANAS programme on science education;
- Promoting best practices in science education in sub-Saharan Africa; and
- Bridging water research and management.

In a new joint venture for 2008 established with the World Economic Forum, IAP invited 60 outstanding young scientists to attend the IAP Young Scientists Conference, which was integrated into the World Economic Forum's "Annual Meeting of 'New Champions'

2008", held in Tianjin, China, from 26-28 September. Six TWAS Young Affiliates were among the 43 young scientists that participated. The meeting brought together a group of young 'champions' – individuals younger than 40 – who had a proven track record of success in fields related to business, politics, technology and science, and provided a platform for the leaders of tomorrow to exchange ideas and learn from one another. Plenary sessions on nanotechnology and life sciences involved IAP's young scientists as panellists. More than 1,500 people attended. The meeting concluded with the release of a statement by the young scientists: 'Passion for Science - Passion for a Better World'. Following the meeting, two of the young scientists were awarded grants of US\$10,000 by IAP to allow them to follow up on science/business ventures developed during the meeting.

For additional information about IAP, see www.interacademies.net or contact iap@twas.org.

INTERACADEMY MEDICAL PANEL (IAMP)

IAMP membership currently comprises 65 medical academies and science academies with medical divisions that are committed to improving health worldwide.

The IAMP executive committee held its annual meeting on 19 September 2008 in conjunction with the bi-annual conference of the Latin American Academies of Medicine (ALANAM), hosted by the National Academy

of Medicine of Mexico in Mexico City. At the meeting, the executive committee confirmed that IAMP will focus on two main programmatic areas: ‘Scientific Communication’ and needs assessment studies for the ‘Perinatal Mortality’ project. Funding support for these two programmes is being sought by lead academies with the support of IAMP.

Enquiries have also been made concerning a proposal to organize an Africa-China Health Summit in China that will involve ministers of health from Africa and China together with academies of science and medicine.

For additional information on IAMP, see www.iamp-online.org or contact iamp@twas.org.



CONSORTIUM ON SCIENCE, TECHNOLOGY AND INNOVATION FOR THE SOUTH (COSTIS)

COSTIS was derived from the Third World Network of Scientific Organizations (TWNISO), created by TWAS in 1988, following a decision by the TWNSO General Assembly and the political backing of the foreign ministers of the Group of 77 (G77) and China in 2006. With its membership of ministries of science and technology, national research foundations, national research councils, academies of science and science-based private-sector institutions, COSTIS aims to build on and enhance TWNSO’s efforts at promoting science and technology for sustainable development to governments in the South.

On 2 July 2008, Ambassador John W. Ashe, Permanent Mission of Antigua and Barbuda to the United Nations and 2008 Chair of the G77 and China, visited

TWAS to discuss issues relating to COSTIS with the TWAS president, Jacob Palis, and TWAS executive director, Mohamed Hassan, as well as Paolo Budinich (TWAS Fellow 1992), president of the Trieste-based *Fondazione Internazionale per il progresso e la libertà delle scienze* (FIT). This group also made up a delegation that met with Alessia Rosolen, councillor for work, training, universities and research, and other officials of the Friuli Venezia Giulia region (*Regione FVG*), where Trieste is located. Among the issues discussed was support for the establishment of COSTIS from the *Regione FVG*, perhaps through the provision of headquarters.



In the meantime, full details of the operational activities of COSTIS are being established by a high-level task force that is discussing such issues as the COSTIS statutes and the launch of the organization, currently scheduled to coincide with the Fourth World Science Forum: ‘World Science Forum: Budapest +10’, to be held in Budapest, Hungary, in November 2009.

The interim COSTIS secretariat is hosted by TWAS in Trieste.

For additional information about COSTIS, see www.twnso.org or contact costis@twas.org.



A P P E N D I C E S

2008 in Figures

In 2008, under the **TWAS-UNESCO Associateship Scheme**, TWAS appointed 32 developing-world scientists from 19 countries, including six least developed countries (LDCs), as associates. In addition, 33 associates travelled to carry out collaborative research at research institutions in 10 countries in the South: Argentina, Brazil, China, India, Mexico, Pakistan, Peru, South Africa, Syria and Thailand. The TWAS-UNESCO Associateship Scheme is kindly supported by the OPEC Fund for International Development (OFID).

