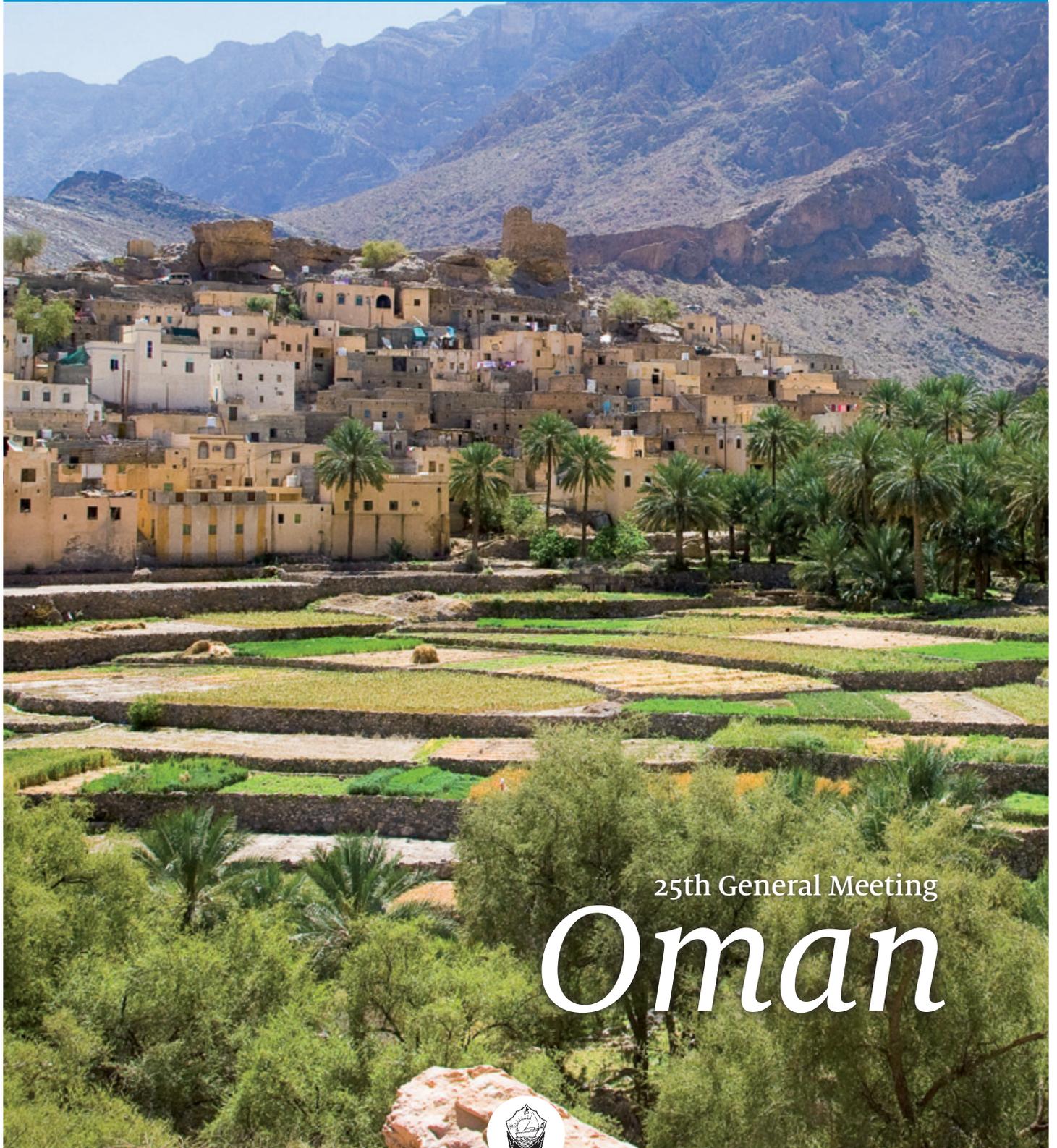


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25th General Meeting

*Oman*





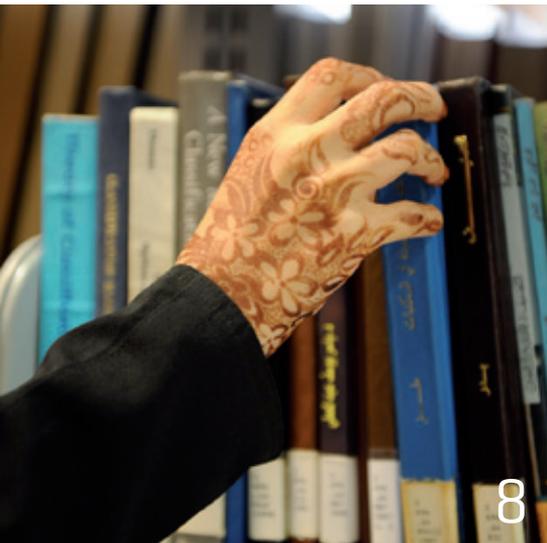
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▲ Participants in the ministerial session at the TWAS 25th General Meeting held in Muscat, Oman; the Sultanate of Oman is making bold investments in education. [Photo: Sultan Qaboos University]

**Cover picture:** The mountain village of Bilad Sayt in Oman [Photo: Andries Oudshoorn/ Wikimedia Commons]

▼ TWAS and India signed an agreement to cooperate in education and science diplomacy.



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EDITORIAL

# SCIENCE COMMUNICATION: A NEW ERA



▲ Edward W. Lempinen

**D**uring the busy days of the 25th TWAS General Meeting, away from the main stage and mostly out of sight, a large room served as a bustling hub for global science communication. In press conferences and interviews, journalists from Oman, China and the U.K. spoke with science leaders from around the world. Their discussions ranged across the spectrum, from new research and science policy to the cultural conditions required for science to thrive.

The energy and hard work among the large contingent of Omani science communicators were particularly inspiring. Newspaper, television and digital journalists all were there, along with media staff from the Ministry of Higher Education. With every interview and every story, they reinforced an overarching impression: Science, engineering and innovation are critical to the future in Oman and the Gulf region. Journalists everywhere could learn much from their interest in science.

But given the complex, interconnected global challenges of the 21st century, more and better science communication will be essential in the developing world, and in the developed world, too. Not just better science journalism, but more effective communication by researchers and their institutions, and by science policymakers and political leaders.

Without sustained commitment to science communication, policymakers and the public will lack a forum for learning about challenges and possible solutions. Understanding will suffer; consensus on complex challenges will be harder to reach. Progress, inevitably, will slow.

TWAS has long been a leader in communicating science and science policy to the developing world. But we recognize that the landscape is being reshaped by new technology and new strategic thinking, and we're evolving rapidly to keep pace.

We've redesigned the *TWAS Newsletter* to revitalize the content and create a lighter, more

contemporary look. In the future, we'll explore high-priority science issues, and we'll feature the expertise of our Fellows, Young Affiliates and partners.

More than ever before, we see digital communication as the driver of our strategy. In early 2014, we redesigned our website – [www.TWAS.org](http://www.TWAS.org) – to make it more powerful and user-friendly. We gave TWAS fellowships, research grants and other career opportunities greater visibility.

At about the same time, we made a stronger commitment to social media. In the past year, our Facebook community has more than tripled to over 4,580. Our Twitter followers have more than doubled to approach 1,400.

We helped to produce a documentary on TWAS in 2013, and with the support of the Chinese Academy of Sciences [CAS], we'll soon release a new promotional film on the five ambitious CAS-TWAS Centres of Excellence in Beijing. Further, we expect to publish an electronic bulletin in the months ahead.

The goal is to use all of these media to dramatically expand the audience for news about research, policy issues and opportunities of interest to TWAS's global community.

Technology is always changing, but human nature is fairly constant, and that means that word-of-mouth is still the king of effective communication. So, please, we're relying on you to talk to your colleagues, your students and friends. We want them – and all the world – to know about the good work that TWAS is doing to advance science and prosperity in the developing world.

**Edward W. Lempinen**, *Editor*

**TWAS NEWSLETTER**

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# IN THE NEWS

## A call for 10,000 new PhDs in Africa

A high-level forum hosted by the Senegalese government in collaboration with the World Bank recommended training 10,000 new PhD holders in applied sciences, engineering and technology in Africa in the next 10 years. The forum released a statement on the urgent need to develop skilled professionals to encourage innovation and create jobs. It describes a new partnership that will lead the skills-building agenda, including a regional scholarship programme.

### University World News:

<http://bit.ly/1oYrwbH>

## Historic pact for Cuba-US science

A group of US scientists and policy experts met with Cuban scientists in Havana, Cuba, and physicians across the city to further scientific collaboration between researchers in both countries. The three-day visit and ensuing discussions led to a landmark agreement. The pact was signed by the leaders of the Cuban Academy of Sciences and American Association for the Advancement of Science [AAAS]. It outlines a plan to advance scientific cooperation by Cuban and US scientists in key areas of interest to both countries, including emerging infectious diseases, brain disorders, cancer and antimicrobial drug resistance.

### AAAS:

<http://bit.ly/1g2RUwn>

## Foreign investors' land could feed 550 million

A study found that land grabbed by foreign governments and corporations in some of the world's hungriest countries could feed up to 550 million people. Since 2000, overseas investors have acquired 77 million acres of land to secure food supplies or increase production, a process known as

land grabbing. Almost half has been in Africa, especially Sudan. The crops grown on grabbed land are frequently exported, or used to produce biofuel. But the new study shows the crops could end malnourishment in those countries if used to feed local people.

### The Guardian:

<http://bit.ly/1lvfbNG>

## A global threat to rice

Nighttime heat has crossed a critical threshold, and a 35-year climate trend study shows the higher night temperatures may lower rice yields. Decreasing rice harvests mean higher prices, a scary scenario in Asia where rice is considered not only a basic food staple but also a political commodity. William Padolina, president of the Philippines' National Academy of Science and Technology, said rice with stronger tolerance to high temperatures needs to be developed.

### SciDevNet:

<http://bit.ly/1IDU88B>



## Major science park planned for UAE

A new science park dedicated to research and development will be built in Ajman, United Arab Emirates, at a cost of almost USD500 million. The Science Park will be able to accommodate 5,000 students and heralds a new era of research and education offered by Ajman University as a leading model for higher education in the region. The park will feature buildings with contemporary design and host various scientific fields for local and expatriate students alike.

