Year 2014 - Vol. 26 - No.1

twas

NEWSLETTER

A PUBLICATION OF THE WORLD ACADEMY OF SCIENCES

Sustainable Development Goals

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▲ Terrace rice fields in Yunnan Province, China. (Photo: Jialiang Gao/peace-on-earth.org); TWAS's redesigned website will bring the Academy's mission and opportunities to a diverse global audience.

Cover picture: Women hold seedlings for reforestation efforts in Tanzania. (Photo: USAID Africa Bureau)

▼ TWAS and its partners played a key role in a workshop on African higher education, co-organized by Rwandan President Paul Kagame (right).

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EDITORIAL

SCIENCE FOR ALL PEOPLE

▲ Romain Murenzi

This editorial is an abridged version of the presentation by TWAS Executive Director Romain Murenzi at the 17th Session of the United Nations Commission on Science and Technology for Development in Geneva, Switzerland.

Fifteen years ago, as the Millennium Development Goals (MDGs) were coming into focus, few could have imagined how they would help to change the world. Brazil, China, India and other nations were only beginning to emerge as centres of research and innovation. My own country of birth, Rwanda, was struggling to overcome the devastation of genocide. After making historic progress, these nations and others have emerged as models of possibility and hope for other developing countries.

With the MDGs expiring next year, the world is joining in a process to give shape to the post-2015 Sustainable Development Goals (SDGs). The draft list of goals touches on every major challenge confronting humanity: Food production and clean water. Health. Building stronger, more sustainable cities. Climate change and a range of environmental threats.

TWAS has joined in this process, and yet, we are aware that international organizations alone cannot solve these problems. If, for example, agricultural production is our goal, we are talking about a challenge that differs across continents, from region to region, sometimes village to village. Therefore, we should see the Sustainable Development Goals as a *global* framework for action that can be adapted by policymakers, educators, businesses, scientists and others at *local* levels.

As an overarching priority, the SDGs should advocate development of an effective and efficient innovation ecosystem that can support sustainable development far into the future. That involves policy and law, technology transfer, communication and partner networks. It will require science diplomacy.

Perhaps most important, building an innovation ecosystem requires education, from early childhood through PhD study. The MDGs have had a strong focus on primary education, and that's important. But when children advance through primary school and high school, are there excellent universities with strong professors awaiting them? Do these universities have modern laboratories and the latest information and communications technology (ICT)?

A nation with a weak corps of PhD scientists, ill-equipped laboratories and limited ICT will struggle to address its challenges. At TWAS, these issues are central to our mission. With our partners, we provide more than 300 fellowships every year to early-career scientists who want to obtain their PhDs. We provide about USD1.5 million each year in small research grants. These lessons can be applied to the post-2015 development agenda.

We must also consider the importance of science literacy in the wider society. If people do not understand the basic science of germs, they will be less likely to wash their hands. If a community does not understand the cause and impact of climate change, its people will be less likely to take remedial action.

The question, then, is how to enable communities and nations to build a culture of science that imparts strength and resilience. This question is at the heart of a debate now underway about the role of science in the SDG process.

Science is crucial in addressing the great challenges of our time and for developing the innovation ecosystem, and the SDGs will influence donor and funding decisions in the years ahead. Therefore, shouldn't the goals expressly support science literacy for every nation and every community? Shouldn't they advocate "Science for All People"?

Romain Murenzi, *TWAS executive director*

TWAS NEWSLETTER
Published quarterly with the support of the Kuwait Foundation for the Advancement of Sciences [KFAS] by The World Academy of Sciences - for the advancement of science in developing countries [TWAS]
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Printing
La Tipografica Srl,
Campoformido, Udine, Italy

IN THE NEWS

The 70-year wait for primary school

It will be more than 70 years before all children have access to primary school, says a UNESCO report released in late January.

The report says 57 million children remain without education and, at the current rate, many poor, rural African girls won't have access to education until 2086. The report describes this gap in education and the low quality of many schools as a "global learning crisis".

BBC News, 29 January 2014:
http://bbc.in/1iDeNw0

China S&T: rising fast

China has become the world's third-largest producer of peer-reviewed research articles after the European Union and United States, according to a major report published by the US National Science Foundation.

According to the report, the world's researchers produced 827,705 scientific articles in 2011. Researchers in the European Union produced about 31%, the United States produced 26%, China produced 11% and Japan produced 6%. That adds up to three countries and the EU producing almost 74% of the world's peer-reviewed research.

University World News, 28 February 2014:
http://bit.ly/1lx86wq

A flood of ocean data

The amount of ocean data being collected through modern methods exceeds scientists' ability to manage it. Researchers at the Ocean Sciences Meeting in Hawaii in February 2014 heard proposals for creating an international database for the incredible amount of data now available on the world's oceans.

The plan would help researchers with low funding participate in pressing fields such as climate science by producing a central place for data from the 13 million locations from which scientists have historically drawn sea surface temperatures. The database would combine automated work on broad swaths of data with more detailed analysis by experts.

SciDevNet, 20 March 2014:
http://bit.ly/1dxRTPJ

Understanding malaria's spread

Scientists have discovered an important step the malaria parasite needs to complete in order to pass from human to human.

Malaria is transmitted to people through mosquitos, which have been infected by biting already-infected people. What researchers identified is a molecule that serves as the master switch that triggers the development of male and female forms of the malaria parasite. If the parasite is unable to take that crucial sexual developmental step, then transmission of the disease can no longer take place from one person to another.

The Times of India, 25 February 2014:
http://bit.ly/1oAsWax

India: In search of gravitational waves

The Indian government is planning to pour $201 million into LIGO-India, the third array of gravitational wave detectors in the world, Prime Minister Manmohan Singh announced at the Indian Science Congress in Jammu.

Gravitational waves are spacetime ripples predicted by Albert Einstein's general theory of relativity. A detector array network in the United States called the Laser Interferometer Gravitational-wave Observatory [LIGO] is collaborating to support the new Indian array. Physicists hope the network's expansion will help detect and pinpoint sources of the waves.

Science, 14 February 2014:
http://bit.ly/1rf2l8D

POST-2015 DEVELOPMENT GOALS

WHAT ROLE FOR SCIENCE?

Rice fields near the village of Batad in the Philippines. (Photo: Adi. simionov/Wikimedia Commons)

The Sustainable Development Goals are being drafted to help lift up the poor countries of the world. If they're to succeed, researchers in developing countries must play a central role.

by **Sean Treacy**

Biotechnology powers the food revolution alleviating world hunger. Efforts to provide clean water require chemists and engineers. And it's impossible to adapt to climate change if climatologists aren't monitoring it. An undercurrent of scientific research runs through most major challenges in the developing world, a fact reflected in the first draft of the new Sustainable Development Goals.

The Sustainable Development Goals (SDGs) are the international community's most ambitious effort ever to resolve the world's greatest challenges and set a firm course for sustainable global development. They will pick up where the United Nations' historic first-of-its-kind effort, the Millennium Development Goals (MDGs), leave off when they expire at the end of 2015. It is no exaggeration to say that the new goals could shape humanity's future for the next century, or more.

As the end of 2015 approaches, they will continue to evolve as they are subject to intense scrutiny and international debate. Policymakers and others involved in the process will be looking to get the right number of goals, with clear language and effective metrics for measuring progress. But there are two related issues of concern for many experts: Though science is relevant to many of the goals, scientists voices may be underrepresented. And while the world's developing nations will be a focus of the goals, they often lack the scientific capacity to be full partners in the process.

"I'm not sure that science anywhere is involved enough in the goal-setting process," said Mark Stafford Smith, the Science Committee chair for Future Earth, an international initiative to coordinate global sustainability research. "The goals in the end are political decisions, but their construction and their feasibility can be greatly informed by research."

The stakes for science and technology are high, because the finished goals will serve as a framework for global research and funding over the next 15 years and beyond. The stakes for humanity are high, too, and that will mean intense engagement and sometimes conflict as scientists and their allies press to make sure that science-related goals are shaped by strong research and data.

A WORLDWIDE MISSION

The global goal-setting effort grew from a series of world conferences in the 1990s and formally began in September 2000, when the United Nations gathered for the Millennium Summit in New York City.

Focusing largely on a long-term effort to end poverty, world leaders established eight global development targets. They came to be known as the MDGs, with goals ranging from eliminating hunger to reducing child mortality and providing universal primary education.

In the years that followed, the world saw progress toward the goals, especially in emerging nations such as China, India and Brazil and other fast-rising Asian and Latin American countries. But in many of the world's least-developed countries, progress was more slow.

At the 2012 United Nations Conference on Sustainable Development in Rio de Janeiro, Brazil, world leaders produced a document called "The Future We Want." That document called for a sequel, the SDGs, to slide into place when the MDGs expire at the end of 2015. In July 2014, the 30-member Open Working Group of the UN General Assembly completed a 17-goal draft for the SDGs. After one more

year of debate and revisions, the UN General Assembly expects to adopt the SDGs in September 2015 with a target year of 2030.

Among the 17 draft goals, five have a clear bearing on the environment: protecting ecosystems and biodiversity; combating climate change; conserving the world's oceans; ensuring sustainable energy for everyone; and providing water and sanitation to everyone. The draft's goals also include eliminating poverty, ending hunger, providing universal secondary education and promoting economic growth.

A STRONGER VOICE FOR SCIENCE

Arguably, every goal in the SDG draft has a component related to science or social science. And if the goals are to succeed, scientists must participate. But in reports and interviews, a consensus emerges: Thus far, they haven't been closely involved in the process.