Geographical area	Awarded	Hosted
Africa and Arab region	9	3
Asia and Pacific region	19	13
Latin America and the Caribbean	4	16
<i>TOTAL</i>	32	32

In 2008, TWAS provided **support for 15 Scientific Meetings** in 12 developing countries. Supported meetings covered a range of disciplines, from regulatory and safety issues in the commercialization of biotechnology research in developing countries, to trends and future research in natural products chemistry and parasitology, and 'Women in Science: Challenges and Opportunities in Africa'.

Geographical Area	<i>TOTAL</i>
Africa and Arab region	5
Asia and Pacific region	2
Latin America and the Caribbean	8
<i>TOTAL</i>	15

In 2008, 15 developing-world scientists from eight countries, including five least developed countries (LDCs), received **TWAS Fellowships for Research and Advanced Training**. These were hosted by institutions in eight countries: Brazil, Cameroon, China, India, Mexico, Pakistan, South Africa and Uruguay.

Geographical area	Awarded	Hosted
Africa and Arab region	8	4
Asia and Pacific region	3	6
Latin America and the Caribbean	4	5
<i>TOTAL</i>	15	15

In 2008, TWAS's **South-South Fellowships** were awarded in collaboration with partner organizations in five developing countries: Brazil, China, India, Malaysia and Pakistan (see page 38). Together, TWAS and its partner organizations offer some 300 fellowships each year – making this the world's largest South-South fellowship programme. TWAS estimates that its partners in this programme contribute some US\$2 million towards costs in the host countries.

In 2008, TWAS received a total of 179 fellowship applications, of which 134 were awarded and 125 were accepted – the highest number yet.

Co-sponsoring organization	Postgraduate fellowship		Postdoctoral fellowship		Visiting scholar	
	Awarded	Accepted	Awarded	Accepted	Awarded	Accepted
CNPq, Brazil	35	32	10	9	-	-
CAS, China	10	10	11	9	23	23
CSIR, India	8	8	5	5	-	-
DBT, India	3	3	1	1	-	-
IACS, India	0	0	3	3	-	-
S.N. Bose, India	1	0	0	0	-	-
USM, Malaysia	11	9	5	5	-	-
CEMB, Pakistan	4	4	0	0	-	-
ICCBS, Pakistan	3	3	1	1	-	-
TOTAL	75	69	36	33	23	23

In 2008, 28 **TWAS Research Grants** of up to US\$15,000 each were awarded to individual researchers in some 19 developing countries. Among these, nine grants went to scientists working in five countries in sub-Saharan Africa. Other grants went to scientists in Bangladesh and Yemen (both least developed countries), as well as Papua New Guinea and Uzbekistan.

Geographical area	Biology	Chemistry	Mathematics	Physics	TOTAL
Africa and Arab region	6	4	1	0	11
Asia and Pacific region	3	5	0	2	10
Latin America and the Caribbean	2	4	0	1	7
TOTAL	11	13	1	3	28

In 2008, 22 **TWAS Research Units** were funded in 14 science and technology-lagging countries (from a list of 80 eligible countries) with grants of up to US\$30,000 each. Of these, 21 were first-time awards and one was a renewal.

Geographical area	Biology	Chemistry	Mathematics	Physics	TOTAL
Africa and Arab region	10	5	1	1	17
Asia and Pacific region	1	3	0	1	5
Latin America and the Caribbean	0	0	0	0	0
TOTAL	11	8	1	2	22

The **TWAS Research Professors in Least Developed Countries** (LDCs) programme was launched in 2005. In

2008, five TWAS members visited their respective host institution.

TWAS Fellow	Country of residence	Field of expertise	Host institution in LDC	Year of appointment
Berhanu Abegaz	Botswana	Chemical sciences	Department of Chemistry, Addis Ababa University, Ethiopia	2005
Mahouton Norbert Hounkonnou	Benin	Physics	Department of Physics, University of Zambia, Zambia	2006
Manuel de Jesus Limonta Vidal	Cuba	Medical sciences	Hubert Kairuki Memorial University, Dar Es Salaam, Tanzania	2008
Syed M. Qaim	Germany	Chemical sciences	Rajshahi University, Rajshahi, Bangladesh	2005
Edemariam Tsega	Canada	Medical sciences	Gondar College of Medical Sciences, University of Gondar, Ethiopia	2005

The **Joint Visiting Scientist Programme** is an initiative of TWAS, the International Council for Science (ICSU), the United Nations Educational, Cultural and Scientific Organization (UNESCO) and the United Nations University Institute for Advanced Study (UNU/IAS). It

enables eminent scientists from developing and developed countries to visit institutions and research groups in developing countries. In 2008, five scientists travelled to their selected host institution.