### Gulf News:

<http://bit.ly/1EwHYZn>



# BAI: RAISING THE NEXT GENERATION

*Young researchers want opportunities to apply their creativity, idealism and skill to important challenges, President Bai Chunli said in his opening address at the 25th General Meeting in Oman. TWAS, he said, must work to support them.*

 by Bai Chunli

[The following is an abridged text of TWAS President Bai Chunli's address to TWAS members and Young Affiliates at the start of the 25th TWAS General Meeting in Oman.]

**E**steemed colleagues, dear friends, ladies and gentlemen, welcome to Muscat, in the Sultanate of Oman, and welcome to the start of the 25th TWAS General Meeting. It is an honour to share this morning with you, and I am very pleased to see all of you with us this year.

I want to give a special acknowledgement to some of our past and current leaders who are here with us today: the Academy's third president, C.N.R. Rao of India. The immediate past president, Jacob Palis of Brazil. Founding Executive Director and current Treasurer Mohamed H.A. Hassan of Sudan. Greetings also to our vice presidents and our Council members; Secretary General A.K. Sood; and Executive Director Romain Murenzi. And I would like to offer a very special welcome, and sincere thanks, to two TWAS Fellows who work in Oman and who have been instrumental in bringing this meeting together: Professors Salma Al-Kindy and Ibrahim Eltayeb, both of Sultan Qaboos University. And special thanks also to Arab Region Vice President Fayzah M.A. Al-Kharafi of Kuwait, who has played an indispensable role in organizing this meeting.

In the classic literature of China, one of the highest social values is to show respect

to elders. But it is also an important value to recognize the potential of young people, and to educate them. *The Analects* quote Confucius on this topic: "A youth is to be regarded with respect. How do we know that his future will not be equal to our present?"

Many other cultures hold similar values. The Arab world, I know, has a similar view: You honour the experience and wisdom of elders. And you respect the promise and potential of youth.

It seems to me that, in our time, similar values apply to the world's scientific enterprise. Certainly it is true for a global science academy like TWAS. TWAS founder Abdus Salam holds a position of the highest respect among our members. Our elected Fellows are typically elite senior scientists, with long careers and many impressive achievements. We regularly call upon their experience and insight to guide us.

Our relationship to young scientists is equally important. As a central part of our mission, we recognize our responsibility to nurture a new generation. Our support takes many forms, but we should recognize that young scientists want substantive opportunities to apply their creativity, their idealism – and their considerable skill – to address important challenges. This can help to advance scientific knowledge, and it can contribute to the well-being of communities everywhere.

► TWAS President Bai Chunli speaking on the opening day of the TWAS General Meeting.

**A DILIGENT SEARCH FOR EXCELLENCE**

In his 1979 Nobel Prize lecture, Salam offered a simple insight that has come to define his legacy: “Scientific thought is the common heritage of mankind”.

While it may be a common heritage, scientific capacity is distributed very unevenly in our world. Therefore, if we want to nurture a new generation of scientists and engineers, we must search more diligently to find scientific excellence. Last year, I talked to you about two crucial goals for the Academy: To increase membership in countries where we have few or no members, and to increase the number of women among our members. I am pleased to



“ Emerging nations, or emerging economies, are taking positions of science leadership for the developing world. ” Bai Chunli

report that we have pursued these goals with positive initial results.

This year we have a total of 178 candidates nominated for election into TWAS membership. Of these candidates, 33 are women; 67 are nationals of 36 countries that have five or fewer members of TWAS. Among these countries are

Algeria, Guatemala, Kyrgyzstan, Myanmar, Oman and its neighbour, Yemen and Tanzania.

I believe these numbers represent progress. Much work has gone into finding these candidates, and this is the scale of effort that we need every year.

**LEADERSHIP FROM EMERGING NATIONS**

Despite all of our talent and experience, we cannot achieve these goals by ourselves.

If you take a look around this beautiful conference centre, you will see that our colleagues from Oman have invested a great amount of energy and resources in this meeting. They are committed to science, and they have shown a very generous commitment to our Academy. In years to come, we expect this relationship will grow and prosper.

We know well, of course, the importance of our friends. From the Academy’s earliest days, the government of Italy has provided core funding for our programmes. The International Centre for Theoretical Physics, too, has been an essential partner from start. UNESCO has brought vast experience to help guide us and a solid administrative framework to support us.

Today, new partners are emerging. Lenovo, the world’s largest personal computer company, is providing highly valuable support by sponsoring the TWAS-Lenovo Science Prize and by pledging support for our Young Affiliates. At the same time, many long-time partners are increasing their support for TWAS. India, South Africa and Brazil in recent months have made new investments in our work. That followed new pledges earlier from Argentina, Kuwait, Malaysia, Mexico, Pakistan and Sweden, and my own country, China.

We’re seeing a significant trend: Emerging nations, or emerging economies, are taking positions of science leadership for the developing world. They have learned lessons about building scientific strength in their own countries, and now they are sharing their experience with other developing nations, especially the Least Developed Countries. This is a very promising trend, and it is a gratifying expression of solidarity with TWAS and our shared mission.

Thank you very much. ■

See the full text of President Bai Chunli’s address at [www.twas.org/node/8475](http://www.twas.org/node/8475)



# A HIGH-LEVEL PLEDGE TO WOMEN, YOUTH

*The developing world must mount bold efforts to prepare a new generation of scientists – especially women – to address the historic challenges confronting humanity.*

 by Edward W. Lempinen

High-level science leaders from across the developing world urged a deeper commitment to educating and training young researchers and women researchers to drive economic development and address global challenges.

At the opening day of the 25th TWAS General Meeting in Oman, the leaders described efforts in their countries to raise a new generation of innovators, from mentoring and science academies to overseas training, and even anti-poverty programmes to support the strong development of young children.

TWAS President Bai Chunli sounded the theme in his opening address to TWAS members and in an address to more than 500 dignitaries, high-ranking policymakers and global science leaders at the opening ceremony.

"We recognize our responsibility to nurture a new generation," Bai said. "We should take a leadership role in helping educational and scientific institutions learn how to support women and bring out their best scientific talents. Leadership also requires that we elect more women as members of TWAS."

Throughout the four-day meeting, leaders agreed that a broader corps of global researchers would be essential for addressing climate change, disease, even recovery from civil conflict.

Biologist Roula Abdel-Massih, a TWAS

Young Affiliate and associate professor of the University of Balamand in Lebanon, shared that message on Oman TV's English News Bulletin. "If you look at the challenge or the battle against hunger, the challenge against poverty, and even the new battle against terrorism, all this, the solution is in educating the youth in science and technology and allowing them ... to create new solutions," she said.

## ADVANCING WOMEN IS 'IMPERATIVE'

TWAS and its global partners won praise for their PhD programmes, research grants and other measures for young scientists, and for supporting the Organization for Women in Science for the Developing World [OWSD]. "TWAS since its founding in 1983 ... has ensured a strong and active support to young scientists from developing and emerging countries," said diplomat Ugo Ferrero from the Italian Ministry of Foreign Affairs.

But there was a view that TWAS could do more, especially for women. At the meeting, TWAS elected 46 new Fellows, 10 of them women. Of 1,148 members, only 119 – 10.4% – are women.

The low numbers of women in TWAS's membership and leadership show "there is still quite some way to go," said Hannah Akuffo, acting head of the research cooperation unit at the Swedish International Development Cooperation Agency [Sida].



▲ From top: Roula Abdel-Massih, a biologist and TWAS Young Affiliate; Hannah Akuffo, Swedish International Development Cooperation Agency [Sida]

To learn more:  
[www.twas.org/node/8641](http://www.twas.org/node/8641)



▲ Students in a laboratory at Sultan Qaboos University in Oman (Photo: Sultan Qaboos University)

“Gender equality is ... a development imperative and a business imperative,” said Anna Paolini, director of the UNESCO Doha Office and its representative in the Arab States of the Gulf and Yemen. “The stakes are high even globally, and so are the challenges, with women representing only 30% of researchers at the global level.”

#### DIFFERENT COUNTRIES, A COMMON VISION

At the annual TWAS meeting of science ministers and high-level policymakers, leaders described how their nations are making far-reaching investments in education to build science and engineering talent.

Oman has built its education system from the ground up since 1970, said Oman Research Council Secretary-General Hilal bin Ali Al Hinai. In 2013, it invested about 13% of its budget, or 4.6% of GDP, in education. Oman provides grants and prizes for undergraduate research and graduate-level student research, he added,

drawing them into the culture of competitive science.

In Azerbaijan, improving education is “the highest priority of state policy”, said Ali M. Abbasov, minister of Communications and High Technologies. The government is investing in infrastructure and offering grants and scholarships, he said. At state expense, more than 5,000 young Azeris are enrolled in European and US universities for undergraduate and graduate studies.

South Africa offers competitions and expos to inspire scientific interest in young people, said Zanele kaMagwaza-Msibi, deputy minister of Science and Technology. Last year, she said, South Africa funded nearly 10,000 postgraduate students; doctoral graduates are up to 1,700, from 1,200 five years ago.

Brazilian investments have focused on childhood poverty and school attendance, said Glaucius Oliva, president of the National Council for Scientific and Technological Development [CNPq]. Through new university facilities and financial support, enrolment in higher education rose from 2 million in 2000 to 7.2 million in 2013. Brazil’s “Science without Borders” initiative has won global acclaim for sending 100,000 young scientists abroad for study and research.

Gender equality is ... a development imperative and a business imperative. ▢

*Anna Paolini*

In developing nations with large youth populations, cultivating their talent is essential, said Egyptian Minister of Agriculture and Land Reclamation Adel E.T. El-Beltagy, a member of the TWAS Council.

“Either they will be a liability for the country, or they will be potential for the future to build on,” he said. “The only ticket for you is to give these young people knowledge and knowledge and knowledge, and then they can work with the world to form this global alliance for peace and prosperity.” ▣

▼ From left: Anna Paolini, director of the UNESCO Doha Office and its representative in the Arab States of the Gulf and Yemen; Ali M. Abbasov, minister of Communications and High Technologies, Azerbaijan; Zanele kaMagwaza-Msibi, deputy minister of Science and Technology, South Africa





SCIENCE IN OMAN

# ADVANCING SCIENCE, ADVANCING PROSPERITY

The inside of a dome  
in Matrah in Muscat, Oman  
[Photo: Andrew Moore/flickr]



*Since 1970, the Gulf nation has been using its natural resources to promote research and develop new technologies that will, in turn, improve the lives of its people.*

 by Sean Treacy and Edward W. Lempinen

The presence of vast oil reserves beneath the deserts of Oman has given the nation extraordinary wealth. But oil has also brought a series of challenges and difficult decisions: If Omanis lacked education and basic health care, then oil wealth, by itself, was not enough. And if oil supplies were limited and production was dropping? Then something had to change.