What role should they have? Gisbert Glaser is a senior adviser to the International Council for Science (ICSU), a Paris-based organization of national and global science bodies that represents almost every nation on Earth. Scientists could lobby the policymakers, Glaser said in an interview, but many scientists are uncomfortable in that role. The alternative, he said, is more indirect: providing scientific information to goal-setters as they make decisions.

In Glaser's view, the SDG draft's social goals have better-defined targets than the environmental goals – and that, he says, is where the remaining negotiations must focus. But delegates shy away from including measurable environmental targets because it requires difficult trade-offs.

Perhaps the strongest example is energy and climate change. "Yes," Glaser said, "we need to provide access to energy for all, but we need to do it in a way which minimizes the CO_2 emissions linked to it, so that these two goals can work in concert."

For the goals to have an effect on the ground, he added, they need the full cooperation from scientists also in the Least Developed Countries. "That's where the scientific divide between the North and the South is a big problem," he said. "This is something where TWAS has always been an excellent advocate and I think that is very important."

TWAS has been a voice for the developing world in several high-level international meetings on how to shape the SDGs. In July 2014, TWAS Executive Director Romain Murenzi moderated "Charting Pathways for the Future We Want", a panel that was part of a high-level UN dialogue on the costs of failing to create a sustainable future. In May, at the 17th session of the Commission on Science and Technology for Development in Geneva, Switzerland, Murenzi encouraged decision-makers to support an innovation ecosystem in which science can flourish and address local challenges.

"For example," he told the Commission, "if we say that agricultural production is our goal, we are talking about a challenge that differs across continents, from region to region, sometimes village to village. Really, it is not one challenge, but hundreds. And so the primary need is for local and national expertise to address those problems."

FOUNDATIONS FOR IMPROVING SOCIETY

UNESCO statistics provide an example of a gap between targets outlined in the SDGs and the skills available to address them. Sub-Saharan Africa will need 2.5 million engineers and technicians to provide clean water and sanitation. But only 0.5% of

▶ A farmer at work in Kenya's Mount Kenya region. (Photo: Neil Palmer/ International Center for Tropical Agriculture)

> The goals ... are political decisions, but their construction and their feasibility can be greatly informed by research. *Mark Stafford Smith*

◀ Solar panels in Hong Kong. (Photo: WiNG/ Wikimedia Commons)

the world's researchers live in the world's least-developed countries, mostly nations in sub-Saharan Africa. To acquire these corps of skilled experts, developing countries need a massive surge of scientific expertise.

Among development experts, there's a growing awareness that it's important to grow expertise from the ground up, said Gabriel Casaburi, the lead specialist for the bank's Competitiveness, Technology and Innovation Division at the Inter-American Development Bank and based in Argentina. In recent years, the Bank has increased its support for local university-level education in Latin America.

"Even to do mission-oriented research, or even to have companies that do research and development, you need the human capital, and to have that human capital you need to educate people," Casaburi said. "You need to have a group of highly qualified scientists that can teach a generation of other highly qualified individuals that will then do the research necessary to improve society."

The Bank's efforts differ country by country. In nations such as Brazil or Argentina, which already have scientific infrastructure in place, the Bank tries to steer them toward socially relevant research.

"But then the emphasis shifts when you go to Paraguay, which is the poorest of the countries in the Southern Cone," he said. The Bank has helped Paraguay by backing the strengthening of its National Innovation System with a relatively small loan of USD9 million, which included setting up of a database of scientists. After six years, Paraguay had a way to contact all of its scientists, including Paraguayan expats living abroad. "You need to

help them start building the innovation system that includes helping universities improve their graduate programs, and build laboratories, as well as helping private firms to learn to use the scientific system to innovate."

And when the university structure grows, the pool of scientists that live in the nation who can be steered toward humanitarian research grows with it. Those scientists play an important role in development: gathering and interpreting data.

> You need to have a group of highly qualified scientists that can teach a generation of other highly qualified individuals. *Gabriel Casaburi*

NO DATA, NO PROGRESS

Each goal outlined in the SDG draft is broad, applying a universal task to every nation in the world. But in individual developing countries, the path to sustainable development is not so clear-cut. Each country has a unique combination of problems that need to be pinpointed and tracked. Without that capability, decision-makers are blind to the best answers.

Gisella Orjeda, president of the National Council for Science, Technology and Technological Innovation (CONCYTEC) in Peru, said that having enough scientists living within a country makes all the difference between whether the country is developed or not. Issues such as malnutrition in children have many different causes, and when those causes arise, it takes scientists to study them, gather the data, reveal the cause and propose a solution.

"If we make policies without evidence," Orjeda said, "those policies will fail."

Without local and national data-collection and research, solutions to problems tend to get based on research from richer countries and thus imitate their practices, said TWAS Fellow Kaushik Basu of India, senior vice president and chief economist of the World Bank.

That's a problem, Basu said. He offered an example from economics: Most policies for controlling inflation, through tactics such as managing interest rates, imitate what is done in the developed world. There is little independent research on inflation in developing countries, leaving those nations to apply solutions that often won't fit each country's unique situation.

"Unless you have a certain amount of research capacity in your region, you are handicapped," Basu said. "There are times when you get a problem, that despite the best effort goes on and on and on in a developing country, and the medicine does not seem to work. It is likely that this is because the medicine is maladjusted for the context."

Data-collectors are needed even when simply delivering existing technologies, such as toilets, to where they are needed. Science is the feedback system that collects data in the field and informs decision-makers on whether their efforts are working, said Secretary of the Indian Department of Biotechnology Krishnaswamy VijayRaghavan.

"Otherwise you end up putting the plumbing in place and expect everything will be fine forever," said VijayRaghavan, a TWAS Fellow. "It never is."

So where can developing countries get the scientists and engineers they need to gather the data that policymakers need to make

◀ From left: Gisella Orjeda, Kaushik Basu, Krishnaswamy VijayRaghavan and Yongyuth Yuthavong

▲ The south entrance of Expo 2010 Shanghai, near the Expo Boulevard in Shanghai, China. [Photo: Cesarexpo/ Wikimedia Commons]

good judgments? The answer lies in the same force that has been advancing humanity for centuries: education.

EDUCATION: A WINDOW TO THE WORLD

The MDGs aimed to make primary school available to all the world's children by 2015, but globally, that goal is still far off. A UNESCO report released in January said 57 million children remain without schools and, at the current rate many still won't have access until 2086.

Still, the SDGs are expanding on those efforts. In the SDGs draft, the fourth goal attempts to address education. It includes yet-unspecified targets for increasing the number of higher-education scholarships for information and computer technology, technical skills, engineering and science in developing countries.

Yongyuth Yuthavong is Thailand's former science minister, presently deputy prime minister and a TWAS Fellow who serves as vice president for East and Southeast Asia on the Academy's Council. In his view, education must be the central goal. It is the main engine of development, Yuthavong said, because an educated society is better-equipped to address poverty, energy, and other challenges.

Education also serves a deeper purpose, he said, providing a country's citizenry with scientific literacy, which provides a "window to the world" through which economies can select what to make, export and import. Education has driven technological growth in Taiwan, Singapore and other Asian nations such as Thailand, allowing them to develop faster.

Murenzi also emphasizes the importance of education and a network of PhDs to support sustainable development. Communities and nations must build a culture of science, he told the Geneva audience in May. "Just as the foundation gives support and shape to a building, so the culture of science can give strength to society."

VijayRaghavan argued that decision-makers behind goal-setting efforts like the SDGs should use education to build acceptance for and understanding of science throughout society. After all, scientific discoveries and new technology matter most to people with the greatest need.

"Those are challenges decision-makers will have," he said, "unless science is understood and accepted, and evidence-based decision making becomes second-nature to people." ◘

Q&A SUSTAINABLE DEVELOPMENT: AN UNCERTAIN PATH

by **Cristina Serra**

Led by Nobel Laureate and TWAS Fellow Y.T. Lee, four prominent scientists reflect on the potential power of the Sustainable Development Goals. Unless science has a strong role, they agree, solutions will be elusive.

Development experts, scholars and policymakers have been working for more than a year to define the most profound challenges facing humanity and the Earth, and to chart a course toward solutions. The Sustainable Development Goals are the result, and now that a first draft has been released, a high-stakes global discussion is underway to refine the goals and the plans for achieving them.

The word "science" doesn't appear in the 17 draft goals. And yet as early as Goal 2 – *End hunger, achieve food security and improved nutrition, and promote sustainable agriculture* – it's clear that science is key to meeting the 169 draft targets.

But does science have a central role in the process? Have scientists, social scientists and engineers had enough input? For insights on these issues, TWAS staff writer Cristina Serra interviewed four illustrious scientists: Nobel laureate and TWAS Fellow Y.T. Lee of Taiwan, China; environmental scientist Samira Omar of Kuwait, who serves as a vice president of the Organization for Women in Science for the Developing World; TWAS Fellow Calestous Juma, a Kenyan-born development scholar and author; and TWAS Fellow Peter Singer of Canada, an influential thinker behind the Millennium Development Goals that expire next year.

All agree that science will be central to understanding the challenges and shaping the solutions. But at this critical moment in human history, they say, difficult discussions lie ahead in the effort to build a global consensus.

Is science sufficiently represented in the Sustainable Development Goals?

Lee: In order to fulfil the sustainable development goals, science will be extremely important, and this importance should be stressed in the preface. The programme of Future Earth [a 10-year international research initiative focused on environmental change and sustainability] will hopefully make important contributions in this area.

Omar: Yes, science is represented in the SDGs, which tackle climate change and its impacts, conserve ecosystems and resources, promote alternative sources of energy and water management etc. The SDGs also call for international collaboration and access to science, technology and innovation and enhances knowledge-sharing and environmentally sound technologies.