Visiting scientist	Country of residence	Field of expertise	Host institution	Year of appointment
Abdoulaye Doucoure	United States	Photovoltaics; water treatment	Faculté des Sciences et Techniques (FAST) de Bamako - Ministère de l'Éducation Nationale - DER de Chimie, Mali	2007
Nwadiuto Esiobu	United States	Microbiology of fermented foods; biotechnology training	University of Agriculture, Abeokuta, Ogun State, Nigeria	2007
Akier Assanta Mafu	Canada	Food safety processing	Institute of Applied Techniques in Food Processing, Kimbese City, Bas-Congo, Congo D.R.	2006
Abul Mandal	Sweden	Plant biotechnology	Institute of Biological Sciences, Rajshahi University, Bangladesh	2006
Dusica Maysinger	Canada	Natural product chemistry	San Andres University, Natural Products Laboratory, Institute of Chemical Research, Cota-Cota, La Paz, Bolivia	2007

FINANCE

The total amount of funds received for activities in 2008 was US\$4,674,032. The main contributions were: the Ministry of Foreign Affairs, Italy (US\$2,437,111); the Swedish International Development Agency (Sida) (US\$956,262); *illycafé*, Trieste (US\$99,954); the Mexican Academy of Sciences (US\$100,000); Microsoft Research Ltd. (US\$60,996); the European Union Seventh Framework Programme (FP7) (US\$79,973); the Kuwait Foundation for the Advancement of Sciences (KFAS) (US\$49,980) and the Wellcome Trust (US\$18,923).

In addition, it is estimated that partner organizations

in the TWAS South-South Fellowships programme (see pages 38-39) contributed some US\$2 million in local (host country) expenses.

At 31 December 2008, the TWAS Endowment Fund stood at US\$11,393,955, with the target set at US\$25 million. Donations during 2008 totalled US\$300,646, including US\$252,525 from the Ministry of Science and Technology, Brazil, US\$25,000 from the *Consejo Nacional de Ciencia y Tecnología* (CONACYT), Mexico, plus other small contributions amounting to US\$23,121. Interest in 2008 totalled US\$476,083.

The TWAS Secretariat

Executive Director's Office

Mohamed H.A. Hassan
Executive Director

Sandra Ravalico
Helen Martin

Programmes and Activities

Peter McGrath
Programme Assistant

Sara Dalafi
Claudia Diogo
Antonella Mastroli
Maria Teresa Mahdavi
Fabrizia Niscio
Cristina Simoes

Public Information Office

Daniel Schaffer
Public Information Officer

Gisela Isten
Tasia Asakawa
Brian Smith

Finance and Administration

Patricia Presiren
Paola Vespa
Nino Coppola
Ezio Vuck

Third World Organization for Women in Science (TWOWS)

Leena Mungapen
Sara Dalafi

InterAcademy Panel on International Issues (IAP)/ InterAcademy Medical Panel (IAMP)

Joanna Lacey
Muthoni Kareithi

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

Graphic Design
Studio Link, Trieste (www.studio-link.it)

Printing
Stella Arti Grafiche, Trieste

TWAS gratefully acknowledges the financial support for its 2008 activities provided mainly by the following:

- the Ministry of Foreign Affairs, Italy
- the Swedish International Development Agency (Sida)
- illycaffè, S.p.A., Trieste, Italy
- the Mexican Academy of Sciences
- Microsoft Research Ltd., UK
- the European Union, Seventh Framework Programme (FP7)
- the Kuwait Foundation for the Advancement of Sciences (KFAS)
- the Wellcome Trust, UK



TWAS
THE ACADEMY OF SCIENCES
FOR THE DEVELOPING WORLD

ICTP campus, Strada Costiera 11 - 34151 Trieste - Italy

tel: +39 040 2240 327 - fax: +39 040 224559

e-mail: info@twas.org - website: www.twas.org