Over a span of decades, Oman has turned these difficult tests into transformation. Today, it is evolving from a conventional oil state into a stage for innovation. Its health system is among the world's best. Its education system is growing robustly – and many of the science and engineering students are women. Investments in science are creating a new future for Oman in which oil remains important, but research across diverse fields creates new opportunities.

Salma Al-Kindy, a chemist and Oman's first female TWAS Fellow, is at the vanguard of Oman's emerging science culture, with her research focused on health and environmental protection.

"The interesting thing about science in Oman is the ... willingness to channel the scientific research output in different directions," Al-Kindy said in a recent interview. "Multidisciplinary, science-based activities such as nanotechnology and materials science, especially those used in green energy and in the construction and oil industries, are getting started."

At the 25th TWAS General Meeting in Muscat, Al-Kindy and the large contingent of Omani scientists, policymakers and students made clear that the nation is committed to taking a strong role in the Gulf region and in the international science community.

The meeting was held from 26 to 29 October 2014 outside the nation's capital in Muscat, hosted and co-organized by three leading Omani science and education institutions: the Ministry of Higher Education, The Research Council and Sultan Qaboos University. The meeting attracted more than 500 scientists, educators and policymakers – many of them Omani – on the opening day. Its agenda explored major scientific achievements ranging from life-saving HIV-prevention strategies to advances that are shaping global policies important to ocean health.

Those who came to the meeting found a nation where science and technology have generated remarkable momentum in recent decades. Sultan Qaboos University, the nation's premier university, is among the top institutions of higher education in the region. Computers with Internet connections are available to more Omanis than ever, as the nation's development boom has touched even the most remote parts of the country.

And it all began, naturally, with oil.

#### **A SOURCE OF ECONOMIC ENERGY**

Oil production is inseparable from Oman's progress thus far. According to the US Energy Information Administration, Oman's crude oil production continually surged until 2000. But then, it began to sink as accessible reserves ran low.

This was an alarming threat to Oman's development efforts, and it provoked a strong move toward innovation. Oman has since emerged as a global leader in using enhanced oil recovery techniques, which inject water, chemicals or gases into an oil well to change the composition of the oil, making it easier to



extract. One such method Oman has adopted is using steam, said Saif Abdullah Al Hiddabi, assistant secretary general of Research & Scientific Programmes for the The Research Council of Oman.

“We have the laboratory, which is the big fields in Oman,” said Al Hiddabi. “So we feel ourselves as unique in that sense and we have some strength, because there is already a significant amount of money being invested by the oil companies in this area.”

These new methods allowed Oman’s oil production to resume its upward trend, beginning in 2007. And in Hiddabi’s view, those improvements in oil technology have a direct bearing on Omani lives: an infrastructure boom, a strong health system and the spread of information technology.

#### A HUMBLE PAST, AN IMPRESSIVE PRESENT

All of Oman’s progress in the last 45 years has been through the work of Sultan Qaboos’s government, said Omani Research Council Secretary-General Hilal bin Ali Al Hinai during the ministerial session on the first day of the General Meeting. Under Qaboos’s leadership, Oman established a policy of aggressively competing to present opportunities for young scientists in Oman.

“The first five-year plan started in 1976, and in 1996 started the first long-term development plan, Vision 2020,” Al Hinai said. “And in that there is significant progress on the development of human resources and through education.”

These plans have already transformed Oman dramatically, said Al Hinai. For example, Oman went from having only three elementary schools and 10 kilometres of asphalted roads in 1970 to over 1,500 schools and more than 31,000 kilometres of paved roads today.

Healthcare is also of paramount importance to Oman’s current government. In 1970 the Sultanate had two missionary hospitals. Now it has 65 large hospitals and more than 1,000 clinics that provide free health care to all of its citizens. [To learn more about the dramatic advances in Oman’s healthcare, see page 16.]

Today, Oman’s Vision 2020 plan is the roadmap for its economic future. It details the

nation’s plans to achieve economic stability, a diversified economy, a stronger private sector and other goals by 2020. Oman commissioned a study on renewable energy sources in 2008, highlighting wind and solar power as the best options. The country aims to produce 10% of its total electricity from renewable energy sources by 2020.

Meanwhile, Oman has excelled at modern communication technology. It boasts the second highest wireless-broadband subscription penetration in the region, behind only Qatar, according to a 2013 report by the International Telecommunication Union. The Omani government has done much to bring the information age to rural populations through a 2002 digital strategy called “e-Oman”. In 2013, 80.1% of Omani households had Internet access.

As its people become more accustomed to modern-day conveniences, Oman will need more energy. And to grow its energy sources, it will need scientists, engineers and other skilled professionals to bring innovative ideas to fruition.



▲ Petrochemical tanks in Sohar, Oman (octal/Wikimedia Commons)

▼ Sultan Qaboos bin Said al Said of Oman





“ We have the laboratory, which is the big fields in Oman. ” Saif Abdullah Al Hiddabi

#### AN INVESTMENT IN OMANI BRAINS

In Al Hiddabi's view, that raises the next great challenge for Oman: building a corps of local researchers so that scientific progress can sustain itself. To achieve this goal, Oman is investing heavily in education and making a strong commitment to bringing women into science and engineering.

Historically, Oman has drawn expertise from other countries to train local scientists who can then take up the mantle as generations pass. He said hosting the TWAS General Meeting in Oman reflected another way the country is trying to shape its own scientific future.



► From left: Minister of Higher Education Rawya Al-Busaidi; Hilal bin Ali Al Hinai; Salma Al-Kindy; and Saif Abdullah Al Hiddabi

“This conference is really to promote the research and innovation awareness among researchers, and create incentives and mobilize along that direction,” he said. “But certainly the critical mass – the capacity building issue – is we don't have enough researchers. This probably will take time.”

Drawing on outside resources is just part of the challenge. The Sultan's government poured about 13% of its 2013 budget, or 4.6% of its gross domestic product (GDP), into education. About 0.5% of GDP has been spent specifically on research and development.

Additionally, all private higher education institutions in Oman have to work with leading international universities that help with projects like curriculum development, Oman Minister of Higher Education Rawya Al-Busaidi said in a 2013 interview with the Oxford Business Group.

Al-Busaidi was a crucial supporter of TWAS's meeting in Oman. In 2004, she was the first Omani woman appointed to a government ministerial position, and she has had a key role in the nation's commitment to science and technology. In 2014, *Forbes* magazine named her the second most powerful Arab woman in government for her improvements to Omani education.

Oman has also taken great strides in including women in the new age of high-level education. Before 1970, practically no women attended schools in Oman, but Qaboos changed that with his universal education policy. By 2004, about 48.4% of students in all public schools were female, as were 56% of the teaching staff, a UNESCO report found. Today, about half of the students at Sultan Qaboos University are women, many of them budding scientists.



Much of the scientific achievement on display at the General Meeting focused on work done by women, or important to their lives. Indeed, women’s achievements have become part of the Omani culture, and since 2009 the country has celebrated Women’s Day every 17 October.

But Al-Busaidi says there is still work to be done. The country needs more competitive faculty pay. “Historically, Oman has offered lower salaries and fewer benefits, relying on more attractive lifestyle factors,” she said in the interview. “Recruiting quality faculty necessitates superior research facilities and a critical mass of other high-standard faculty.”

### A FUTURE OF SUSTAINABLE ENERGY

Just as energy has defined Oman’s character and created its wealth, energy creates important challenges for the future.

Demand for power has grown so rapidly that the country has suffered from severe power outages, according to a report from Norton Rose Fulbright, a global legal practice that specializes in advising industries on sectors such as energy.

“Currently one-third of Oman’s current energy needs are met by oil, and as its oil reserves are predicted to have a remaining lifespan of only 40 years,” says the report, “the government is faced with the question of what will replace this source of energy when it runs out.”

But Oman has shown keen awareness of these challenges. According to Norton Rose, with the right policy, solar and wind



▲ Omani scientists at Sultan Qaboos University [Photo: Sultan Qaboos University]

power have great potential in the nation. This energy-consciousness has also led to Oman’s emergence as a centre of environmental science. Oman’s Ministry for Environment and Climate Affairs is the only such government ministry in the Arab region.

“At the school level, there’s excitement that there’s a focus on research and innovation.” **Hilal bin Ali Al Hinai**

Oman’s fast-growing education system appears ready for the task. Al Hinai said there’s a growing focus within the system on environmentally friendly technology. He cited work being done on developing carbon-capture technology – methods for trapping carbon dioxide emissions before they’re released into the atmosphere – a competition for students to design and build environmentally friendly houses.

“And it is creating excitement. Excitement among the students. Excitement among those who want to see the state-of-the-art in terms of energy efficiency,” said Al Hinai. “At the school level, there’s excitement that there’s a focus on research and innovation – and we’re trying to expand on that.”

◀ Children in Wadi Bani Awf, Oman [Photo: Mark Hills/Wikimedia Commons]

## Q&amp;A

ABDALLAH DAAR'S  
LONG-TERM  
COMMITMENT

by Cristina Serra

*As a researcher, teacher and policy adviser, the Omani TWAS fellow has a prescription for scientific success: Make a long-term commitment. Connect research to social values. And don't be afraid to fail.*

TWAS Fellow Abdallah Daar is linked by history and professional ties to the Sultanate of Oman, and he sees positive developments in the Gulf nation's scientific culture: The creation of its Research Council, its commitment to health and communication technology, and its increasing focus on the value of science. But now, he said, Oman must press ahead with efforts to make its research enterprise more focused and sustained for the long-term.

"Great applied research has to produce results that make a difference in a place or community," Daar said during a recent interview. "In other words, it has to be translated into a product, policy or intervention, and these have to be scaled up so that more people in the world can benefit."

His counsel is valuable for many nations in the developing world. During a candid discussion with Omani science communicators at the TWAS 25th General Meeting, Daar's remarks ranged widely, from developing research goals and the potential benefits of brain-drain to the importance – and necessity – of failure.