Juma: It is alarming that the role of science and technology in the SDGs was an afterthought. This is disappointing considering that scientific input was a major part of the preparations for the Rio Conference in 1992. Agenda 21, which arose from the conference, had three chapters

▼ Calestous Juma

◀ Y.T. Lee

devoted to science, technology and education. This was in addition to references to science in nearly all the substantive chapters. It can be argued the United Nations had more foresight on the role of science and technology in sustainable development in 1992 than is evident in the sprawling list of items under the SDGs.

Singer: SDGs are framed primarily as overcoming challenges. Science contributes to the solutions. (These are sometimes called 'means of implementation'.) So it's a bit too soon to know. I hope science will play a big role in the solutions. If it doesn't, the challenges cannot be solved.

> It is alarming that the role of science and technology in the SDGs was an afterthought.
>
> *Calestous Juma*

Given the current draft list of sustainable development goals, do you think anything is over-emphasized, or under-emphasized?

Omar: The draft is a collective effort of the major groups and stakeholders. It has been reviewed and amended by many experts with contributions from citizens. The SDGs are addressed with equal importance for their implementation.

Juma: The structure of the draft does not lend itself to systematic consideration of the role of science and technology. It is an ensemble of ideas and not a visionary document that reflects contemporary development and the significance of science and development in the new millennium.

Singer: There are too many goals and targets. With 17 goals and 169 targets, it's hard to see how the world can focus and how those who are tackling these targets can inspire, finance, execute. We need to identify interacting clusters of targets to focus on, and these are sometimes across goals. For example, if one is interested in improving the welfare of girls, this appears under many goals.

Lee: The beautiful goals we would like to reach seem clear; however, the way to get there is under-emphasized. The urgency of tackling climate change is also under-emphasized. Goal 13

> The obligation is to fundamentally transform the way human societies develop. *Y.T. Lee*

[*Take urgent action to combat climate change and its impacts*] should be elevated up the list. Without tackling climate change, the progress we make on hunger, poverty and so on will be severely compromised.

Should emerging nations – such as China, South Africa, Brazil – which have generated quite a bit of wealth in the past 15 years, have obligations to support the Least Developed Countries (LDCs)?

Singer: Yes, I think these South-to-South connections in science, technology and innovation are a win-win for LDCs, emerging nations and the world. But we need to all do it together. I am pleased emerging countries are strong proponents of the Grand Challenges approach to innovation, which is at its core a governance mechanism to work together to use the power of innovation to solve global challenges.

Lee: It is not appropriate to place particular obligation on a few nations

that have emerged economically in the past 15 years. The problems we are facing are global, and so our approach should be global as well. The developed nations – or as I like to call them, "over-developed nations" – have just as much obligation. But the obligation should go beyond supporting the developing nations with money and technology. The obligation is to fundamentally transform the way human societies develop.

Juma: I do not think countries have obligations to support others. They do so given their strategic interests. Science and technology provides new opportunities for diplomatic cooperation between nations irrespective of their stage of development. Science is a universal language and opportunities for cooperation are driven by mutual interests in areas such as health, food security, environmental management and international security. These are also science-based issues. In the future, science and technology will drive international diplomacy just as much as international cooperation will shape science and technology.

Omar: The world at large has obligations towards sustaining the human race and the planet Earth. Wealthy nations should support poor nations to achieve the SDGs.

Should you pick just one goal, which one would it be?

Omar: I would choose Goal 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. This goal covers some aspects of sustainable development such as human rights, equality, justice, economy and environment.

Lee: That would be Goal 13 [*Take urgent action to combat climate change and its impacts*] on climate change. As I mentioned above, if we do not solve the climate change issue, any progress on other fronts will be severely compromised.

> The world at large has obligations towards sustaining the human race and the planet Earth. *Samira A.S. Omar*

Juma: One of the most important developments in the new millennium is understanding the world as a complex network of interactions. This worldview precludes the traditional assumption that the world can be shaped by single interventions. It is the interactions that matter, not the parts in the system. This reductionist approach should be left to the barren scribbling of economistic models and does not apply to the real world.

Singer: For me there is no grander challenge than child development. Recent evidence shows the first 1,000 days of life shape a child's lifetime. Risks such as malnutrition, vaccine-preventable diseases, lack of responsive parenting and stimulation, child abuse and neglect degrade a nation's human capital, lower gross domestic product, increase violence and disease. The return on investment to address these risk factors is huge. The challenge of child development is segmented across many SDGs. I would like to see a concerted approach as we argued recently in *Science*. [11 July 2014, Vol.345, issue 6193, p.121]

SDGs address issues that call for carefulness about local habits and beliefs. How may we face these needs in a respectful way?

Juma: The age of grand global strategies is over. Answers to

▲ Samira A.S. Omar

▼ Peter A. Singer

PROFILES

Calestous Juma, a TWAS Fellow, is professor of the practice of international development, Harvard Kennedy School, USA. Born in Kenya, he has made outstanding contributions to policy research on the application of science, technology and engineering to development in Africa and other regions.

Y.T. Lee, a TWAS Fellow, received the 1986 Nobel Prize in Chemistry, and has been awarded honorary PhDs by 40 universities. Born in Taiwan, China, he was president of the International Council for Science (ICSU) from 2011 to 2014.

Samira A.S. Omar has been employed by Kuwait Institute for Scientific Research (KISR) since 1973 and was the director of food resources and marine sciences division from 2001 to 2013. She is Arab Region vice president of TWAS's partner organization, the Organization for Women in Science for the Developing World.

Peter A. Singer, a TWAS Fellow, is the chief executive officer of Grand Challenges Canada. He has dedicated the last decade to applying science and innovation to the health challenges of the world's poorest people.

some of the most pressing global challenges will be solved through local experimentation. To do this effectively will require considerable attention to building local scientific and technological capabilities. There are no alternatives to respecting the knowledge imperative.

Lee: The transformation towards sustainability should be a bottom-up process. It means that the SDGs should allow for different ways of achieving the goals. The way to transform into sustainable society will vary in different regions, countries and localities. The SDGs should also respect not just local habits and beliefs, but local heritage and environments as well.

Omar: Nations must build up institutional capacity to achieve the SDGs as well as enhance public awareness through education and media. Networking is also important and involvement of stakeholders and communities at large will lead to making changes in habits and beliefs.

Singer: In the long term, people have to solve their own problems. I am pleased to say that at Grand Challenges Canada, which is funded by the Government of Canada, about 2/3 of our funds support innovators and institutions in low- and middle-income countries.

> "For me there is no grander challenge than child development."
>
> *Peter Singer*

What is your favourite goal and how should it be addressed for successful results?

Lee: That would be Goal 17: Strengthen the means of implementation and revitalize the global partnership for sustainable development. But I would like to see it framed in a different way: we should move away from nation-based solutions, and instead towards truly global solutions, in which national boundaries do not matter as much. Here I would like to quote a statement from the Sustainable Development Solutions Network: "Human-induced climate change is an issue beyond politics. It transcends parties, nations, and even generations. For the first time in human history, the very health of the planet, and therefore the bases for future economic development, the end of poverty, and human wellbeing, are in the balance. If we were facing an imminent threat from beyond Earth, there is no doubt that humanity would immediately unite in common cause. The fact that the threat comes from within – indeed from ourselves – and that it develops over an extended period of time does not alter the urgency of cooperation and decisive action."

Singer: My favourite domain is maternal, newborn and child health which has targets across goals. Without protecting our mothers and children, our world cannot reach its full potential. I am proud that the Government of Canada, with personal commitment and leadership from our Prime Minister, has been such a leader on maternal, newborn and child health.

Juma: I do not think of goals in isolation. I think of specific problems. I have been working mostly on agricultural innovation in Africa. To address this issue requires a wide range of inputs cutting across the various goals. I take a systems approach to the issue and reject attempts to reduce complex problems to single factors.

Omar: My favourite Goal is 15: Protect, restore and promote sustainable use of terrestrial ecosystems...halt and reverse land degradation and halt biodiversity loss. It can be addressed by supporting large-scale restoration programs, involving stakeholders and communities in conservation of biodiversity, providing alternative sources of energy and water (e.g., recycled water for irrigation) and designating protected areas for conservation of nature. ◘

A REVOLUTION COMES OF AGE

The Millennium Development Goals have helped to produce remarkable progress against poverty, disease and early childhood death. But are we overlooking the MDG's biggest success?

by **Edward W. Lempinen**

Sean Treacy contributed to this report

▼ From the top: Winnie Byanyima and Shantanu Mukherjee

Fifteen years ago, as the 20th century came to a close, the nations of the world and key global bodies agreed on a plan that was unprecedented in its ambition and scope: They would work together to sharply reduce poverty and disease, halt the spread of malaria and other diseases, increase security and opportunity for girls and women, and make primary education available to every child. The ideas weren't new, but the Millennium Development Goals were the first-ever coordinated, high-energy, well-funded campaign to address all of these needs at one time, on a global scale.

The world has changed profoundly since then – and the changes have coincided with pursuit of the MDGs. While the initiative has not yet met its targets in key areas, the consensus is that they've had a transformative effect, saving millions of lives and improving the well-being of billions of people globally.

"The most successful global anti-poverty push in history" – that's how UN Secretary-General Ban Ki-moon has described the MDGs.

Winnie Byanyima, executive director of Oxfam International and a former member of Uganda's Parliament, agreed. "The world has seen the fastest reduction in poverty in human history since the MDGs were launched," she said in an email interview with TWAS. "The goals have rallied governments, donors and civil society behind a common purpose and ambition, and inspired many successes."

The MDGs had precedents dating at least to the 1970s, said Shantanu Mukherjee, MDG team leader in the UN Development Programme (UNDP) development policy bureau. An initiative started by the UN to eradicate smallpox achieved its goal well before the target date in the mid-1970s, Mukherjee said in an interview. In the 1990s, global initiatives took on child welfare and population issues. All of those were based on significant scientific input, he said.

The Millennium Development Goals drew on those experiences, but the ambitions were in a completely different realm.

Even so, they are quite simple: eight goals focused on poverty and hunger; primary education enrolment; gender equality; childhood mortality; maternal health; infectious diseases; ensuring environmental sustainability; and partnerships for global development.

The results have been significant:

- Extreme poverty has been reduced by half or more. In 1990, almost half the population in developing countries lived on less than USD1.25 a day; by 2010, the rate had fallen to 22%.
- The campaign against malaria saved an estimated 3.3 million lives from 2000 to 2012, some 90% of them young children in sub-Saharan Africa. The campaign against tuberculosis saved an estimated 22 million lives.
- The proportion of people without access to an improved source of drinking water was cut in half; more than 2.3 billion people gained access between 1990 and 2012.

But MDG leaders acknowledge the effort has fallen short in some areas, and much remains to be done.

Worldwide, 1.2 billion people still live in extreme poverty. An estimated 162 million young children suffer from chronic undernutrition; estimates say that in 2012, a quarter of all children under 5 were stunted. More than a quarter of primary school children in developing regions are likely to drop out. Greenhouse gas emissions continue to rise at an alarming rate.

Today, MDG leaders are mounting a final push to achieve more of the targets and accelerate progress before the initiative expires at the end of next year. At the same time, they are assembling and refining the post-2015

▲ Worldwide, boys and girls are attending primary school in equal numbers. But some countries are still lagging. (Photo: Mark Knobil/Wikimedia Commons)

Sustainable Development Goals, looking to lessons from the MDGs to guide their efforts.

Perhaps because the project was so new, and so ambitious, the MDGs were slow to get off the ground in the early 2000s, analysts say. Nations and global bodies had varied and inconsistent levels of commitment.

"Although heads of states signed up in New York in 2000, many of the national institutions that were responsible for the implementation (of the MDGs) did not come up to speed until many years later," said Berhanu Abegaz, a TWAS Fellow and executive director of the African Academy of Sciences.

Regions had different starting points, too, with Latin America generally well ahead of Africa as the MDG process began. A lack of funding also slowed progress. Critics have complained that developed nations did not follow through on their financial commitments to the MDGs, a problem linked at least partly to the global economic crisis beginning in 2009.

Many have criticized the MDG process for lacking direct, substantial scientific input. A particular concern is that data for measuring needs and progress has been in short supply – or missing altogether.

"More than 40 developing countries lack sufficient data to track performance on extreme poverty and hunger", reported the UK-based *Guardian* newspaper last year. "Countries with the highest levels of maternal mortality, malaria and tuberculosis, meanwhile, often have the least reliable data on these issues."

▼ Berhanu Abegaz

> "The MDGs may have fundamentally changed the global culture, creating a new awareness, new partnerships and a new focus for funding."

That may have a disproportionate effect on women, suggested microbiologist Sudha Nair, who represents South Asia on the Executive Board of the Organization for Women in Science for the Developing World. "At least for India," she said, "the way we collect data and the frequency in which we do it, will not help us to generate data needed for a meaningful assessment."

Social sciences, behavioural sciences, and communication are also critically important for contributing to MDG successes, and what lies beyond.

But 14 years is enough to create perspective about the progress and the lessons learned. The biggest impact of the MDGs may be one impossible to measure: The initiative may have fundamentally changed the global culture, creating a new awareness, new partnerships and a new focus for funding.

Mukherjee is among many who say that a key goal now, for SDG planners, is to engage national leaders – often in Least Developed Countries – who remained apart from the MDG process. In his view, bodies like the African Union and TWAS can be key partners.

Working in concert with other international agencies and policymakers, they can help nations to build an ecosystem for innovation, especially in countries that have suffered from conflict or a long period of economic crisis. "If you have a need for energy," Mukherjee said, "if you can't innovate your own solution to reach the most deprived, in the long term, that's an opportunity lost." ◘

TWAS.ORG: THE LOOK OF INNOVATION

With a newly redesigned website and a strong commitment to digital communication, the Academy plans to deliver its news and opportunities to a bigger, broader audience.

by **Edward W. Lempinen**

The design is bright and clean, and the mood is optimistic. But beneath the surface appeal of TWAS's new website, there is a serious mission: Tell the world about the Academy's work to build science and technology in the developing world.

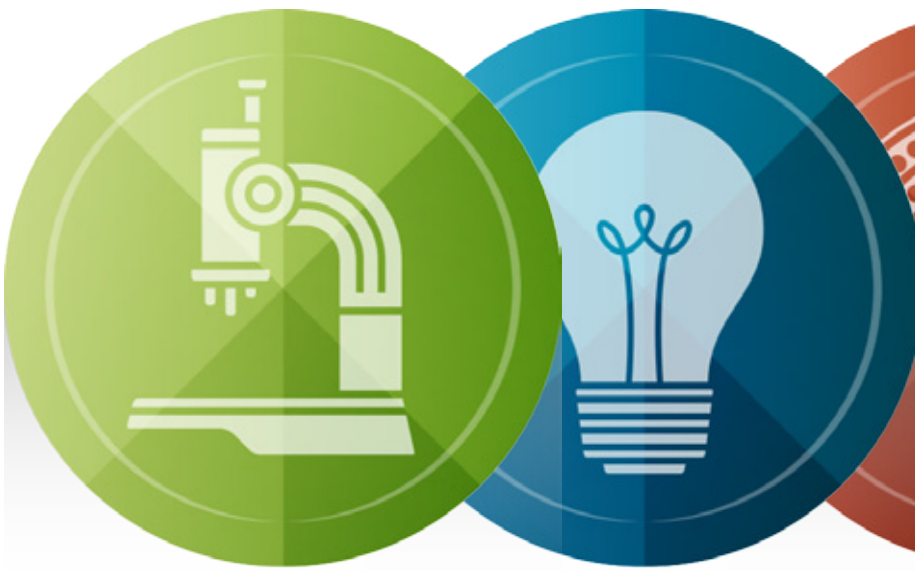
The new TWAS.org builds on the Academy's existing web presence with an array of new features for visitors: The fellowships, research grants and other opportunities that TWAS offers to researchers are front and centre. So are the Academy's policy programmes. Navigation is easy and intuitive. Interactive tools illustrate TWAS's elite international network of elected Fellows and committed partner organizations.

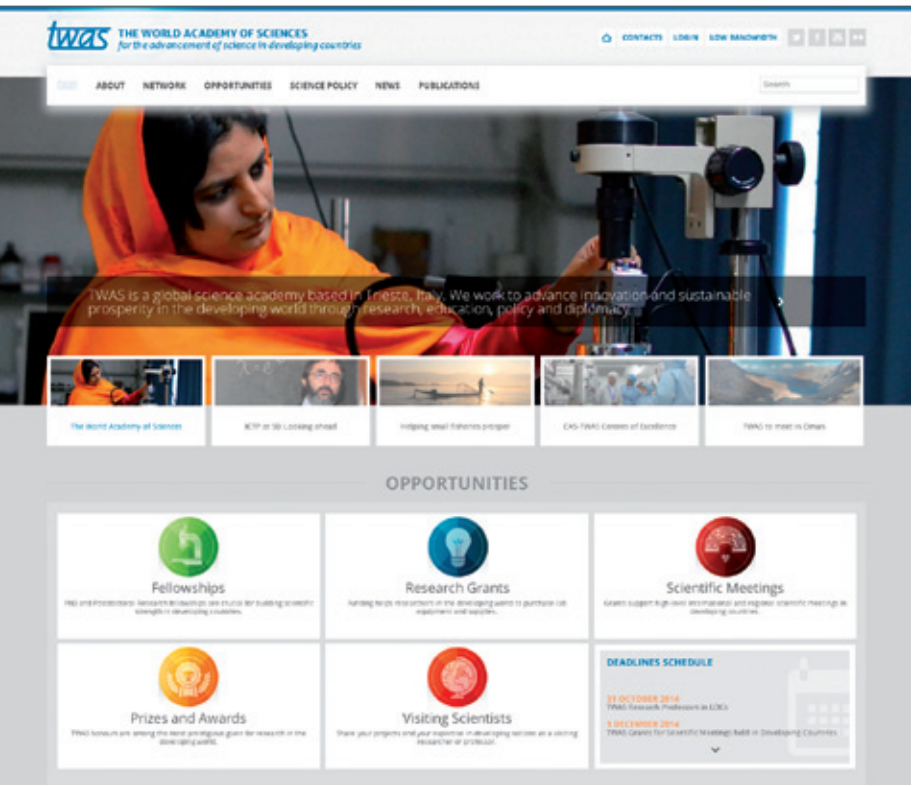
"At the start of our fourth decade, we wanted TWAS.org to reflect our mission and our vision for the future," said TWAS Executive Director Romain Murenzi. "Just as important, when visitors come to the site to learn about a PhD fellowship or our work in science policy, we want to be sure that the site is both interesting and easy to use. Our new design achieves all of those objectives."