Abdallah Salim Daar was born in Tanzania and lives in Canada, but he has close ties to Oman. He was the founding chairman of the department of surgery at Sultan Qaboos University, where he helped build the medical school. He worked in Oman for more than a decade. His research at the University of Toronto and affiliated research institutions has focused on how genomics and biotechnology help reduce inequities between developed and developing nations. Today he is a professor of clinical public health and global health at the Dalla Lana School of Public Health and of Surgery in the Faculty of Medicine at the University of Toronto, Canada; he also serves as a member of the elite United Nations Secretary-General's Scientific Advisory Board. He has been a TWAS Fellow since 2007.

He has worked closely with TWAS Fellow Peter Singer at Grand Challenges Canada, where until recently he served as a member of the Board of Directors and chief science and ethics officer; he still serves as chair of the scientific advisory board. Given his accomplishments

and global experience, he has a clear vision of scientific research – especially when it is carried out in developing countries. Focusing on local needs is a priority, he says, and critical thinking is equally important and must be stimulated.

The following is text of Daar's interview, edited and condensed by TWAS staff writer Cristina Serra.

#### **Oman is a young nation where science is gaining momentum. What are basic requirements that qualify good research?**

- In order to benefit humankind, top-quality research must be conducted with a view to producing results that make a difference, i.e. have a positive impact, in a place or community. In other words, it has to be translated into a product, policy or an intervention, and these need to be scaled up so that more people in the world can benefit. Ideally it should be published in high-level publications. If scientists do not publish their results, that research may not be noticed and will fail to have an impact. That process leading from the initial idea to its global impact is a long road, as you can imagine. But it is important to pursue.

We mustn't forget that basic scientific research and the generation of knowledge for its own sake is also important. The humanities and social sciences also are important.



**Living in a Western country puts you in a privileged position to observe science in developed and developing countries. Have you seen any major difference between research in the West and in the Arab region?**

● Yes. The first difference lies in the approach to research in Western institutions that I am familiar with. There is much more focus in the choices made within research programmes: Research is carried out within well-defined programmes, which are at the same time open to new ideas and approaches. In this part of the world I have noticed, and you can see this in the lists for publications from university departments, that research is often not carried out in a programmatic way, but rather in an opportunistic way. Also I have observed that researchers often act without long-term strategic planning. Jumping from one isolated project to another is counterproductive.

The second difference lies in the identification of these strategic research priorities. Great research like that produced in the best Western universities can be achieved everywhere, providing that we identify priorities at different levels: national, local, as well as at university and department levels. Recruit the best scientists, build teams that include graduate students, and fund these teams well for the long term, sustaining the focus. Students and young scientists need to be trained well, and exposed, even abroad, to the best research institutions. The focus must be on excellence. All these sound idealistic but they should be long-term objectives.

**Could you offer some examples related to Oman?**

● There are two interesting examples I can think of now. Oman has some of

the best geological resources in the world, and if someone wants to study geology, Oman is probably the best place to do it. But I don't see this happening on a grand scale, in a focused, systematic way, by Omanis themselves. Is Oman making good use of its geological resources? The answer is probably no, not at the moment.

Secondly, Oman has very close connections with East Africa and Zanzibar, linked by the Indian Ocean. It would be great to see Indian Ocean studies as a long term strategic focus. Cultural interactions between Arabs and East Africans date back to the 10th century and earlier. In this case, social sciences, linguistic studies and historical and economic and trade studies would enrich humanity.

There is good news: Oman has established The Research Council, which is relatively young but very active. And one of its best features is that it is eventually helping to fund research in a programmatic way rather than in an opportunistic way.

**You have done important work in Oman, but now your activities have a more global focus. Did you ever think to launch a national project in this country?**

● Should I bring my research here? There is a possibility. I have talked to scientists in the Gulf region and with my colleague Peter Singer we have proposed establishing a Grand Challenges Gulf – forming partnerships, finding priorities, rewarding excellence and achieving rapid results that have an impact. We now have Grand Challenges initiatives in several countries including Brazil, India and others that are informed by the experience of Grand Challenges Canada.

One area where Oman might take the lead would be doing research

on the Middle East Respiratory Syndrome (MERS) that affects camels and makes people very sick. It could also work on increasing its preparedness for major outbreaks like Ebola.

I think we should also mention the importance of making mistakes.

“ Many researchers in this part of the world are not used to failure ... To innovate successfully, you have to accept some failures. ” *Abdallah Daar*



### What do you mean by “make mistakes”?

● I want to suggest that many researchers in this part of the world are not used to failure. They do not accept it and the culture looks at failure as a terrible thing. Yet to innovate successfully, you have to accept some failures. So we need to inculcate this notion at least among research scientists and innovators. And we should perhaps teach how to fail, in order to succeed.

### What are your views on brain drain?

● What I see is that Oman is a lucky nation: most of the students that my colleagues and I taught here are still here, and many are in senior positions

now. Most of them have not left. This is due in part to the beautiful Omani culture that attracts them back, but also to the fact that in recent times salaries have been increased, so brain drain doesn't really affect this country at present. The people of Oman are the friendliest people I know.

However, if we talk generally about the subject of brain drain globally, I also see some positive aspects. These include the idea of brain recirculation, remittances from workers who have emigrated, sometimes against their will, the building of professional and research networks, and experience in finance, management, etc. Minds open with travel and prolonged interaction with others. People become flexible: after they have settled abroad they may wish to contribute to the source

countries and may come back for short periods to teach and do collaborative research. So rather than condemning brain drain completely, it is more important to think about the subject in a nuanced way, for example by focusing on how we can best make use of the people that have left. There are creative ways to think of brain drain, not always negative.

### What advice would you give to young Omani scientists who want to carry out good research?

● My advice works for all scientists: if you have gone the way of doing a PhD, which really should be about training the mind to think critically, you should be adventurous and not necessarily stick to the very narrow area of your former research. Initially learn a method for doing research, rather than aim to become a world expert on your narrow subject right at the beginning of your scientific career. Be open to new ideas. Find a good mentor early. Fight people who try to close your mind, because the universities are full of them. Do not think in terms of money as a young scientist. Always think critically and open-mindedly. Be incredibly curious. This is largely what research is about.

But let me give some other advice. What young Omanis should do is learn to listen. And to address problems without preformed “ideology”. Listening is one of the most difficult things to learn and do in life. But also learn how to talk to each other respectfully, as we are taught in the Quran. Don't assume that a person with a different opinion is your enemy. This is a very hard lesson to learn. ◻

◀ Abdallah Daar in Muscat (right), during an interview with Omani journalists Sultan Al Sara'ei (left), from Omani Television, and a colleague from Sultan Qaboos University





# A FAST TRACK TO BETTER CARE

*In four decades, Omani medical care went from terminally ill to the picture of health. How? A focus on primary care and attracting doctors from other developing nations.*

 by Sean Treacy

Half a century ago, the state of health care in Oman would have impressed few.

In 1958, the entire nation only had two hospitals and 13 physicians. One out of every five children died before turning 5, and one out of every three citizens had experienced at least one bout of malaria. In 1970, the year Sultan Qaboos bin Said Al Said came to power, life expectancy was only 49.3 years.

And then, in the decades that followed, health care in Oman was reconceived and rebuilt, largely financed through the nation's oil and gas revenues. By 2008, the country had 58 hospitals and over 5,000 physicians. About 99% of children live to be at least 5 years old. Life expectancy is now over 76 years. And malaria? Nearly eradicated, as disease rates have broadly plunged.

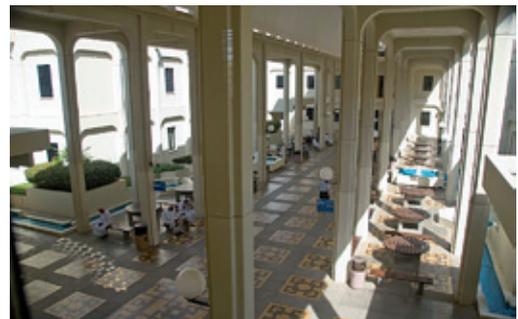
► The atrium of the Sultan Qaboos University Hospital

▼ The bell tower on the campus of Sultan Qaboos University [Photos: Sultan Qaboos University]



In 2000, the World Health Organization ranked Oman's health care system the eighth best in the world. The same report ranked Oman as the top system in the world for cost-effectiveness. Oman reached another milestone that stands out 21 years ago, hosting a kidney transplant for a 17-month-old child. It was the youngest kidney transplant in world history, and the recipient is still alive and well today.

"For a country of its relative level of development, Oman has a very good health system," said the transplant surgeon, TWAS Fellow Abdallah Daar. Born in Tanzania, Daar spent about 10 years in Oman, founding the surgery department at Sultan Qaboos University, the nation's premier university. "The medical school in Oman is probably one of the best in the Gulf, if not the best."



In fact, health care is an essential priority in modern-day Oman, said the Omani Minister of Health, Ahmed Mohammed Obaid Al Saidi, in an interview with TWAS. "Health is not only related to well-being but also peace and security," he said. "If people are not provided with health care, they have all these other problems."

For this enormous change, medical experts in Oman credit two major factors: the strength of its basic health services and a big push to attract expertise from outside Oman's borders to build its health system.

## THE POWER OF BASIC CARE

In 1970, Sultan Qaboos began a health care push with a strong focus on free, universal primary care, said Al Saidi. He called primary care the “backbone” of the health care system. More than 95% of the public is now within five kilometres of a health centre where they can get basic care – even in many remote regions, which are served by mobile clinics. Primary care is essential for emergencies and disease prevention, Al Saidi said, and spills into other issues that concern people, such as the economy.

With primary care so strong, life-spans are growing, presenting the country with a new challenge. Oman is currently focusing on growing its corps of health workers to include more specialists to deal with chronic diseases.

“Primary health care drives day-to-day needs, but now chronic diseases have taken over,” Al Saidi said. “The older you are, the more specialist care you require.”

Sudanese TWAS Fellow Riad Bayoumi, head of clinical biochemistry at the Sultan Qaboos University College of Medicine, said the primary health care expansion is special in another way: it has helped support research in the Gulf nation by collecting data on the health status of the populace.