The new website reflects an important evolution in TWAS communication strategy. Along with a more active presence on the web, the TWAS Public Information Office (PIO) is working to build the Academy's audience on social media such as Facebook and Twitter (@TWASnews). The goal is to create a synergy between digital media and conventional publications that extends the Academy's communication to new and broader audiences, including more younger scientists and science students.

Increasingly, PIO is promoting TWAS.org articles on social media. TWAS's Twitter community stood at 580 at the start of 2013; by year's end, it was approaching 900. At the start of 2013, 625 people were following the TWAS Facebook page; 12 months later, the number had more than doubled to 1,430 – and growth was accelerating. For Facebook, the audience is concentrated in ages 18-34, with Pakistan, Egypt and Brazil as the top three countries for followers.

To learn more, visit: http://bit.ly/1sjnYFJ





▲ The new TWAS.org has a contemporary look and prominently features career-building opportunities.

With a contemporary look that expresses commitment to innovation, the new www.twas.org intended to convey two initial impressions: TWAS is a dynamic global Academy with engagement and impact across a range of fields and countries, both at high levels and in local communities; and TWAS offers a rich menu of opportunities, from PhD fellowships and research grants to prizes, to help build science in the developing world.

The digital makeover also has given TWAS a version of the website tailored for smartphones and tablets, and a separate low-bandwidth version for users who lack strong Internet connections. A new interactive element on the homepage makes TWAS partners and associated organizations much more visible. And there's also a prominent appeal for donations. There's a section for TWAS news, and a separate section for news and reports related to science, engineering and policy in the developing world.

In the months ahead, additional new features are expected. The Public Information Office is working to develop a "wizard" tool to help scientists easily sort through TWAS programmes to find opportunities that match their interests; a new system of digital forms for meeting registration and programme applications; and password-protected access allowing TWAS Fellows and Young Affiliates to update their biographical data online and for the TWAS Yearbook.

The TWAS website project is being developed by Interfase s.r.l. [http://www.interfase.it], a design and communications strategy firm based in TWAS's headquarters in the city of Trieste, Italy.

> "At the start of our fourth decade, we wanted TWAS.org to reflect our mission and our vision for the future."
>
> *Romain Murenzi*

"TWAS is a world-wide organization dealing with thousands of stakeholders, from huge government and non-government agencies to individual scientists and scholars," said Interfase CEO Maurizio Terpin. "Providing the right person with the right information is a true challenge.

"The new TWAS web resource addresses a variety of different needs, and gives users clear paths to the information they want. This is the first step towards the digitalization of the TWAS communication system, aiming to provide its users with simpler, faster and more effective services." ◘

AT THE UN, A NEW VOICE FOR SCIENCE

Four TWAS Fellows have been named to a new, high-profile scientific commission that will help the United Nations integrate science into policy on a range of important issues.

by **Cristina Serra**

The United Nations has formed a new Scientific Advisory Board to provide high-caliber advice to Secretary-General Ban Ki-moon and to create direct connections between the global research community and other top UN organizations and policymakers.

Twenty-six internationally leading scientists from 25 nations – including four TWAS members – were named to the new board, which is part of a broader UN strategy to integrate science in international policymaking.

Advisers were chosen because of their scientific accomplishments and vision, with the aim of having representatives in all the fields where scientific advice is needed.

TWAS is well represented on the panel. Four elected Fellows – scientists from Asia, Latin America, the Arab world, including a Nobel laureate from Egypt – have wide expertise in both science and diplomacy. They are:

- Ahmed Zewail, from Egypt, a Nobel laureate in chemistry, Linus Pauling professor of chemistry and physics and director of the Center for Physical Biology at the California Institute of Technology.
- Brazilian climate expert Carlos Nobre, a senior scientist at the Brazilian national secretary for R&D policies;
- Abdallah Daar, born in Tanzania, professor of public health at the University of Toronto, Canada;
- Abdul Hamid Zakri, science adviser to the Prime Minister of Malaysia and chair of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES);

What is promising about the new board is that, "for the first time in the history of the United Nations, the scientific community has a direct line to the Secretary-General," said Zakri. "This has never happened before. We are given the opportunity to make a difference and we should not squander this opportunity." Zakri is a professor emeritus at the National University of Malaysia.

"This Scientific Advisory Board is, fundamentally, about action," said UNESCO Director-General Irina Bokova, who chairs the board. Board members will offer advice on technical and scientific issues and ensure that scientific data are reflected in political discussions. They will identify knowledge gaps that, once properly addressed, could reshape the life of millions of people; they will also advise on issues related to the public visibility and understanding of science.

The panel held its first meeting in January in Berlin. It will meet twice a year to address key issues, but between meetings, the scientists will team up in sub-groups to prepare reports for the UN Secretary-General. UNESCO will host the board and its staff.

TWAS President Bai Chunli, who also serves as president of the Chinese Academy of

To learn more, visit: http://bit.ly/1o0WAfR

▼ TWAS President Bai Chunli

▲ High-level officials gathered on stage for the inauguration ceremony of the Scientific Advisory Board of the UN Secretary-General.

Sciences, expressed strong support for the new UN advisory committee. The panel "reflects a recognition that many of the challenges facing humanity today are global challenges in which science should play a constructive role," Bai said. "This board will have a great influence in the developing world, and we look forward to a close working relationship with our TWAS colleagues and other members of the board."

Both genders are equally represented in the panel. Among its members are Italian physicist Fabiola Gianotti from CERN, who is among the discoverers of the Higgs boson; Nigerian Wole Soboyejo, president of the African University of Science and Technology; Judi Wakhungu, a professor of energy resources management and also first cabinet secretary at the Kenyan Ministry of Environment, Water and Natural Resources; and Susan Avery, president and director of the Woods Hole Oceanographic Institution (USA).

Board members will tackle global problems, including water, energy, health, agriculture and biodiversity, which often pose life-threatening challenges for million people worldwide.

Nobre, a Brazilian academic and a former chair of the International Geosphere-Biosphere Programme, is a world-renowned expert on complex systems such as the Earth. As a climate scientist, he hopes he will be able to bring forth the urgency of global action to mitigate and adapt to climate change.

"There is a serious misplaced psychological barrier to be overcome in considering, for example, the issue of climate change," he said in an interview. "The truth is that transition to a sustainable economy is not as costly or difficult as it is perceived. The stalemate in climate negotiations is due to institutional inertia and not lack of climate science. Therefore, education for sustainability becomes as important an element for the global transformation need as implementation of green technologies."

Words of praise for the scientific board came also from Zewail, who called it "... an excellent platform for an outreach to all the nations." Zewail was awarded the Nobel Prize in chemistry in 1999, and his appointment to the new board reflects his long-standing experience and passion in global affairs related to science, education and peace.

> "The truth is that transition to a sustainable economy is not as costly or difficult as it is perceived." *Carlos Nobre*

Daar has extensive experience in matters at the interface between science and policy.

"With complex issues like these, it is not just one thing at a time that needs attention, it is usually many things together," Daar said. "Primarily it is about building better health care systems, introducing things like universal health coverage and proper resourcing. But again, to implement all these, you need evidence, and that is where science comes in".

"The Scientific Advisory Board is a very important new body," said Romain Murenzi, the executive director of TWAS. "It reflects very well on TWAS's elected membership that four of our members have been appointed to this panel. Our Academy looks forward to working with the board and to supporting its work however we can." ◘

BRINGING ENERGY TO POLICY AND PEOPLE

At a TWAS science diplomacy workshop, developing-world researchers and policymakers were exposed to new problem-solving approaches in energy policy.

by **Sean Treacy**

The government of a small, landlocked developing country wanted to provide electricity to the 40% of its citizens who had none. But there was no clear way to do so, and they could not count on their neighbours for help. So what creative strategy would allow them to connect their people to the national grid?

The country was a fictional example from an exercise for scientists and policy experts from the developing world who attended a workshop on energy policy and science diplomacy held recently at TWAS headquarters in Trieste, Italy. The hypothetical nation also had vast crude oil reserves it could use for trade, but was cut off from potential markets by the unfriendly powers bordering it in the north, west and east. Worse yet, it was blocked from the sea by a nation to the south that had been unstable for years.

So a committee of workshop participants – playing the role of energy policy officials – went to work. Maybe because most of them were scientists, the first thing that came to mind was to fund research and development. But as time went on, something became startlingly clear: The best policy for providing power to their citizens left little money for scientific research.

Carlos Meza-Benavides, a renewable energy technology researcher from Costa Rica, said that after realizing that research and exports could not be the priority, the group found that their best resource was actually their own citizens. That shifted their focus – they decided it would be more effective to develop local processing of their crude oil by investing in infrastructure and foreign technology, while improving relations with their neighbours over the long term using science diplomacy.

"We can have a technology programme for people in neighbouring countries to come to our country to do some research on energy or contribute to our development and we will repay them," he said. "In this way, we'll have a better relationship with our neighbours."

This exercise was a centrepiece in the week-long workshop held 9-13 December 2013 that brought energy-sector scientists and policymakers from throughout the world to TWAS to explore the relationship between science, policy and diplomacy. The participants, more than 20 in all, came from 16 nations: Bangladesh, Cameroon, China, Costa Rica, Egypt, India, Iran, Italy, Nepal, Nigeria, Pakistan, Senegal, South Africa, Tanzania, Uzbekistan and Zimbabwe.

The workshop was financially supported by Sida, the Swedish International Development Cooperation Agency. It was part of TWAS's larger science diplomacy programme, organizing lectures and workshops to bring together highly regarded experts and early-career scientists and diplomats.

The case of the landlocked country was one of three hypothetical situations workshop attendees tried to resolve through a mix of science and diplomacy. Another group managed the budget for a country that was

For a deeper look at the workshop, visit: www.twas.org/node/1975

Learn more about the science diplomacy programme at www.twas.org/science-diplomacy

▼ Participants in the TWAS diplomacy workshop discussed energy policies during a breakout group of experts in non-traditional, high-technology energy sources such as hydrogen fuel cells.

very underdeveloped but had a rapidly growing economy and young population, most of whom make their living through agriculture.

"When you're writing (a policy document), you want to assume the people who are reading are laymen," said Willie Davison Ganda to his group-mates. He advised that avoiding dense language was important so that everybody can understand what the government's policies are. Ganda is the director of research development and innovation for the Ministry of Higher and Tertiary Education, Science and Technology Development in Zimbabwe. He was also one of the workshop's four "science diplomacy ambassadors" – scientists with policy experience.

> "A key idea of science diplomacy: you can pursue development and build better relationships with neighbouring nations."

A third group managed a hypothetical petro-state with an oil-reliant economy and a massive unpaid debt. As they planned their budget, they created a chart detailing how much interest in green energy and decision-making power each interested party would have. "Foreign debt owners would have a lot of power and low interest in green energy," pointed out Heba Khalil, an associate professor at Cairo University in Egypt, during the discussion. "They'll want to get their money back."

In addition to the exercises, the workshop featured several presentations. Vaughan C. Turekian, director of the Center for Science Diplomacy at the American Association for the Advancement of Science (AAAS), provided an overview of science diplomacy. Also, the group toured Termovalorizzatore Errera, a waste-incinerating energy plant in Trieste.

Mirabbos Khujamberdiev, a hydrogen-power technology scientist with Tashkent Institute of Chemical Technology, said the hypothetical landlocked country faced a situation similar to Uzbekistan, his home country. Uzbekistan has an interest in trading with China and Russia, he said, but has neighbours that necessitate pipeline negotiations. They are also cut off from the sea by the unstable nation of Afghanistan. His familiarity with Uzbekistan's geopolitical reality allowed him to illustrate the situation in the exercise to his group.

"I was able to provide the current situation with my landlocked country as an example, and provide what is going on politically, economically, socioeconomically," said Khujamberdiev.

The workshop opened up a new professional and personal horizon, for Tabassum Mumtaz, a biologist with the Bangladesh Atomic Energy Commission. Mumtaz received her PhD from the Universiti Putra Malaysia through a fellowship sponsored by the Organization for Women in Science for the Developing World (OWSD), a close partner of TWAS. She was also central to a spirited discussion during the workshop about nuclear power in the developing world because her home country of Bangladesh is making progress toward establishing its first-ever nuclear plant.

TWAS's future workshops on science, diplomacy and policy are likely to cover such issues as sustainable water management, food security and climate change, and sustainable exploitation of the oceans. ◘

AFRICA'S CALL TO ACTION

At a forum organized by the World Bank and Rwandan President Paul Kagame, TWAS joined African leaders in talks on building higher education to support science and technology.

by **Edward W. Lempinen**

KIGALI, Rwanda – Citing the close link between science and human prosperity, high-level representatives of five African nations ratified a far-reaching call for new policies, investments and global partnerships to improve university-level science and engineering education.

The call to action was approved during a forum organized by Rwandan President Paul Kagame and the World Bank, "Accelerating Africa's Aspirations: Higher Education for Science, Technology and Innovation." Science and education ministers from Ethiopia, Mozambique, Rwanda, Senegal and Uganda pledged an "ambitious commitment" to produce more African scientists and engineers who will be needed for the continued development for the continent's 1 billion people.

> "Our collective commitment must be followed by concrete action to drive innovation for the development of our people and our continent." *Paul Kagame*

The forum was attended by Kagame and leaders from the African Union, the African Development Bank, UNESCO, TWAS, IAP – the global network of science academies, and other influential advocates of Africa's emerging knowledge economy.

"I welcome the commitment to strengthen and mobilise resources for building capacity in science and technology, in our pursuit of Africa's socio-economic transformation," Kagame said in the forum's closing address on 13 March. "Our collective commitment must be followed by concrete action to drive innovation for the development of our people and our continent."

Makhtar Diop, the World Bank's vice president for Africa, also urged the forum participants to set transformative goals.

"To be more competitive, expand trade, and remove barriers to entering new markets, Africa must expand knowledge and expertise in science and technology," Diop said in the keynote address. "Let us set some bold targets: that we will see a doubling of the share of university students graduating from African universities with degrees in mathematics, science and technology by 2025."

The five-page communiqué ratified by the governmental representatives prescribed a range of efforts improve education and expand the corps of PhD scientists and engineers. Policies and resources are essential to increase enrollment – of women, especially – in science, technology, engineering and mathematics. The statement called for greater investment in information and communications technology and closer partnerships with business leaders and the African diaspora to build the strength of universities and technical schools. And researchers and policymakers must engage with the public to build broad support.

Among the key participants who shaped

▲ Left to right: Makhtar Diop, World Bank Vice President for Africa Region; Rwandan President Paul Kagame; and Rwandan Minister of Education Vincent Biruta at the closing of the forum. [Photo: Office of President Paul Kagame, Rwanda]

the final communiqué were Vincent Biruta, Rwanda's minister of education; Mary Teuw Niane, Senegal's minister of higher education and research; Jessica Alupo, Ugandan minister of education and sports; Ato Wondwossen Kiflu, Ethiopia's state minister for technical and vocational education and training in the Ministry of Education; and Arlindo Chilundo, Mozambique's deputy minister of education.

TWAS and some key partners had a significant role at the meeting. Mohamed H.A. Hassan, co-chair of IAP and chairman of the Council of United Nations University, delivered the keynote address at the inaugural ceremony; Hassan is TWAS's treasurer and former executive director. Executive Director Romain Murenzi gave an address and chaired a panel that focused on S&T lessons from other nations. Fernando Quevedo, director of the Abdus Salam International Centre for Theoretical Physics (ICTP) in Trieste, Italy, and a TWAS Fellow, spoke in a panel on the relationship between science and business in Africa's development. Lidia Brito, director of UNESCO's Division of Science Policy and Capacity Building, chaired a session that shaped the forum's final statement; she has represented UNESCO on the TWAS Steering Committee.

The spirit of the meeting was hopeful, but there were stark concerns that complex, interlocking challenges could threaten future progress.

Many African nations are racing to build new universities and technical schools, with a clear focus on science, engineering and technology. But Africa's PhD deficit is profound. In the United States, there are 1,580 PhD scientists per million residents, and in South Korea nearly 1,200. African countries often have fewer than 100 scientists per million residents – and some have fewer than 20.

In coming decades, speakers said, Africa will need hundreds of thousands of new scientists and engineers in virtually every sector of the economy, from agriculture and health services to infrastructure engineering and adapting to climate change.

Some 40% of the population in sub-Saharan Africa is under 15, and today's students could provide the pool of talent to meet Africa's needs. Indeed, training them is essential – over the next decade, an estimated 11 million young people will enter the job market every year.

But the educational system, in its current condition, does not have the capacity to teach and train them, experts said at the forum.

"What we are gathered here to do has profound implications for young people in Africa," Tawhid Nawaz, the World Bank's director for Human Development in Africa, told the audience. "Essentially, young people can take advantage of economic opportunities only if they have the right knowledge and skills."

Hassan, in his keynote address on the first day of the forum, cited centres of excellence in science and engineering as "critically important" building blocks for every country. Not only do they attract top researchers, but they also attract political and funding support and become hubs of international cooperation. And, Hassan said, merit-based science academies can "mobilize accomplished scientists, mentor young talent and advise governments".

"The challenges of African higher education are enormous," Diop said. "Today, the tree of knowledge can grow only if we take care of the roots and the leaves." ◘

To learn more about "Accelerating Africa's Aspirations," see www.twas.org/article/call-action-african-universities

LOOKING TO NATURE FOR POWERFUL CURES

Five early-career women chemists from developing countries have been honoured with the Elsevier Foundation Award for Early Career Women Scientists.

An award for early-career women scientists in the developing world honoured five fast-rising chemists. The Elsevier Foundation Awards for Early Career Women Scientists in the Developing World celebrated their research, which looks to nature for ways to address cancer, malaria and other medical problems.

The winning researchers, representing five regions of the developing world, are from Indonesia, Jamaica, Nigeria, Uzbekistan and Yemen. The prizes are awarded annually by The Elsevier Foundation, the Organization for Women in Science for the Developing World (OWSD) and TWAS with a goal of building scientific strength and advancing scientific knowledge in developing countries. The winners received their awards on 15 February 2014 during a ceremony at the American Association for the Advancement of Science (AAAS) Annual Meeting in Chicago.

The winners are:

- **Central & South Asia:** *Nilufar Mamadalieva, Institute of the Chemistry of Plant Substances, Tashkent, Uzbekistan* (biochemistry). For her work on the phytochemical and biological investigation of active compounds derived from medicinal plants growing in Central Asia, in particular the development of efficient nutraceuticals and the discovery of new lead compounds for the pharmaceutical industry.
- **East and South-East Asia & the Pacific:** *Ritmaleni, Faculty of Pharmacy, Gadjah Mada University, Yogyakarta, Indonesia* (medicinal chemistry). For her work in the field of organic synthesis, focusing on the development of tropical medicines, in particular improved methods for the synthesis of sulfoxides and their application in the preparation of biologically active targets.
- **Latin America & the Caribbean:** *Simone Ann Marie Badal McCreath, Natural Products Institute, University of the West Indies, Jamaica, West Indies* (biochemistry). For her work in designing a new cell culture lab to investigate the cancer-fighting properties of Jamaican natural compounds.