“They screen for obesity. They screen for diabetes. Health systems research is very active and very well-endowed with funds,” Bayoumi said. “In many other countries, there is no real research within the service.”

## EXPERTISE UNIQUE TO THE DEVELOPING WORLD

Another important driver behind the transformation was the presence of foreign health expertise. In the 1970s, the country drew doctors and nurses from other countries, mostly from other developing countries, said public health expert Moeness Moustafa Alshishtawy of Tanta University, Egypt, in an email interview.

Alshishtawy, a former consultant at the Oman Ministry of Health, said Oman attracted physicians, dentists and pharmacists from India, Egypt, Pakistan, Philippines, Sudan and



▲ From top: Ahmed Mohammed Obaid Al Saidi; Abdallah Daar; Moeness Moustafa Alshishtawy; and Riad Bayoumi

For a deeper look at health care in Oman, visit: [www.twas.org/node/8469](http://www.twas.org/node/8469)

“Health is not only related to well-being but also peace and security.”

Ahmed Mohammed Obaid Al Saidi

Iraq. Most nurses came from India and the Philippines, with noteworthy numbers also from Bangladesh and Sri Lanka.

These doctors and nurses had something important: experience with diseases common to countries at an early developmental stage. “The major health problems prevailing in Oman at that time were trachoma, malaria, diarrhea, malnutrition, measles and other infectious diseases, especially those of childhood,” Alshishtawy said. “These problems required experienced practitioners from developing countries who are able to communicate with the local people.”

## THINKING FOR THE FUTURE

In the meantime, the nation is building its ability to address chronic diseases and expand the nation’s private health sector, including building a “medical city” which will house all the medical subspecialties under one roof. “We need liver transplants and more bone marrow transplant service in the country,” said Al Saidi. Oman is also working to expand its percentage of homegrown doctors and nurses. Al Saidi calls it “Omanization”.

But for the moment, Daar said that Oman’s successes can serve as a model for other countries, including the nation’s focus on general wellness as opposed to just treating illness.

“Things like happiness, resilience, wellness, functioning – you don’t normally see people talk about that, and they are actually much more important for a national health care system,” he explained. “They are really important ways to think about health care in the future.”



▲ TWAS President Bai Chunli and Omani Minister of Higher Education Rawya Al Busaidi converse during the opening ceremony.

▼ Azerbaijani Minister of Communications and High Technologies Ali M. Abbasov, left, talks with an Omani journalist.

▲ The 2014 TWAS Medallists, all of them TWAS Fellows, from left: environmental scientist Jane Lubchenco, former undersecretary of commerce and administrator of the US National Oceanic and Atmospheric Administration; analytical chemist Salma

Muhammed Zahran Al-Kindy, a professor at Sultan Qaboos University in Muscat; and geneticist Chen Sai-Juan, executive director and researcher at Shanghai Institute of Hematology at Shanghai Jiao Tong University in China.



► From left: Elisa Quevedo, wife of Fernando Quevedo, the director of the Abdus Salam International Centre for Theoretical Physics;

TWAS Executive Director Romain Murenzi; Immacolata Pannone of the Italian Ministry of Foreign Affairs.



◀ An Omani journalist, left, interviews TWAS Treasurer and former Executive Director Mohamed H.A. Hassan.

▼ TWAS's Young Affiliates gather to display their certificates from TWAS. [Photo: Oman Ministry of Higher Education]

For more photos from the meeting, see TWAS's Flickr page: [www.bit.ly/1y4G067](http://www.bit.ly/1y4G067)





# INDIA, TWAS STRIKE MAJOR ACCORD

*The five-year agreement marks a new commitment in the historic partnership between the Academy and India, a nation that has long been a leader in science and technology.*

 by Edward W. Lempinen

India's Department of Science and Technology and TWAS will embark on an ambitious five-year programme of cooperative efforts in PhD education, postdoctoral training and science diplomacy under an agreement signed in Oman.

The Department [DST] and TWAS will launch an initiative of science diplomacy training and events both in India and in Trieste, Italy, where TWAS is based. In addition, the agreement provides for DST and TWAS to work together on a Pan-Africa Doctoral Fellowship programme for about 100 fellowships over five years. TWAS would also help to place early-career Indian scientists in fellowships at leading research centres in the developing world.

DST will provide TWAS with support totalling USD1 million, or USD200,000 per year from 2015 through 2019.

"We regard this as a very important initiative, an investment in the future, and we look forward to a very productive partnership," said Sadhana Relia, head of DST International Multilateral and Regional Cooperation [Division I]. "India continues its journey of increasing its share in the pie of TWAS scientific affairs devoted to the cause of the developing world."

"India and TWAS have had a long, historic partnership that has produced great benefits for science and the developing world," said TWAS Executive Director Romain Murenzi. "We are honoured to be part of this agreement with

our Indian colleagues, and I am confident that this new agreement will yield very valuable dividends."

The "programme of cooperation" agreement was signed on 26 October 2014 at a brief ceremony during the 25th TWAS General Meeting in Muscat, Sultanate of Oman. The programme will be known as Partnerships for Inspiring and Empowering Next-Generation Scientific Talent [PIE-NGST]. The agreement was signed by Murenzi and DST Secretary Krishnaswamy VijayRaghavan.

The Department of Science and Technology is within the Indian Ministry of Science and Technology. Among other initiatives, it funds scientific research and international science engagement by Indian researchers.

According to the agreement, the new partnership will help both sides pursue their common values: "building scientific capacity



▲ TWAS Executive Director Romain Murenzi (front left) and Secretary of the Indian Department of Biotechnology Krishnaswamy VijayRaghavan exchange signed agreements. Behind them, from left: TWAS Secretary-General A.K. Sood; former TWAS President C.N.R. Rao; TWAS President Bai Chunli

◀ Murenzi, left, and VijayRaghavan signed an agreement to cooperate in education and science diplomacy.



“We regard this as a very important initiative, an investment in the future, and we look forward to a very productive partnership.” *Sadhana Relia*

and excellence for strengthening collective self-reliance in science, resolving critical issues in pursuit of scientific research and catalysing socio-economic development among developing countries.”

The partnership between TWAS and India dates back to TWAS’s founding in 1983. Of 42 Founding Fellows, 12 were Indian – making India the single biggest national contingent among the Founding Fellows who worked with Pakistani Nobel laureate Abdus Salam to establish the Academy.

Over the years, the partners have shared a common vision of building healthier and more prosperous societies in the South through science and technology. Today, TWAS works in partnership with Indian research centres to offer a range of PhD and postdoctoral research fellowships to early-career scientists from the developing world. India also has made significant contributions to the TWAS endowment fund.

The new DST-TWAS “programme of cooperation” establishes initiatives in science diplomacy and research training, areas of special interest for both partners.

**Science diplomacy:** Under partnerships with the American Association for the Advancement of Science and the Swedish International Development Cooperation Agency, TWAS is emerging as a hub for science diplomacy training for the developing world.

Now India will send up to 10 participants to science diplomacy courses organized by TWAS in Trieste, Italy. TWAS and DST will also cooperate on regional programmes on science diplomacy in India for about 30 participants from developing countries.

**Science training for Africa:** The agreement provides for TWAS and DST to join in a “Pan-Africa Doctoral Fellowship” for about 100 fellowships over five years for early-career African scientists, with funding from DST.

**Science capacity-building for India:** TWAS and DST will support a range of activities focused on India and South Asia: regional scientific meetings; a high-level lecture series to engage the public in emerging science issues; and expanding the network of TWAS-affiliated centres of scientific excellence, especially in South and Central Asia.

In addition, TWAS would facilitate the placement of about 200 fellows from DST’s talent-building INSPIRE programme – 100 postgraduates, 75 PhD scholars and 25 postdocs – at world-class research institutions across developing countries to enhance their international experience. ■

To learn more:  
[www.twas.org/node/8482](http://www.twas.org/node/8482)



# AIDS WORK WINS TWAS-LENOVO PRIZE

*Quarraisha Abdool Karim of South Africa is a pioneer of high-impact research that protects African women from HIV/AIDS and tuberculosis. Her work is already saving lives, and it could save millions more.*

 by Sean Treacy

South African epidemiologist Quarraisha Abdool Karim's work on strategies against HIV is already saving lives, and she has led research on a preventative strategy that could save millions more. Now, her extraordinary achievements have been recognized with this year's TWAS-Lenovo Science Prize.

Abdool Karim's discoveries have shaped life-saving clinical guidelines for patients infected with a combination of HIV and tuberculosis in countries across the world. It has also found the potential basis for an HIV vaccine. But her most celebrated work is for a finding that could save millions of lives: a study demonstrating the effectiveness of tenofovir gel, a substance that women can use to protect themselves from HIV infection with no cooperation necessary from men.

Abdool Karim said she is humbled by the award. "South Africa is an important and key population in terms of AIDS research," she said. "With our contributions to this field, I think it adds an advantage to have this kind of acclamation. I feel very privileged and honoured to be the recipient of this award."

The annual prize is one of the most prestigious honour given to scientists in the developing world, and includes an award of USD100,000 provided by Lenovo, the global leader in consumer, commercial, and enterprise technology that is the largest PC company in the world. It was announced in a special

ceremony during the yearly General Meeting of TWAS in Muscat, Oman.

"We have great admiration and respect for the work of Dr. Abdool Karim," said TWAS President Bai Chunli. "She has an exemplary record of high-impact science, and there is a deep humanity to her work. Just as important, she has helped to train hundreds of young African scientists who are expanding the research into HIV and tuberculosis. She really is a model scientist, and a tremendous inspiration to colleagues across the world."

"Innovation is how Lenovo achieves competitive differentiation and drives new



◀ South African epidemiologist and TWAS-Lenovo Prize winner Quarraisha Abdool Karim

▼ Quarraisha Abdool Karim, centre, receives the TWAS-Lenovo Science Prize from Lenovo Senior Vice President George He, left, and TWAS President Bai Chunli, right. [Photo: Oman Ministry of Higher Education]

market opportunities. Lenovo’s global scale and emphasis on innovation give us a degree of visibility regarding the health and well-being of the communities and markets we serve,” said Yuanqing Yang, Chairman & CEO of Lenovo. “Dr. Abdool Karim stands out for her exceptional record of research and her remarkable grassroots engagement. Through her creativity and hard work, she has helped to save countless lives. We are very proud that she has won the 2014 TWAS-Lenovo Science Prize.”