To learn more, visit: http://bit.ly/1km9nr4

More information on each candidate's achievements can be found at http://bit.ly/1oCuscf

▼ The 2014 winners of the Elsevier Foundation Awards for Early Career Women Scientists in the Developing World accept their prizes at the annual AAAS meeting in Chicago. From left are Eqbal Mohammed Abdu Dauqan from Yemen; Simone Ann Marie Badal McCreath from Jamaica; Taiwo Olayemi Elufioye from Nigeria; Ritmaleni from Indonesia; and Nilufar Mamadalieva from Uzbekistan. (Photo credit: Alison Bert)

- **Arab region:** *Eqbal Mohammed Abdu Dauqan, Department of Medical Laboratories Sciences, Faculty of Medical Sciences, Al-Saeed University, Taizz, Yemen* (biochemistry). For her research on the antioxidant properties of vegetable oils and specialized research in sensory evaluation and organic chemistry.
- **Sub-Saharan Africa:** *Taiwo Olayemi Elufioye, Department of Pharmacognosy, Faculty of Pharmacy, University of Ibadan, Oyo State, Nigeria* (hamacology). For her research on the medicinal properties of native Nigerian plants, in particular the effectiveness of different species in treating malaria, wounds, memory loss, leprosy and cancer.

This year's competition focused on chemistry. A panel of distinguished chemists independently selected each winner based on her achievements, finding that the best candidates all had impressive accomplishments in applying the chemistry of nature to pharmaceutical science. The Elsevier Foundation prize included USD5,000 and all-expenses paid attendance at the 2014 AAAS Annual Meeting in Chicago. In 2015, the prize will be for physics and mathematics.

"These five women, like all women undertaking scientific research in developing countries, will certainly have faced challenges on the road to this award," said Fang Xin, president of OWSD. "But their determination, commitment and enthusiasm have paid off. The award is recognition that they are excellent scientists and that their research has made an impact both regionally and internationally. They are an inspiration to all young women considering careers in science."

"The winners of the 2014 Elsevier Foundation prizes are impressive not just for their research, but also for their potential," said TWAS Executive Director Romain Murenzi. "Certainly these awards could bring them exciting new opportunities for research. We also believe that, over time, these researchers also will fulfill their potential as teachers and mentors, as partners in international projects and as advisers to governments. Such leadership can make a long-lasting contribution to global science."

David Ruth, Executive Director of the Elsevier Foundation, said: "Professional visibility is crucial to developing high-profile international scientific careers, especially for women. The Elsevier Foundation provides support to early-career women scholars through our New Scholars grant programmes and mentoring, research retreats, professional visibility, childcare, work-life integration and recognition programmes. The awards for these impressive women scientists represent a cooperative effort supported by Elsevier, OWSD, AAAS and TWAS to build research capacity and advance scientific knowledge throughout the developing world – and what better place than the annual AAAS conference to raise awareness among scientists, policymakers, journalists and the public about the need to retain and celebrate women scientists."

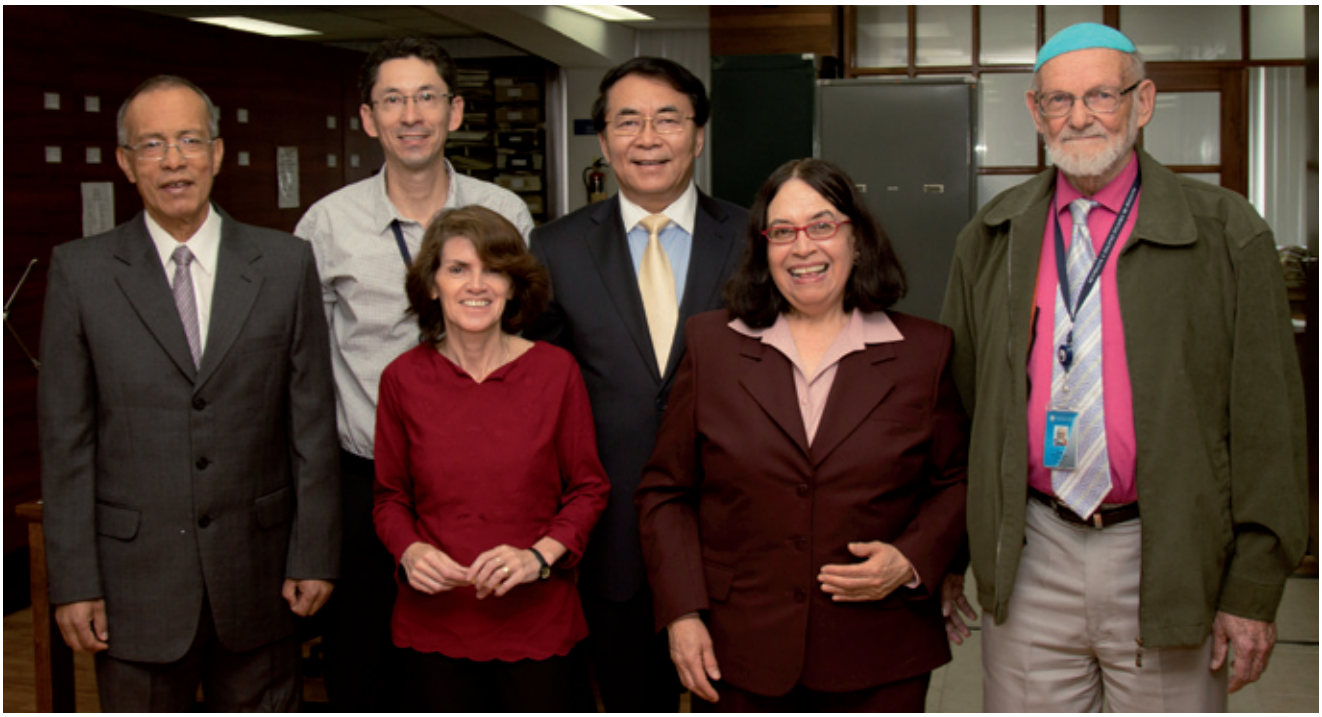
In interviews, the winners said the awards could have a significant impact for their own careers, and for the regions they work in.

> "The award is recognition that their research has made an impact both regionally and internationally." *Fang Xin*

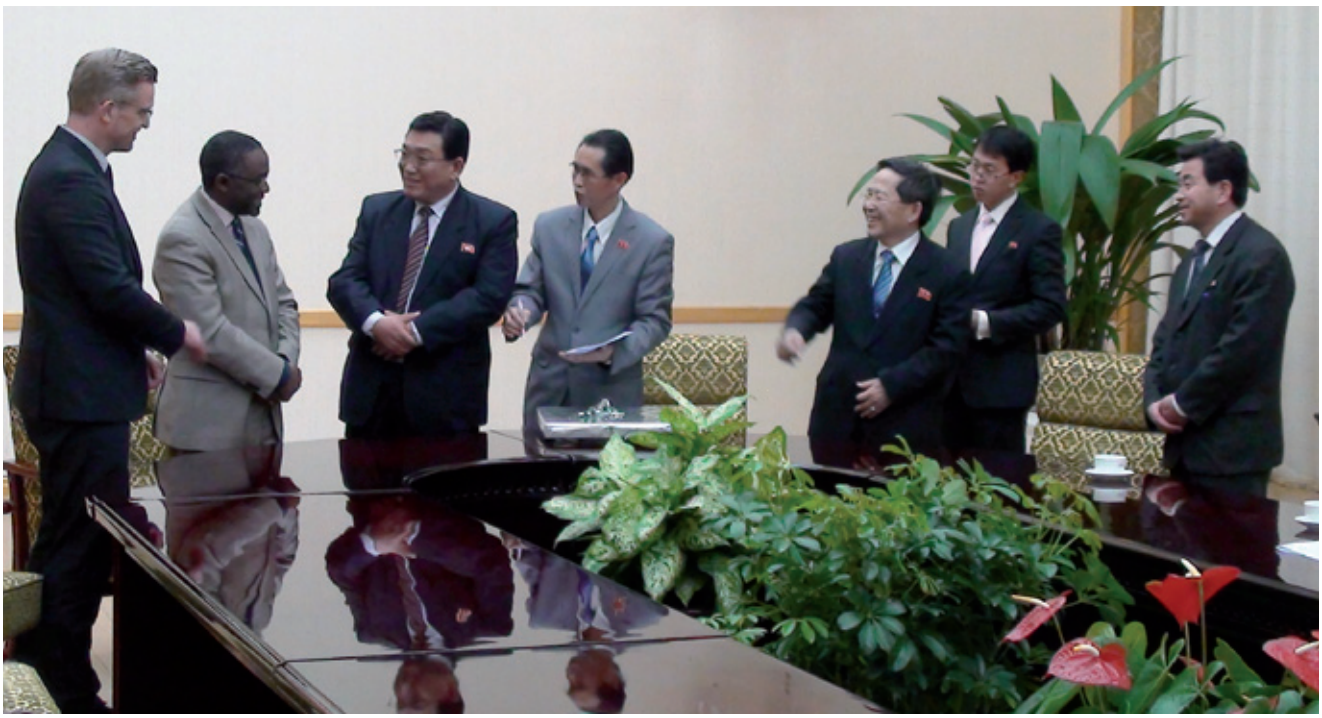
McCreath said she was "overwhelmed and truly humbled to be receiving such a prestigious award. It will no doubt inspire my students, mentees and the community of Jamaican women." She added: "Such an award is also vital towards increasing awareness and consequently interest among the private sector and governmental communities and will encourage the development of an anticancer research facility of excellence in Jamaica and, by extension, in the Caribbean."

Dauqan stressed the impact the award would have on women from her region. "The prize is very encouraging for Arab women and is the result of efforts to enhance scientific research in the Arab world", she said.

Ritmaleni, from Indonesia, put it simply: "Women need science, science needs women – and they need to work together." ◘



▲ The founding members and board of directors of *Academia de Ciencias del Ecuador* (ACE) with TWAS President Bai Chunli. From left: Carlos Soria, Santiago Ron, Katya Romoleroux, Bai Chunli, Eugenia del Pino, Tjitte de Vries. (Photo: Diego Quirola)



▲ During a visit to the Democratic People's Republic of Korea (DPR Korea) 13-16 January, TWAS Executive Director Romain Murenzi and UNESCO Beijing Office Programme Specialist Hans Thulstrup met in Munsudae Assembly Hall with officials from the nation's State Academy of Sciences. Murenzi visited several State Academy institutes and met with Academy President Jang Chol and others to discuss strengthening its ties with TWAS, as well as the State Academy's participation in international science diplomacy activities. From left are Thulstrup; Murenzi; Jang Chol; Bureau of International Cooperation Official Kim Kyong Min; Bureau of International Cooperation Director Hong Ryun Gi; DPR Korea Ministry of Foreign Affairs Stenographer Ri Kuk Chol; and Bureau of International Cooperation Senior Official Ri Hak Chol. (Photo credit: DPR Korea State Academy of Sciences Photographer Kim Kwang Ho)

PEOPLE, PLACES & EVENTS

IN MEMORIAM

Riazuddin, a Pakistani particle physicist with a worldwide reputation and a TWAS Fellow since 1993, passed away on 9 September 2013, in Islamabad, Pakistan.

Riazuddin was a prolific scientist with a deep interest in several topics such as strong and weak interactions, neutrino oscillations and graphene physics. He earned his PhD from Cambridge University, in 1958. Under the supervision of Nobel laureate Abdus Salam (the founder of TWAS), he did his postdoctoral work at the University of Rochester and the University of Pennsylvania.

In 1966, he founded the Physics Institute at Islamabad (now Quaid-e-Azam) University where he established a strong, dynamic group that gained international acclaim.

From 1973 to 1975, working largely alone and with access to limited amounts of publicly available literature, Riazuddin designed Pakistan's first nuclear device. After the bomb was tested in 1998, he urged that Pakistan should sign the Comprehensive Test Ban Treaty.

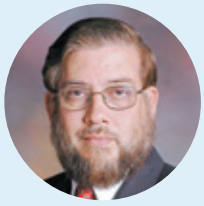
In 1976, he instituted the Nathiagali Summer College, an annual conference that attracted some of the greatest physicists of the time.

He authored over a dozen textbooks, including *Theory of Weak Interactions in Particle Physics* (coauthored with Marshak and Ryan), which has become the textbook for an entire generation.

GADAGKAR NAMED INSA PRESIDENT

Raghavendra Gadagkar, a TWAS Fellow (2000) and a Professor at the Centre for Ecological Sciences, Indian Institute of Science, Bangalore, India, is the new president of INSA, the Indian National Science Academy, New Delhi.

Gadagkar holds a B.Sc (Hons) and MSc in zoology from Bangalore University and a PhD in molecular biology from the Indian Institute of Science, Bangalore. He has become an international expert in eusocial insects such as ants, bees and wasps and has established a school of research in the area of animal behaviour, ecology and evolution.



The author of more than 250 scientific papers, Gadagkar has also penned two books: *Survival Strategies - Cooperation and Conflict in Animal Societies* and *The Social Biology of Ropalidia marginata: Toward Understanding the Evolution of Eusociality*.

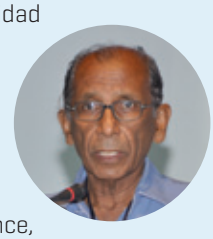
He serves in many national and international scientific bodies and government advisory committees, and is the recipient of several prestigious awards including the Shanthi Swarup Bhatnagar Prize and the B.M.Birla Science Prize.

RAMKISSOON TO LEAD PANEL

Harold Ramkissoon, a mathematician and TWAS Fellow (2003), is the new chair of the CARICOM Science, Technology and Innovation Committee, established to promote economic integration and cooperation in the Caribbean region.

The Caribbean Community (or CARICOM) is an organization of 15 nations and dependencies established in 1973 to promote economic integration and cooperation among its members.

Ramkissoon, who represents Latin America and the Caribbean on the TWAS Council, is an independent senator in the Trinidad and Tobago government.



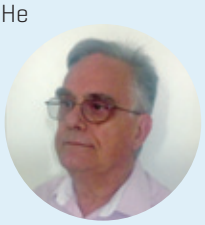
He also serves on the board of the UNESCO International Science, Technology and Innovation Centre for South-South Cooperation.

Within the Caribbean S&T panel he will work to strengthen S&T capacity in the region to promote economic and social development.

PANZA ELECTED TO LINCEI

Giuliano Panza, a professor of seismology at the University of Trieste (Italy) and TWAS Fellow (1996), has been elected national member of the Italian Accademia dei Lincei, one of the oldest and most prestigious scientific academies in the world.

Panza lives in Trieste, where he leads the SAND research group at the Abdus Salam International Centre for Theoretical Physics. He is an expert in the study of seismic waves, and has had a pivotal role in the accomplishment of time-dependent hazard models that were much appreciated by the Italian Civil Defence.



During his career, Panza has received many prestigious awards. They include: The Beno Gutenberg medal from the European Union of Geosciences for outstanding contributions to international seismology; the Laurea

PEOPLE, PLACES & EVENTS

honoris causa in Physics; and the medal of honour of the Central European Initiative.
He has authored and co-authored more than 500 peer reviewed papers and more than ten books.

LITTLEWOOD NAMED ARGONNE DIRECTOR

Peter B. Littlewood, an associate laboratory director for physical sciences and engineering at Argonne National Laboratory (ANL) and a TWAS Fellow (2010), is the new ANL director.

ANL is a non-profit multidisciplinary research laboratory operated by the University of Chicago for the US Department of Energy (DOE), with 15 research divisions, 1,250 scientists and engineers, and projects in fields such as energy, environment, security and high-performance computing.
Littlewood succeeds the 12th director, Eric D. Isaac, who took a new position as a provost at University of Chicago in March. He joined ANL in 2011 as the new associate laboratory director of Argonne's physical sciences and engineering. Before moving to Argonne, Littlewood was the head of the Cavendish Laboratory and the department of physics. He was also at Los Alamos National Laboratory where he carried out research in theoretical physics, materials science, atomic physics and nuclear radiation detection.
Littlewood also serves as a professor of physics in the James Franck Institute at the University of Chicago. He holds six patents and has published more than 200 articles in scientific journals.

DEL PINO GIVES RHODES LECTURE

Eugenia Maria del Pino, an internationally recognized scientist, educator, and conservationist from Ecuador, was invited to give the Rhodes Lectureship 2014, on 23 April.

Del Pino, a TWAS Fellow (1989) and professor at the Department of Biological Sciences, *Pontificia Universidad Catolica del Ecuador*, studies the development of non-model amphibians by comparing features of about 40 different species of marsupial frogs.
She is a pioneering educator in developmental biology, and her work has been recognized by many awards, including the L'Oréal/UNESCO Prize for Women in Science for Latin America (2000).

FUCUGAUCHI HONOURED

Jaime Urrutia Fucugauchi, a TWAS Fellow (2004) and director of the Institute of Geophysics at the *Universidad Nacional Autónoma de México* (UNAM), has received the 2013 International Award from the American Geophysical Union.
The award honours "an individual scientist or a small team for making an outstanding contribution to furthering the Earth and space sciences and using science for the benefit of society in developing nations."
Fucugauchi has had international experience from his earliest days. (Urrutia means "distant" in Basque, and Fucugauchi means roughly "Good luck-come in!" in Japanese). He earned his bachelor's degree at UNAM and his PhD at the University of Newcastle (UK). During a one-year postdoc at the University of Michigan (USA), he carried out research in palaeomagnetism and nuclear geophysics.
In 1997, he became the director of the Institute of Geophysics at UNAM, and his work has fostered many international collaborations. He gave invaluable contributions to the exploration of the *Chicxulub* crater, a prehistoric impact crater buried underneath the Yucatán Peninsula in Mexico.

PARKIN WINS MAJOR PRIZE

Stuart S.P. Parkin, a British-American physicist and a TWAS Fellow, won the EUR 1 million Millennium Technology Prize in April 2014. The biennial prize acknowledges Parkin's discovery that will allow a thousand-fold increase in storing digital data on magnetic discs compared to past technology.
Parkin, a consulting professor at Stanford University (California) has been recently appointed director of the Max Planck Institute of Microstructure Physics at Halle (Germany).

He works in the field of spintronics (short for "spin electronics"), devices that take advantage of electrons' quantum property called "spin".
Parkin's scientific contribution will lead to storage devices that are not only much faster than conventional disk drives, but also less expensive.

A TWAS-RAI Friuli Venezia Giulia co-production

SEEDS OF SCIENCE

IMPROVING LIFE THROUGH SCIENTIFIC RESEARCH

Clean water, thriving crops, healthy children –
African scientists are transforming communities with support
from TWAS, The World Academy of Sciences.

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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.

TWAS was founded in 1983 by a distinguished group of scientists from the developing world, under the leadership of Abdus Salam, the Pakistani physicist and Nobel Prize winner. Today, TWAS has some 1,100 elected Fellows from 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.