In Sub-Saharan Africa, HIV and AIDS are an ever-present threat. The region includes a majority of the 33 million people worldwide who live with HIV. In South Africa alone, an estimated

South Africa was at an early stage of an HIV epidemic, that women were already three times more likely than men to be infected and that women also became infected at an age five to seven years younger than men.

It eventually became clear that these women felt powerless to negotiate their partners’ monogamy, and were stuck in these relationships because they’re economically dependent on the men. “If you are dependent on a man for survival in whatever form, or even if you love someone, and this person has other partners, you’re at risk,” she said.

In 1994, Abdool Karim began looking for a way for women to protect themselves from HIV that didn’t depend on the cooperation of men. After she co-founded the Centre for the AIDS Programme of Research in South Africa [CAPRISA] in Durban, South Africa, in 2002, her team tested a gel version of an antiretroviral drug called tenofovir in a study of 889 women that spanned nearly three years. It turned out that tenofovir gel, when topically applied to the genital area, reduced HIV infection in women by 39% – and by 54% among those who used it the most. The results were published in the prestigious journal *Science* in 2011 and won

“We have the potential of altering the epidemic in many settings and saving many millions of lives.” **Abdool Karim**



6.1 million people suffer from HIV infection, more than any other nation in the world. And women who are younger than 24 are up to eight times more likely to have HIV than young men of the same age group.

Abdool Karim grew up in apartheid South Africa, where social inequality was notorious and pervasive. In 1988, she went into AIDS research because social justice is a part of epidemiology. “AIDS brought together two separate things for me,” she explained. “I saw a convergence between advocacy work and science.” Her initial work uncovered the frightening reality that

widespread acclaim, making headlines in major newspapers around the world.

The finding generated excitement largely because models have shown that widespread use of tenofovir gel in South Africa could prevent over 500,000 new HIV infections over the next decade. But before tenofovir gel can be licensed, it must pass a second trial currently under way and expected to finish in 2015.

“By preventing HIV infection in women,” said Abdool Karim, “we have the potential of altering the epidemic in many settings and saving many millions of lives.” ■

To learn more:  
[www.twas.org/node/8474](http://www.twas.org/node/8474)



Hassanien  
in his laboratory

# NATURE'S GIFTS HELP FORTIFY FOODS

by Cristina Serra

*Mohamed Fawzy Ramadan Hassanien, the 2014 winner of the Atta-ur-Rahman Prize, says chemicals from seeds and fruits can make food healthier.*

Nature offers many chemical compounds that can make foods more nutritious. But finding them requires commitment and a good knowledge of chemistry. Egyptian biochemist Mohamed Fawzy Ramadan Hassanien, the 2014 winner of the Atta-ur-Rahman Prize in chemistry, is a hunter of such compounds.

The prize is awarded annually by TWAS to an under-40 chemist living and working in a developing country.

Rahman, a chemist and TWAS Fellow (1985), is a pioneering advocate of science education and president of the Pakistan Academy of Sciences.

Hassanien, a professor of biochemistry at Zagazig University in Egypt, received the prize during TWAS's 25th General Meeting in Oman for discovering potentially useful substances from uncommon vegetables and fruits.

Hassanien is interested in bioactive lipids because "their contribution to our health and well-being is widely recognized," and he carries out research on bioactive molecules and on functionality and properties of food components. Non-conventional oilseeds have unique bioactive and functional properties that may augment the supply of novel foods and also pharmaceuticals.

Inspired by his father, a professor of food science at Zagazig University,

Hassanien screens underutilized and non-traditional seeds, fruits and spices of Egyptian, Indian and Arabic origins in search of interesting compounds.

"I select the most valuable ones by anticipating their potential commercial usefulness," he explained. He applies basic analytical chemistry for precise identification of interesting compounds. Then, more sophisticated analysis leads to application of the findings.

Black cumin seed oil, for example, is rich with antioxidants and other chemicals with antiviral properties. "We have used these substances to make fortified white cheese," he adds. Already, some Egyptian companies have expressed interest in commercial exploitation of his findings.

With a PhD in food chemistry from Berlin University of Technology in Germany (2004), Hassanien's interests are not restricted to chemistry and lab work. The environment is his second focus. Potato peels, a by-product of processing, can be further used, Hassanien found. He is extracting antioxidants, which prolong the life of other compounds, from the discharged materials, recycling a raw product (up to 10-25% in weight) that otherwise would be discarded.

"The compounds we have obtained from potato peels ... can be used to protect common oils during prolonged storage," he adds. Now his team is thinking of scaling up the process.

Receiving the Atta-ur-Rahman Prize was a great pleasure, Hassanien said. "It is one of the greatest prizes in the field of chemistry worldwide," he explained. "I know that the competition was high. This makes it even more important to me." ■

To learn more:  
[www.twas.org/node/8483](http://www.twas.org/node/8483)

# HONOURS FOR WORK ON MALARIA, CANCER

by Cristina Serra

*C.N.R. Rao Prize winner Muntaser Ibrahim of Sudan spots genetic differences that explain why some people are more susceptible to infections than others.*

Why are some populations more prone to malaria, cancer and other diseases? The answer is encrypted in our genes, and molecular biologist Muntaser Ibrahim, from the University of Khartoum in Sudan, is working to decipher this hidden message.

Muntaser Ibrahim – a founder of the Sudanese Academy of Sciences and an expert on population genetics – is

the winner of the 2014 C.N.R. Rao Prize for Scientific Research. He received the prize during the opening ceremony of TWAS's 25th General Meeting in Oman for his life-long commitment to understanding the role of human genetic variations and populations' structure in disease susceptibility. His discoveries bring scientists closer to developing effective vaccines and novel treatments against common diseases.

TWAS awards the C.N.R. Rao prize every year, to reflect the innovative spirit and accomplishments of Indian chemist C.N.R. Rao, a TWAS Founding Fellow, former Academy president and a leading scientist in the field of solid-state chemistry and materials science.

Ibrahim's investigations address malaria, cancer and infectious diseases that are common in Africa. Malaria, in particular, is a global burden, killing about a million people worldwide every

year, 90% of them in Sub-Saharan Africa. Effective vaccines are still missing because of the complexity of the disease.

Malaria is caused by the parasite *Plasmodium*. To complete its life cycle, *Plasmodium* needs two hosts: the mosquito *Anopheles*, a vector that hosts and spreads *Plasmodium*; and humans, who are the final recipients that *Plasmodium* invades via a mosquito's bites.

"Malaria is very interesting. Different populations show different susceptibility to the disease, both at the immunological and genetic levels," Ibrahim explained. "They do not respond in the same way to the infection – some never develop the disease, while others do – because of variations in their genomic settings."

This unusual susceptibility prompted Ibrahim to investigate 15 ethnic groups across Africa, looking for gene variants that could explain differences in the infection pattern. In the study, carried out with colleagues from the consortium MalariaGen, the scientists found DNA mutations in two genes coding for proteins that *Plasmodium* uses to bind human red blood cells, where its life cycle is completed.

These mutations change the final shape of the protein that the parasite uses to enter red blood cells. Different populations show different rates of protective mutations in these DNA hot spots, and also variations in their susceptibility to the infection.

By tracking how local communities have evolved protective mechanisms against parasites, and how the parasites are co-evolving with humans, Ibrahim is writing a chapter in the book of ancient migrations across Northeastern Africa. ■



Ibrahim during his presentation in Oman.

To learn more:  
[www.twas.org/node/8479](http://www.twas.org/node/8479)



# FOR YOUNG OMANIS, THE FUTURE IS NOW

*Science and technology are at the forefront of Oman's development policies. By supporting basic and applied research, The Research Council is nurturing a new generation of scientists who can succeed in globalized world.*

 by Cristina Serra

“Its feet shall be in a stream of water, and its head in the furnace of Heaven.” So reads an Arab proverb that celebrates the ability of date trees to thrive in extremely harsh conditions.

Dates are essential to Omani's economy but they must be healthy and beautiful too.

In an awards ceremony for young Omani scientists held during the TWAS General Meeting in Oman, researchers described their efforts to control harmful fungi that reduce date tree productivity and surface cracks that make the fruits less marketable.

The meeting offered The Research Council (TRC) of Oman a venue to launch its first Annual Research Forum, to showcase the best of Oman's research in fields of national importance such as energy, industry, environment, education and health.

The best six research projects under the Faculty Mentored Undergraduate Program were honoured during a ceremony. In addition, in the frame of Oman's first National Research Award, several presentations received public praise as well as honours.

Date palm (*Phoenix dactylifera* L.) fields occupy nearly 50% of the cultivated land in Oman, with 35,000 hectares yielding more than 278,000 tons of fruit every year. But palms and their fruits are sensitive: noxious pests may affect cultivation and wipe out farmers' work, with a heavy economic impact. Not surprisingly, young Omani scientists have taken

on a challenging task: preserving the health of these trees.

Abdullah Mohammed Al-Sadi is an associate professor in the department of crop sciences at Sultan Qaboos University (SQU). He earned his PhD in 2007 from the University of Queensland, Australia, and is now focused on date palm health.

In a recent study with colleagues from the College of Agricultural and Marine Sciences, Al-Sadi inspected 111 date palm trees from 29 varieties. The team proved that as many as 35 different fungi may sit on the roots of date palms, causing roots to go rotten and reducing the yield.

“We found 22 new species of noxious fungi never reported before in Oman, of which 13 are new fungal pathogens of date palm in the world,” Al-Sadi explained after the ceremony. “Filling a knowledge gap about the most important national crop was critical.”

“These results suggest that some fungal species were introduced from abroad, and this should urge competent authorities to strengthen quarantine measures,” added Al-Sadi, whose work won praise at TWAS meeting. His team won the TRC's 2014 National Research Award for PhD holders in the area of biological and environmental resources.

The team's results were first published in peer-reviewed journals and then explained to the agricultural community during farm visits.

What happens if roots are healthy but dates

▼ Omar S. Al-Abri [right] while carried out tests on expandable tubes.





▲ Abdullah Mohammed Al-Sadi is conducting research into date palm health.

have surface cracks, or are not the right size and shape? They cannot be exported, and even locally they are hard to sell.

Sawsana Al-Rahbi, a masters student in the department of soils, water and agricultural engineering at SQU, is addressing this issue. With colleagues, she has authored a paper on detecting date surface cracks using computer-vision techniques and a mathematical algorithm they developed.

The quality of the research and its relevance in Oman's economy has qualified her team to win TRC's 2014 National Research Award for non-PhD holders.

"Visual inspection and manual selection of dates to spot poor-quality fruits is time-consuming and costly. Besides, it often relies on personal judgment," Al-Rahbi explained. Their algorithm has allowed identification of high-crack, low-crack and no-crack dates obtained from factories in Oman, with 84% accuracy.

"This is a good starting point to explore more sensitive techniques and aim at even better results," she observed.

#### INNOVATION FLOWS THROUGH TUBULAR TECHNOLOGY

By establishing The Research Council in 2005, Sultan Qaboos bin Said Al Said set the stage to make Oman a regional hub for innovation. In a decade's time, TRC has supported research in areas such as culture, social sciences, community service and telecommunications.

Among those honoured in the first National Research Award was Omar S. Al-Abri, a PhD student and research assistant in the department of mechanical and industrial engineering at SQU. Al-Abri is studying expandable tubing technology, a technique used abroad since the 1990s but relatively new for Oman.

Oman is a world leader in oil and natural gas production; 86% of government revenues come from these two commodities, totalling 40% of Oman's gross domestic product in 2012.

“Filling a knowledge gap about the most important national crop was critical.”

*Abdullah Mohammed Al-Sadi*

But Oman's complex geology makes exploration and production an expensive challenge. Oil extraction, recovery and transportation with conventional techniques pose several problems: New reservoirs are difficult to access. It's difficult to maintain the proper size of the drill-hole. Pipes age and decompose. Failure to meet these requirements often leads to unprofitable production or missing the target well.

"Oman soil has zones of high permeability, fractures, fault-like areas which may hamper drilling," Al-Abri explained. "That's why we are exploring the new, for Oman, expandable tubular technology, as an alternative to old procedures."

The approach that Al-Abri and Tasneem Pervez are testing relies on the development of mathematical models that mimic the behaviour of tubular expansion process while drilling. This is a cost-effective approach that might help reduce the time needed to conduct expensive experiments and simulation practices.

"We hope that our mathematical model helps assist in designing and promoting the use of expandable tubes in Oman, while enhancing local expertise," said Al-Abri. "This should allow collecting more precise and reliable data, maximizing success and reducing failures." ■





# NEW MEMBERS, HIGH HONOURS

*In 2014, the Academy elected 46 new fellows, announced 11 winners of the TWAS Prize, and selected two TWAS Medal lecturers for 2015.*

 by Sean Treacy

## NEW FELLOWS

Forty-six new TWAS fellows, elected at the 25th General Meeting in Muscat, Oman, bring the Academy's total membership to 1,148. The academy has also elected its first-ever members from Austria, the Central African Republic and Hungary.

There are 11 new fellows from China; 11 from India; five from Brazil; three from Taiwan, China; two from Austria; and two from Tanzania. Of the remaining 12, one each live and work in Argentina, Australia, the Central African Republic, Ecuador, Hungary, Japan, Kuwait, Oman, Trinidad and Tobago, Uruguay, Uzbekistan and Zimbabwe.

The new fellows are divided by scientific field as follows:

### Agricultural Sciences

ABDURAKHMONOV, Ibrokhim [Uzbekistan]  
DATTA, Swapan [India]  
GROSSI DE SA, Maria Fatima [Brazil]  
HAN Bin [China]  
MUNNS, Rana [Australia]  
OMAR ASEM, Samira [Kuwait]

### Structural, Cell and Molecular Biology

CHARY, Venkata Ramana Kandala [India]

SALUNKE, Dinakar [India]  
SHAHA, Chandrima [India]  
TSAI Ming-Daw [Taiwan, China]

### Biological Systems and Organisms

ALLEYNE, Trevor [Barbados/Trinidad & Tobago]  
BRAHMACHARI Samir Kumar [India]  
MAJUMDER, Hemanta K. [India]  
MGAYA, Yunus [Tanzania]  
RON, Santiago [Ecuador]

### Medical and Health Sciences including Neurosciences

CORREA-OLIVEIRA, Rodrigo [Brazil]  
CUNHA, Fernando Q. [Brazil]  
ELGOYHEN, Ana Belén [Argentina]  
GAO, George Fu [China]  
MUTABINGWA, Theonest Kahangwa [Tanzania]  
SALOTRA, Poonam [India]

### Chemical Sciences

ALVES, Oswaldo Luiz [Brazil]  
KURODA, Reiko [Japan]  
LI Yadong [China]  
PATI, Swapan Kumar [India]  
TIAN Zhong-Qun [China]  
ZHAO Jincai [China]

### Engineering Sciences

AL-SULAIMAN, Sabah Ahmed Abdul-

Wahab [Oman]  
CHEBIYYAM, Siva Ram Murthy [India]  
CHENG Hui-Ming [China]  
TAN Tieniu [China]

### Astronomy, Space and Earth Sciences

FERESU, Sarah [Zimbabwe]  
JIAO Nianzhi [China]  
MIRABEL, Igor-Feliz [Uruguay]  
ZHAI, Mingguo [China]

### Mathematical Sciences

LI Ker-Chau [Taiwan, China]  
N'GUEREKATA, Gaston Mandata [Central African Republic]  
SRINIVAS, Vasudevan [India]

### Physics

MUKHI, Sunil [India]  
PÁLINKÁS, József [Hungary]  
PIMENTA, Marcos [Brazil]  
WU Yueliang [China]  
ZEILINGER, Anton [Austria]

### Social and Economic Sciences

KUAN Chung-Ming [Taiwan, China]  
LUTZ, Wolfgang [Austria]  
ZHANG Linxiu [China]

## THE 2014 TWAS PRIZES

The 2014 TWAS Prizes, announced at the Academy's 25th General Meeting in Muscat, Oman, are awarded in the nine fields listed below. This year, there are 11 prize winners: two from Argentina; four from China; three from Taiwan, China; one from India and one from Malaysia. The prize winners include two women.

Each TWAS Prize carries a cash award of USD15,000. The winners will lecture on their research at TWAS's 26th General Meeting, slated for Angola in the autumn of 2015.

### Agricultural Sciences

● ZHANG Fusuo of China, of the Centre for Resources, Environment and Food Security, China Agricultural University,



in Beijing, for work enhancing food production and reducing environmental damage.

#### **Biology**

- Marcelo RUBINSTEIN of the Department of Physiology, Molecular and Cellular Biology, Faculty of Natural Sciences at the University of Buenos Aires in Argentina, for work related to appetite, addiction and obesity.

#### **Chemistry**

- XIE Yi of the Department of Chemistry, University of Science and Technology of China, in Hefei, for her work in nanoscale chemistry.

#### **Earth Sciences**

- CHUNG Sun-Lin of the Department of Geosciences, National Taiwan University, in Taipei, Taiwan, China, for his work on plate tectonics and magma generation.

#### **Engineering Sciences (shared)**

- Viswanathan KUMARAN of Macronix International Co. Ltd. in Hsinchu Science Park, Hsinchu City, Taiwan,

China, for his work on soft-walled tubes and channels.

- LU Chih-Yuan of the Department of Chemical Engineering, Indian Institute of Science, in Bangalore, for his work on semiconductors.

#### **Mathematics**

- YUAN Yaxiang of the Institute of Computational Mathematics and Scientific/Engineering Computing, Academy of Mathematics and Systems Science, Chinese Academy of Sciences in Beijing, for his work on numerical methods for nonlinear optimization.

#### **Medical Sciences (shared)**

- Irene Oi Lin NG of the Department of Pathology, Queen Mary Hospital, in Hong Kong, China, for her work related shedding light on the nature of liver cancer.

- Tse Wen CHANG of the Genomics Research Center, Academia Sinica, in Taipei, Taiwan, China, for his work on a new therapy for severe asthma.

#### **Physics**

- Daniel DE FLORIAN the Department of Physics at the University of Buenos

Aires in Argentina, for his work on using particle colliders to produce Higgs bosons.

#### **TWAS-Celso Furtado Prize in Social Sciences**

- Rajah RASIAH of the University of Malaya, in Kuala Lumpur, Malaysia, for his work on the relationship between technology and economic development.

#### **TWAS MEDAL LECTURES 2015**

Two distinguished researchers have been selected to give TWAS Medal Lectures on their work next year at the Academy's annual General Meeting. The lectures are one of the organization's highest honours, featuring some of the most prominent accomplishments by elected TWAS members:

**Hala El-Khozondar**, a professor at the electrical engineering department of the Islamic University of Gaza.

She is recognized for her research on popular materials such as optical fibres and metamaterials, as well as polycrystalline materials – which are composed of small grains that are glued together by forces between atoms. Understanding polycrystalline materials is useful, for example, in improving metals and ceramics for industrial use. She was elected a member of TWAS in 2011.

**Hans van Ginkel**, a professor emeritus of Utrecht University in the Netherlands. He is a social scientist with special interest in societal uses for geographical knowledge, including urban and regional planning, public housing, housing markets and public administration. He has prepared and led debates on higher education and sustainable human development. He was elected a member of TWAS in 2005. ■



# IN MEMORIAM: FARIDA SHAH

*Her work had a deep impact on women and development in Malaysia and beyond. She will be remembered also for distinguished work with OWSD and TWAS.*

Malaysian molecular biologist and TWAS Fellow Farida Habib Shah passed away on 1 November 2014, at the age of 66. Shah was a member of the TWAS Council and a vice president of OWSD, the Organization for Women in Science for the Developing World, where she had served with sustained commitment since 1994.

As a scientist, Shah pioneered research on the biology and genetics of the oil palm, Malaysia's main commodity crop, but she was also a key figure in promoting science education and advocating a better role for women in science. She dedicated part of her energies also to help single mothers, the poor, the homeless and the young.

From 1999 to 2010, Shah served two terms at the Asia-Pacific representative on OWSD's Executive Board, and then was elected vice president for the region. In 2011, her vision and perseverance led to the establishment of OWSD Malaysia National Chapter, which is now a robust resource for Malaysian women in science and engineering. Her work with TWAS dates to 2002, when she was elected a Fellow.

In 2012, she started a three-year term as a TWAS Council member.

"As a member of our Academy and a Council member, she was deeply committed to the cause and objectives of TWAS and for many years she actively supported us," TWAS President Bai Chunli wrote in a letter of condolence to Shah's family. "Farida was a wonderful human being. She will be sorely missed by all of us."

OWSD President Fang Xin shared that sentiment: "Farida was a deeply committed and hard-working member of OWSD. We will miss her."

Former TWAS President Jacob Palis of Brazil said Shah was "... a dear friend and a great symbol of the presence of women in science."

Mohamed H.A. Hassan, TWAS treasurer and co-chair of IAP - the global network of science academies, called her "a very dedicated TWAS member".

Farida Shah sat on the S&T Commission under the Malaysia National Council of Women's Organizations, which has a consultative and advisory role to the government on gender issues. She encouraged women's organizations to work together in a project called "Networking Women", aimed at training women in website design and at increasing women's use of the Internet, even in rural areas, as a vehicle for the online promotion of products and activities.

"She always had new ideas and initiatives and went further to implement them," said Mayra de la Torre, OWSD vice president for Latin America and the Caribbean.



"We lost a great woman and wonderful friend."

On the entrepreneurial side, Shah was the founder and managing director of a new biotechnology-based company, "The Natural Story Sdn Bhd" [Sdn Bhd is the Malay equivalent to *incorporated*] which produces herbal and aromatic products.

Important biotechnology initiatives at the state level stemmed from her passion and commitment to scientific research. She established the Melaka Biotechnology Corporation, with two institutes under its umbrella: the Melaka Institute of Biotechnology and Melaka Biotech Holdings Sdn Bhd.

Shah also founded two biotechnology companies: Tropical BioEssence, and the biotech start-up and consultancy company Novel Plant, a start-up created to transfer scientific discoveries to the market. In addition, Shah set up a platform for DNA Marker Technology Bioinformatics, to authenticate and verify medicinal and herbal plant species and varieties.

Her scientific production - she has authored over 200 papers and presented over 250 papers - reflected her enduring passion for research. In addition, she was an adjunct professor at Universiti Malaysia Terengganu.

She leaves her husband and life-long travel companion, Peter Anderson. Together they wrote the 1994 guide, *Discover Malaysia*. ■

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# PEOPLE, PLACES & EVENTS

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## IN MEMORIAM: GUY BLAUDIN DE THÉ

**Guy Blaudin de Thé**, the founding co-chair of the InterAcademy Medical Panel (IAMP), passed away on 7 August 2014. He was a pioneer in research on virus-related cancer and the head of the unit of biological carcinogenesis at the International Agency for Research on Cancer in Lyon, France.

Blaudin de Thé spent his career trying to understand cancer and its relation with viruses. He propelled seminal investigations on the link between the Epstein-Barr Virus (EBV) and the development of Burkitt lymphoma in African children. He has also studied a very common EBV-associated tumour, the nasopharyngeal carcinoma, which is quite common in some regions of China.

He was elected founding co-chair of IAMP at a time when 16 academies were in the panel; today there are 73. He was re-elected again for the term 2006-2010. During these terms he propelled successful initiatives to build capacity among member academies, including a maternal and perinatal mortality project.

## JUMA RECEIVES AFRICAN FOOD PRIZE

Kenyan scientist **Calestous Juma** (TWAS Fellow 2005), one of the most authoritative voices of agricultural innovation in Africa, is among the 2014 Lifetime Africa Achievement Prize Laureates. The award is bestowed every two years by the Millennium Excellence Foundation, to acknowledge iconic individuals who have greatly contributed to the empowerment of the African continent.



Juma, in particular, was awarded the "Prize for Food Security, Agro Processing Development and Quality". The ceremony took place in Uyo, Nigeria, on 10 October. Among the 15 winners were heads of state, academicians, and political leaders. Juma is professor of the practice of international development at Harvard Kennedy School (USA) and the director of the science, technology and globalization project there. He is also a former executive secretary of the United Nations Convention on Biological Diversity and founding director of the African Centre for Technology Studies in Nairobi.

He is internationally renowned for his contribution to policy research regarding the application of science, technology and engineering to development. In 2007, he was named one of Kenya's 100 most influential people.



## ATTA-UR-RAHMAN HONOURED BY CHINA

Pakistani chemist **Atta-ur-Rahman**, a TWAS Fellow (1985) and the President of the Network of Academies of Science of Islamic Countries, received "The Friendship Award of China" on 29 September 2014. The prize acknowledges "foreign experts who have made outstanding contributions to the country's economic and social progress". The ceremony was held in Beijing, where Bai Chunli, the president of the Chinese Academy of Sciences and of TWAS, delivered the prize. Rahman has been a visionary leader

of science education in Pakistan and champion of international relations. In particular, he has worked to build bonds between Pakistan and China, in the fields of science and higher education.

In the field of organic chemistry, he is well known for elucidation of bioactive compounds, and for developing new methods to clarify chemical structures. He was elected as a Fellow of Royal Society (London) and made an Honorary Life Fellow at Kings College, Cambridge University. He has authored almost 1,000 scientific publications and signed 37 international patents, and he has promoted a nation-wide training project aimed at teaching China's Mandarin language to Pakistani students.



## PANZA HONOURED BY EGYPT

**Giuliano Panza**, a distinguished Italian seismologist and a TWAS Fellow (1996), has been awarded the prestigious National Institute of Astronomy and Geophysics (NRIAG) Honorary Medal. The award to Panza and his Structure and Non-Linear Dynamics of the Earth (SAND) team comes from the Egyptian Ministry of Scientific Research and is bestowed for high-impact scientific accomplishments.

Panza, who is head of the SAND group at the Abdus Salam International Center for Theoretical Physics, received the prize for his "fundamental scientific contributions for the better understanding of





# PEOPLE, PLACES & EVENTS

dynamics of the lithosphere-asthenosphere system” [two Earth sections that include the crust and the upper solid mantle, and the section just below it].

Panza is among the world-renowned seismologists who have developed realistic seismic hazard assessment methodologies and earthquake prediction.

The award ceremony took place during the opening ceremony of the 4th Arab conference of Astronomy and Geophysics on 20 October 2014, at Helwan, Egypt.

## C.R. RAO WINS THE NEYMAN MEDAL

**C.R. Rao**, a TWAS Founding Fellow from India and Eberly Professor emeritus of statistics at Pennsylvania State University, is the recipient of the Jerzy Splawa-Neyman Medal awarded every year by the Polish Statistical Society.

Rao was awarded the medal in recognition of his outstanding contributions to the theory, applications and teaching of statistics and his commitment to the field. The medal is named after Jerzy Neyman, an eminent statisticians of the last century who propelled the emergence of statistics as an independent discipline by developing the theory of hypothesis testing.

The Medal was established in 2010 to celebrate the 100th anniversary of the Polish

Statistical Association, which honours the best statisticians in the world, along with scientists who have given meaningful contributions to statistics.



Rao is a professor at Buffalo University and a member of the Royal Society, London, of the US National Academy of Sciences, and of the Indian Academy of Sciences.

## TWAS FELLOW MASHELKAR WINS PADMA VIBHUSHAN PRIZE

Indian chemical engineer and TWAS Fellow **Raghunath A. Mashelkar** has been awarded the 2014 Padma Vibhushan prize, the second highest civilian award in the Republic of India. Mashelkar, a professor at the National Chemical Laboratory in Pune, India, and the president of Global Research Alliance, is also the former director general of the Council of Scientific & Industrial Research, an ensemble of 38 publicly funded industrial research and development institutions in India.

Mashelkar’s career has focused both on scientific research and on science diplomacy. His passionate enthusiasm for chemistry led him to bring important contributions in the field of transport phenomena and in the thermodynamics of swelling. He is also known for his contribution to the intellectual property movement, which succeeded in revoking some US patents on Indian products such as turmeric and Basmati rice, raising awareness on the importance of protecting traditional Indian products and knowledge.

The Padma Vibhushan recognizes people who have provided exceptional and distinguished service to India in any field.



## LUBCHENCO NEW U.S. OCEAN ENVOY

Environmental sciences pioneer **Jane Lubchenco**, a 2004 TWAS Fellow and distinguished professor of marine biology at Oregon State University, is the first US science envoy for the oceans.

Her nomination by US President Barack Obama is part of the science envoy programme, aimed at building science-based relationships between the US and other nations.

Lubchenco was the first woman administrator of the National Oceanic and Atmospheric Administration [NOAA]. She has made seminal contributions to marine ecology by discovering the ecological and evolutionary bonds that link animals and plants in coastal systems. Her studies have provided deep insight on factors that affect the distribution, abundance and biodiversity of marine species.

A distinguished scholar and pragmatic policy-maker, Lubchenco is a passionate advocate of the importance of reversing the oceans’ degradation while continuing to benefit from their abundant resources.



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The World Academy of Sciences for the advancement of science in developing countries – TWAS – works to advance sustainable prosperity through research, education, policy and diplomacy.

**T**WAS was founded in 1983 by a distinguished group of scientists from the developing world, under the leadership of Abdus Salam, the Pakistani physicist and Nobel Prize winner. Today, TWAS has nearly 1,150 elected Fellows from some 90 countries; 15 of them are Nobel laureates. It is based in Trieste, Italy, on the campus of the **Abdus Salam International Centre for Theoretical Physics [ICTP]**.

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

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

TWAS and its partners offer nearly 500 fellowships per year to scientists in the developing world for PhD studies and post-doctoral research. TWAS prizes and awards are among the most prestigious given for scientific work in the developing world. The Academy distributes more than USD1 million in research grants every year to individual scientists and research groups. It supports

visiting scientists and provides funding for regional and international science meetings.

TWAS hosts and works in association with three allied organizations on the ICTP campus:

**The Organization for Women in Science for the Developing World [OWSD]**. At its founding in 1989, OWSD was the first international forum uniting women scientists from the developing and developed worlds. Today, OWSD has more than 4,000 members. Their objective is to strengthen the role of women in the development process and promote their representation in scientific and technological leadership.

**IAP, the global network of science academies**. Established in 1993 as the 'InterAcademy Panel on international issues', IAP unites more than 100 science academies worldwide. It provides high-quality independent information and advice on science and development to policymakers and the public; supports programmes on scientific capacity-building, education and communication; and leads efforts to expand international science cooperation.

**The InterAcademy Medical Panel [IAMP]**. IAMP is a network of the world's medical academies and medical sections of academies of science and engineering. It is committed to improving human health worldwide through the coordinated global action of its 70 members.



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